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Can an informative artefact induce sustainable behaviour in the French households? The answer of a cognitive transfer experience.

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To Mark

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List of abbreviations

ADEME : Agence de l'Environnement et de la Maîtrise de l'Energie
AISD : Association of Detergents and Soap Manufacturers.
AISE : International Association of Soap & Detergents Manufacturers.
CB: Collective Buildings
CCI: Individual Central Heating
CCC: Collective Central Heating.
CEREN : Centre d'Etude et de Recherche Economiques sur l'Energie.
CGE : Compagnie Générale des Eaux .
CREDOC : Research Centre for the Observation and the Study of the Conditions of Living.
CT: Cognitive Transfer
DSM: Demand Side Management.
EEB : Energy Environment Budgets
FOE: Friends of the Earth
FUL : Fondation Universitaire Luxembourgeoise
GAP: Global Action Plan
GMO: Genetically Modified Organisms.
IH: Individual House
INC : National Institute of Consumption
INED: National Institute for Demographic Studies
INESTENE : Institute for the Evaluation on Energy and Environment Strategies in Europe.
INRA : National Institute for Agronomic Research
INRETS : National Research Institute on Transports and transports' Safety.
INSEE : French National Institute of Statistics and Economic Studies.
LMC : Lower Middle Class
NIMBY: Not In My Backyard
NIPO : Netherlands Institute of Public Opinion.
PCRD: Plans Communaux de Reduction des Déchets (Town plans for waste reduction)
SPC : Socio-Professional Categories
SMCS : Socio-Material-Collective Systems.
TEM: Theory of the Ecological Modernisation of production and consumption.
Tep : Tons equivalent Petrol . 1tep = $4,19 \times 10^{10}$ (exp 10) Joules.
TPB: Theory of Planned Behaviour
TPP : Tri polyphosphates.
TRA: Theory of Reasoned Action
UFCS : Social and Civic Feminine Union.
UPC : Upper Middle Class.
UVC: Unit of Product Sold

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INTRODUCTION

In France, environmental policies have dealt with the issue of implementing sustainable consumption in the household either directly with fiscal incentives or indirectly thanks to the adoption of new and less polluting technical norms in the construction industry and in the manufacturing of consumption goods.

However, policies directly targeting household consumption have been scarce on the general environmental policy agenda. If we consider that households are responsible for 50% of the phosphates pollution (Agences de l'eau, 1997)¹ and for an important part of CO₂ emissions thanks to heating and transport (INESTENE/WWF 1998) without talking about the impact of their purchasing habits (for example, the impact of their purchase of organic products on agricultural practices), active participation of people in environmental policy seems essential.

Sustainable development: a development mode that respects human and social rights and minimise its impact on the environment (see Ch 1). In this work we will refer to the notion of sustainability in its environmental aspect.

Sustainable behaviour: behaviour, which, when taken, allows one to minimise his/her impact on the environment thanks to the use of fewer or no natural resources i.e. more efficient consumption or savings². Driving one's car more slowly is an example of a sustainable behaviour. It is a way of consuming less petrol therefore of polluting less. However, a distinction is often made between **sustainable consumption and sustainable behaviour**. The latter referring to consumption and to the way we use (or avoid using) products or services while the former focuses on the resource's consumption of these products and services.

While many Northern European countries- particularly The Netherlands (Noorman; Schoot Uiterkamp, 1998)- have been implementing such policies for years, it is not the case in France where policies targeting the household behaviour have been very limited until now. The common justification for such a situation is based on a couple of surveys³ that refer to the weakness of social demand for a more sustainable society. In these surveys, French people are described as considering that adopting sustainable behaviour will reduce their living standards (see Chapter 1).

¹ Phosphate use in detergents is not banned in France.

² For details see chapter 1

³ For example, the annual global survey of the CREDOC.

Another explanation is that people are difficult to reach. When trying to implement behaviour changes at the household level, policy makers are entering a very private sphere that is normally out of their influence and for which “classical” policy tools such as fiscal incentives have shown their limits. All of these are good reasons for the politicians to avoid going against the will and habits of their electoral basis.

I was convinced that this was too easy a way of avoiding the issue and that people were much more ready to take sustainable action than it seemed. But was there really an ignored potential of action within the French household?

In the respect of the individual’s rights, everybody should have the freedom to choose a more sustainable lifestyle.

A group of people is often present in a **household**. As we will see in chapter 3, these people try to influence each other 's behaviour. However, without ignoring the influence of children on their parents, I chose to focus the study on **individual adults** who are decision makers for the household's consumption. This is why there will be a constant to-ing and fro-ing between these two notions in this work.

It implies access to information that will allow such a choice, all the more so as sensitivity to environmental issues doesn’t mean a perfect understanding of what is at stake. Actually, if, thanks to media coverage, there is no doubt that people are aware of issues such as acid rain, threatened animal species, oil spillage, air pollution, ozone layer etc, I was doubting whether they are able to connect those global and far away environmental issues with their daily life.

My assumption was that people's apparent ill will to adopt sustainable consumption doesn’t reflect a lack of interest in environmental issues but is the consequence of a lack of representation of existing solutions for minimising one’s impact on the environment. In other words, I was making the following hypothesis:

- H1: PEOPLE DON'T KNOW THE POSSIBLE ADVERSE ENVIRONMENTAL IMPACTS OF THEIR BEHAVIOUR AND IF SO, THEY DON'T KNOW WHAT THEY SHOULD DO TO AVOID IT.

Therefore, raising people’s awareness of practical solutions and of the link between individual action and its benefits for the environment can lead to the adoption of sustainable behaviour.

- H1 a : As a secondary hypothesis I was assuming that MOST LAY PEOPLE ARE NOT AWARE OF THE IMPORTANCE AND ENVIRONMENTAL IMPACT OF THE CONSUMPTION LINKED TO THE HOUSEHOLD'S CONNECTIONS TO SERVICE NETWORKS ALTHOUGH THEY ARE A MAJOR SOURCE OF POLLUTION.

This secondary assumption was linked to official data that show that many people are considering that “doing something for the environment” is equivalent to joining a collective movement (Maresca, 1999). At best, we could assume that waste sorting or the purchase of “green” products could be understood as sustainable action because this aspect had been marketed. The fact that energy and water consumption belonged to the most intimate part of life and were linked to our daily habits which are far less well known than the purchase mechanisms was reinforcing my interest in the subject.

However, democratic access to information has never turned out to be enough to modify practices. Something else had to be found to reinforce the impact of information in the process of taking sustainable action. All the more so as the various information tools (leaflets, advertising campaigns, press coverage etc.) that have been used in French environmental policy and in other countries have shown their limits.

The “Actant Network Theory” (Latour, 2000; Callon & Law, 1997) insists on the importance of artefacts in the action process.

Artefact: an object created by people
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This Theory has suggested that artefacts embody action. For example, waste-sorting practices can't be implemented if there are no specific bins and containers. At the opposite, if one possesses those bins and containers it will be difficult for him/her to keep on putting all his/her waste in the same container. Accordingly, my second hypothesis was:

H2: INFORMATION EMBODIED IN AN ARTEFACT ALLOWING PEOPLE TO ASSESS THE IMPACT OF THEIR BEHAVIOUR ON THE ENVIRONMENT WOULD SUPPORT THE ACTION TAKING PROCESS.

This is the reason why, as there was no such a kind of artefact in France⁴, I decided to build one myself that will be called an Energy Environment Budget (EEB) i.e. an artefact that will allow people to assess their environmental impact by creating a link between their behaviour and its impact and showing what one could expect from a behaviour change in terms of pollution and resource's savings. When looking at the repartition of the thesis' work in time, creating an EEB took whole year of my PhD (Fig. 1). It was hard work because it wasn't possible to design this budget with available data. I had to re-construct household's consumption thanks to a bottom-up approach

⁴ Except for a energy consumption model displayed by The ADEME (Agence de l'Environnement et de la Maîtrise de l'Energie) which was quite difficult to handle and was not considering issues such as transport or water use.

that was difficult and time consuming. This work is detailed in the appendix. The volume of which is explained by the amount of calculation I had to do.

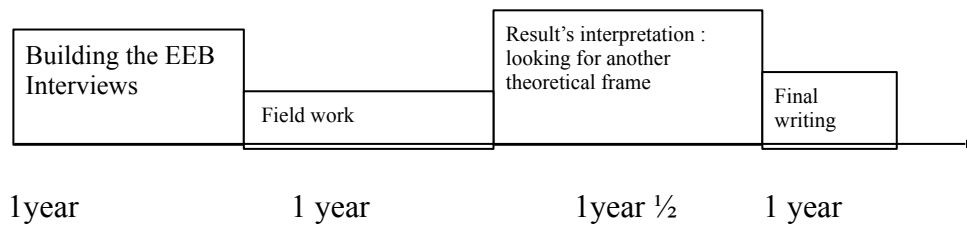


Fig 1 : Repartition of the thesis'work in time.

The principle of an EEB is simple: the idea is to calculate the average direct energy and water consumption of a household according to its equipment, its location (climate zone, countryside, towns etc), the number of inhabitants and to evaluate the amount of CO₂ that their use produces.

Direct Energy use measures the amount of energy that is necessary for the use of a good, for example the electricity consumption of a washing machine.

Indirect Energy use refers to the whole energy consumption that is involved in the production, transportation and disposal process of a good.

OECD values household Direct Energy Use between 15 and 20% of total national energy consumption and Indirect Energy Use between 60 and 70% of total national energy consumption. (Kok. R & al, 2003).

Water consumption for washing can be related to the use of detergents therefore to an amount of phosphates release. The pollution linked to the usage of a car can be evaluated according to the type of car and the characteristics of the journey. All this information i.e. consumption and its various polluting consequences is synthesised in a document that allows easy consultation. The idea was to build an Energy Environment Budget (EEB) that could be used easily by lay people in order to make them able to play with the different consumption parameters and to assess by themselves the variations of consumption and pollution levels that could be induced by behaviour change. Therefore the EEB should have a simple form that would help manipulation. It will be the main difference with the usual means that are used to convey information.

In this background,

- The creation of EEBs was, in itself, a way of concretising, of giving to the lay people access to the world of the environmental policy, its challenges and its issues.
- Opposite to “top down” policy instruments that were confronting people to final results, EEBs

- were confronting people with their own environmental responsibility,
- could be conceived in a more inter-active way allowing people to have a minimum understanding of the calculation process therefore being able to use it themselves.

In this understanding, EEBs could be an instrument of the recognition of the lay people's value as an actor in the environmental policy.

Creating EEBs could then be understood as an attempt of providing policy makers too with a new policy management tool that one could hope more efficient for inducing action than classical information systems.

At the end of the day, working on the EEB was a way of looking for the optimisation of a new informative tool while demonstrating that there was a potential audience for it therefore introducing it as a coherent instrument for environmental policy and challenging the hypothesis that a basis for the implementation of sustainable policies does not exist among the French household.

At the theoretical level, designing and testing Energy Environment Budgets was coherent with the perspectives opened by the theory of the "Ecological Modernisation of Production and Consumption" (TEM) which, as we will see in chapter 1:

- Considers that it is possible to minimise the environmental impact of growth thanks to the "ecologisation" of economy.
- Considers that consumers/citizens are "rational" actors who would adopt sustainable behaviour if given "good reasons" for doing so thanks to proper and innovative information tools, in our case Energy Environment Budgets (EEBs).

The issue of people's identity- consumer or citizen- when taking sustainable action is a constant concern in this work. I don't mix them up but the TEM tends to do so and to consider that people behave in a "**rational**" way. This "rationality" means that people are consciously weighing the pros and the cons of their behaviour in order to maximise their profit and their quality of life.

The issue was then to organise the fieldwork but, before doing so, I wanted to have a deeper understanding of the people's understanding and performing of sustainable actions. This is the reason why a serie of 48 face-to-face interviews were held in the area of Valence. As people's attitudes towards main sustainable behaviour were already quite documented, I focused on what

people were doing, not on their intentions to take action. The results of this study were used as a complementary source of information.

However, if, at a general level, I referred to the theory of the Ecological Modernisation, the question of the analytical treatment of the construction of the field work and of its interpretation was more opened because I wanted:

- a) to be able to take into account the specificity of the EEB as an informative tool
- b) to give an account as detailed as possible for what I would be able to observe and in particular for the processes (by opposition to the results) that were at stake at the individual's level .

Once Energy Environment Budgets were built, it was time to check whether they would induce behaviour change. For doing so, and because EEBs were not a usual product to be marketed but the prototype of an informative artefact, we had to use a specific methodology, the Cognitive Transfer (CT) that originates from the auditing industry. In contrast to product tests, such a methodology based on qualitative methods and the organisation of focus groups, authorises us to assess the implementation of a practice on a certain period of time and to spot its pros and cons in the long run.

Another theoretical question to be solved was the choice of a theoretical frame for understanding what was at stake during the group sessions. The “Attitude Behaviour” models that state that action is the product of its anticipated consequences, of subjective norms linked to that action and of perceived behavioural control was my first choice. This conception was fitting my objective of enhancing both personal control and anticipation of the impact of behaviour change.

The results of both the face-to-face interviews and the Cognitive Transfer groups showed a strong political criticism that was a major determinant in sustainable action taking. Moreover, it turned out, after both field researches, that people's adoption of behaviour changes had little to do with "rationality". Even if the Energy Environment Budgets happened to be quite efficient for inducing sustainable action taking, much more than a rational appropriation process of information was at stake. Not only was the political issue omnipresent but also the social construction of the environment as a risk and as a threat for human beings was a pre-eminent element that was underlying pretty “irrational” notions such as fear, trust, physical sensations etc.

There are many definitions of the environmental risk (Peretti-Watel, 2000). In this study the environment appears both as a **risk** that is geographically limited and can be assessed and as a **threat** that can't be assessed nor controlled.

These assessments were challenging our first and, with insight, quite simplistic understanding of the functioning of policy-making tools as a result of a cause-to-effect chain. I could also assess that the group dynamic was at least as important as the informative artefact (the EEB) for inducing sustainable action.

Therefore, to give a more precise report of what was going on, insights from sociology were necessary to describe and understand the different elements that are mobilised in the sustainable action taking process when it is introduced by an EEB. They helped me drawing a different picture of the conditions of an efficient use of environmental policy tools where sociological element directly influence socio-psychological ones which can be described thanks to the interpretative frame theory. From this analysis, it was then possible to discuss the TEM. The work done during the thesis can therefore be distributed according to these various theoretical references (Fig. 2)

Theory	Action
TEM	General framing of the project.
	Construction of the EEB
Cognitive transfer method	Organisation of the fieldwork
Attitude/Behaviour models	Interpretation of the fieldwork
Sociological reading and mobilisation of the Interpretative Frame Theory	A full description is not possible

Fig 2 Theoretical references of the thesis.

The plan of the thesis reflects these interrogations and the change of perspective that was adopted. The first chapter explains how the Theory of the Ecological Modernisation of production and consumption is the framework that underlie our two hypothesis. Chapter two emphasises the importance of artefacts in the action taking process and describes the creation of an informative one : the Energy Environment Budget. Chapter three details the organisation of the Cognitive Transfer,

its results and the inputs given by the Attitude/Behaviour Model for understanding them and the questions that remain unsolved.

The second part introduces the wider frame in which artefacts should be considered by environmental policy makers in order to maximise their efficiency. Following this perspective, chapter 4 focuses on the analysis that a sociological reading of the field research could help building and states that, at the heart of the action taking process is the way people deal with the scale gap that they perceive between the individual action range and the dimension of environmental issues. A gap that overwhelms people all the more so as it is not bridged by the institutions. Consequently, empowering people is the main condition for the voluntary adoption of sustainable behaviour. Chapter 5 draws the lines that can lead to an increase of this empowerment and suggests a description of the process at stake.

To summarise, this research work is built around the question of a practitioner who had to refer to various theoretical concepts to understand what she was observing and who proposes, then, her interpretation of the conditions and ways according to which information artefacts should be understood if one wants them to be efficient. To this extent, this work on household's sustainable behaviour is representative of the many environmental issues that require, nowadays, the mobilisation of various academic fields. As such, this thesis mobilises inputs from sociology, psycho-sociology and energy efficiency. Therefore, it is presented as a thesis in "Environmental sciences" for which the FUL institution was the most conducive place for this work.

1. The Theory of the Ecological Modernisation of production and consumption is the framework of a study where an informative artefact is aimed at reinforcing behaviour change in the household.

When making the assumption that an informative artefact will be efficient in inducing sustainable action taking in the French household because of the rise in people's awareness of practical solutions and of the link between individual action and its benefits for the environment, we are in a prevailing paradigm that is important to understand. First of all, the very idea of achieving "sustainability" i.e. that it is possible to minimise the environmental impact of human activity on the environment, is in line with the Theory of the Ecological Modernisation of production and consumption. This will be the subject of the first chapter. Secondly, the idea of building an Energy Environment Budget, even though it would be reduced to a paper support, strongly assumes the importance of artefacts. This will be the subject of the second chapter. Finally, the very idea of testing the EEB once conceived, assumes that it is possible to identify "rational" reasons to behave that could be mobilised to improve the EEB's characteristics or to consider new tools. It will be the subject of the third chapter.

1. *Influencing household's behaviour is part of a policy that derives from the theory of the ecological modernisation of production and consumption.*

In this chapter we will see how the theory of the ecological modernisation of production and consumption can be considered as the global frame in which the use of Energy Environment Budgets was considered (section 1). We will focus on household consumption and the inputs brought by Spaargaren in the theory (section 2). We will consider then, what is known about the sustainable behaviour of the French household (section3) and about people's expectations (section 4) hence drawing the background in which the EEB experience was to be held.

1. 1 THE CONCEPT OF SUSTAINABILITY IS RELATED TO THE THEORY OF THE ECOLOGICAL MODERNISATION OF PRODUCTION AND CONSUMPTION, WHICH AIMS AT RECONCILING THE ECONOMY AND THE ENVIRONMENT WITH MODERNITY.

The Theory of the Ecological Modernisation of production and consumption (TEM) appeared in the eighties. According to Spaargaren (Spaargaren,1997) it was introduced as a theory of social change

by Joseph Huber, a German sociologist, who analysed the future of the post-industrial society considering the ecological crisis as the main factor of change. Most of this author's work is in German and is not easily accessible. According to what is said about it by Spaargaren, Mol (Mol 1996) or Cohen (Cohen, 1997), Ecological Modernisation is seen by Huber as the last phase in the development of the western modern industrial society.

Huber introduces the analytical category of an "Eco-sphere" which, representing « Nature » completes the "Techno-sphere" (or industrial system) and the "Socio-sphere" (or what he calls "life world"). The Eco-sphere is seen as a means of production, a good for consumption and a pre-condition for human health i.e. a "sustenance base". In this analytical frame, the main problem is the colonisation of both the socio and the Eco-spheres by the Techno-sphere, which has led to the ecological crisis that the western world faces. In current language, the notion of Eco-sphere, Techno-sphere and Social-sphere are summarised in the trio: "Planet", "Profit", "People".

Huber states that, in order to overcome this situation, integrating environmental issues should restructure the industrial system. He also states that the ecological rationality should be the leading factor for the whole of society. *«The ecological modernisation theory emphasises the possibilities of a process of re-embedding economic practices in respect of their ecological dimension within the institutions of modernity. This modern re-embedding process should result in the institutionalisation of ecology in the social practices of production and consumption»* (Mol, 1996).

Huber is presented by Spaargaren as one of the founding fathers of the theory but other authors, including those already quoted, have contributed to it . Therefore, the theory now appears more as a set of point of views about the relationships between the environment and the other parts of the society than as the intellectual production of one main author.

However, it is possible to draw a couple of general rules that characterise the theory.

- 1) It is directed at the industrial dimension of modernity.
- 2) Within the industry, technology and modern science are the main factor of change. « Super industrialisation» (Cohen, 1997) is the process that will correct the « design flaws » of industrial technology. Hence the importance of artefacts within that framework.
- 3) Its aim is the « ecologisation of the economy » and the « economisation of ecology ». Therefore, the ecological rationality has to be able to stand for itself (emancipation of the Eco-sphere) but the importance of the market and of the economy is not denied. In this perspective, building an Energy Environment Budget is an attempt for finding new ways of emancipation.

Summarising, this theory can be understood as opposite to ideas that promote a complete change of production and consumption structures. The capitalist character of the society is not questioned neither the objective of a general growth nor the possibility of a real institutional reform. The ecologisation of the society is only the next step in the industrialisation process. By asserting so, the ecological modernisation of society is mainly what Maarten. J Hajer calls a « moderate social project » (Hajer, 1996) in which the focus is on the relationships between the Techno-sphere and the Eco-sphere as described in the schematic figure of the ecologisation of production and consumption (Fig.3)

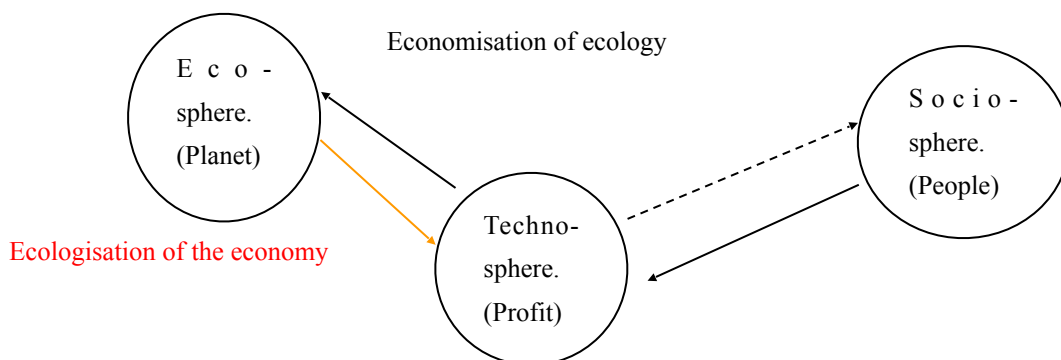


Fig 3 Schematic representation of the Ecological Modernisation of Production and Consumption

Although Huber himself seems to regard state intervention as counterproductive because it goes against innovation, most applications of his theory have given to the State a central function as

promoter of the ecologisation of the economy and as a way to repair the ecological consequences of the market competition. Cohen proceeds on the preventive aspects of the state action and speaks about « strict government regulations » (Cohen, 1998 a). After analysing the ongoing literature on ecological modernisation, Cohen added two new criteria to the theory:

- 4) It promotes the organisational internalisation of environmental responsibility i.e. all public and private entities should integrate a concern for environmental quality in all of their activities.
- 5) Constructive relationships between industry, government, NGOS and the public should be achieved and grounded in good faith and the free exchange of information (Cohen 1998 b).

An interesting aspect in this approach is that it recognises a moral concept « good faith/freedom » as the core element that makes the theory work. Therefore it states that the type of link that should exist between the local action of individuals and the institutional action is central to the ecological modernisation issue. The generalisation of such a link can be perceived as an utopia but it gives the idea that the usual « rational » category that are used in analysing the relationships between technology, environment and society might not be adequate anymore. In other words, we can also consider this statement as an attempt to define the characteristics of the Eco-sphere, hence suggesting that the usual normative criteria that are predominant in a world colonised by the Techno-sphere are not valid if we want to achieve the emancipation of the Eco-sphere. It is also an attempt to define the relationships that should exist between “People” and the “Planet” are they are not denied in the common understanding of the ecological modernisation. Furthermore, it suggests that, when understood as its common sense of a decision making process focusing on logical and technical elements only, rationality might not be a sufficient basis for the creation of an ecologically modernised society. This question will drive most of our research work. In this perspective, the work of Hajer suggests the existence of other constitutive elements of the Eco-sphere when he synthesises the various interpretations of the TEM.

- i) First of all, he describes understandings according to which Ecological Modernisation is an "*institutional learning*" process that corresponds to the use of various policy tools to enhance the ecologisation of the society. This is the most commonly accepted interpretation of the ecological modernisation. However, he defines two other interpretative frames of the theory:

- ii) Ecological Modernisation as a "*technocratic project*" assumes that no institutional change is possible and that the TEM is only seen as a means to get round the issues brought by radical environmentalism. It states that even re-embedded in ecology, technology will only be used by the technocracy as a way to control nature & society. Therefore, attention and work should concentrate on the alternative movements and the best way of introducing local and democratic concerns in the ecologisation process.
- iii) Ecological Modernisation as "*cultural politics*". In this interpretation, the Ecological modernisation should be analysed as a « preferred social order » which provides tools for social action. In doing so, says Hajer, ecological modernisation “freezes or excludes some aspects of reality while manipulating others.” In our opinion, this approach views Ecological modernisation as a constructed object which is the product of specific social relationships: while some aspects are emphasised, others are frozen i.e. not questioned until the next change in the balance between the social actors’ relationships brings a new social order. For example, the first understanding of the concept of sustainable development was emphasising the consequences of the development on Nature while later understanding was focusing on its social consequences. This shows that the discursive aspects of the ecological modernisation are the products of the cultural politics. Therefore, the debate should no longer be on the protection of nature but on the kind of “nature and society” we want, technology being a mean to reconstitute the social relationships between nature and society.

Following this debate about the type of Nature wanted by society, we may question whether Hajer’s typology reflects variations in the conception of Nature. For this purpose, we can compare it to the concepts of Nature in environmental sociology defined by Van Koppen (Van Koppen, 2000). According to this author, there are three concepts of Nature in Environmental Sociology. Nature can be considered

- either as a resource i.e. as “a means of production, a good for consumption and a pre-condition for human health. In other words as a sustenance base”
- or as Arcadia i.e. an object with intrinsic values that deserves preservation for itself.

- or as a social construction i.e. “by demonstrating how nature concepts depend on their social contexts, their meaning and use can be questioned and explained in terms of social processes”.

Van Koppen states that the TEM considers Nature as a resource. However, I could suggest that, if institutional learning, the mainstream understanding of the ecological modernisation, matches perfectly with that definition, other definitions of Ecological Modernisation might correspond to an attempt of referring to the other social concepts of Nature. Accordingly, the critics emphasising the TEM as a “*technocratic project*” to control Nature underline the value of Arcadian approaches while the TEM as cultural politics is based on the paradigm of the social construction of Nature because we should define what sort of Nature we want. In other words, the various concepts of Nature seem to be linked with the various acceptances of the TEM.

Therefore, I can suggest that the “Planet, Profit, People” trio can be translated as “ Arcadia, Resource, Constructed Nature, ” when studying the various meanings of the concept of “Nature” in the TEM (Fig.4).

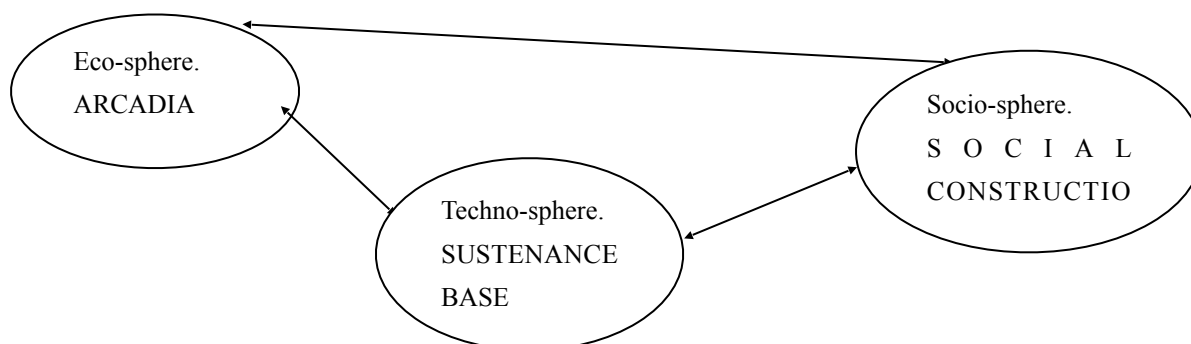


Fig 4 Nature in The Ecological Modernisation of Production and Consumption

Returning to my first research question of the type of rationality that will contribute to the emancipation of the Eco-sphere, one may suggest that both the debate on what sort of environment and technology we want and on the introduction of local and democratic concerns allow the re-introduction of other types of rationality and other perceptions of the Environment which are constitutive of the Eco-sphere

Anyway, the TEM as “institutional learning”, is the predominant paradigm. It may have had fruitful applications since it didn’t promote radical changes in the structure of society. For example, we can consider that social actors such as environmental NGO’s and institutions are coherent with the theory. The OECD, the European Union and the World Business Council for Sustainable

Development have endorsed selected principles of ecological modernisation and various concepts have emerged to rationalise the ecology and institutionalised the ecologisation of the society. Many refer to the concept of sustainable development to the extent that Zaccāi (Zaccaï, 2002) says that ecological modernisation is "a *widespread dimension, or version, of the questions raised by sustainable development*".

The Brundlandt report defines sustainable development as « *a development that meets the needs of the present without compromising the ability of future generations to meet their own needs* » (World Commission on Environment and Development, 1997). This definition has been interpreted in many different ways from which various kind of policies aimed at implementing sustainability have emerged. Some people focus on the necessary reduction of human activities' environmental impact, some underline the social aspects that derive from this definition and others the kind of personal fulfilment that it should bring to people (Goldsmith & all 1972) to the extent that there is no one and only understanding of the concept⁵. Consequently, as Ligteringen suggests (Ligteringen, 1999), it is better to take a pragmatic position and to consider sustainable development as a "relative concept, a rationality".

Anyway, future generations will not meet their needs if the Environment, as the sustenance base defined by Huber, is destroyed. From this perspective, many different notions have appeared. Among them, notions based on the idea that there are limits to the "carrying capacity" of the environment.

The latter concept emphasises the limits of the sustenance base. It is the same idea that had given birth to notions such as the ecological rucksacks (the amount of resources that is necessary to produce one item), the ecological footprint (the surface that is necessary to produce the goods and services consumed in a specific region or to produce a specific item).

The UN Commission on Sustainable Development refers to the Earth's carrying capacity when defining the aims of the ecologisation of the economy: «*the concept of sustainable consumption and production provides a framework for recognising that economic policy can potentially contribute to, or alleviate environmental stress. The emphasis on sustainable production is on the supply side of the equation... Sustainable consumption addresses the demand side looking at how goods and services...can be selected in ways that reduce the burden on the Earth's carrying capacity (UN commission on Sustainable Development, 1998)*» In line with this theme, the Commission defines sustainable consumption as an objective of the consumer protection policy and precises the

⁵ For a detailed study of the notion of sustainable development see Zaccāi (2002) quoted above.

framework in which information policy should be considered: *«When environment is being damaged, the damage is being done by individuals. Sometimes they are consumers acting irresponsibly. More often they are consumers forced to use unsuitable products...So collective action to protect the environment can only be achieved when there is widespread individual awareness of the environmental consequences of consumption»*. As mentioned in the previous paragraph, this approach is clearly linked with an institutional acceptance of the institutional interpretation of the TEM i.e. an approach that uses policy tools to enhance the ecologisation of society. Coherent with that framework are the ideas of improving the efficiency of our consumption of resources by a factor four (Von Weisacker, Lovins, 1997) or a factor ten without threatening the planet's resources therefore allowing the production growth that is necessary if one wants to give to the whole world population an appropriate level of "well being". The ways to increase efficiency is the generalisation of the use of the most efficient existing technologies and resource savings.

This is not going without raising questions about the consumer's behaviour, not only because he will have to adopt saving behaviour but also because the use of efficient technologies musn't be counterbalanced by a larger use of the technology itself otherwise it will not have any impact on the resource consumption and/or the pollution level. This phenomena is called the "rebound" effect. For example, if one buys an energy efficient dishwasher but uses it twice more (when half-empty etc) the increase in the frequency of use will counterbalance the savings made thanks to better technology. Therefore the issue at stake is not only to replace one technology by an other but also to convince people to avoid increasing the use of artefacts or to choose alternative ones that will keep on minimising our environmental impact.

To what extent is this possible with the aim of achieving a level of "well being" i.e. keeping an environmentally and socially sustainable way of life without affecting our quality of life? " From this consideration some people now try to promote the idea of "Eco-sufficiency"(FOE, date unknown; UNDP, 2002) i.e. knowing "how much is enough". This notion considers that there is a limit where more wealth doesn't longer translate into more quality of life. It can be related to another interesting application based on the conception of Nature as a sustenance base: the IPAT analysis.

It refers to the quantity of resources used and its environmental impact. The IPAT "equation" (Ehrlich & Holdren , 1971) $I = P \cdot A \cdot T$ states that the environmental impact of a society (I) is the product of the population (P) per the consumption per capita defined as affluence (A) and the environmental damage caused by specific technologies (T).

This “equation” can be applied to the household, which have a population, affluence and uses specific technologies⁶. It completes the factor X approach to the extent that, while keeping the idea of the importance of the consumption choice between one technology or the other given that the same service is provided by the product, it introduces the idea of the importance of the range of product that people can have access to-thanks to the capital he owns. By doing so, it emphasises the idea that, in order to reduce the environmental impact of western societies, one should limit or diminish this affluence. This aspect underlines the specific responsibility of the “rich countries” in the achievement of sustainability and seems coherent with the idea of Eco sufficiency. While the focus on the technological side of the equation can be understood by the layman as a « business as usual » society, the issue of affluence underlines the impact of one’s use of his/her affluence, therefore a person's own responsibility towards society. This suggests that the state of social relationships might be worthwhile exploring when studying the implementation of sustainable behaviour.

Anyway, the mainstream policy recommendations issued from the TEM approach focus on:

- the regulation of the supply side of consumption: product testing, Eco-labelling, advertising, ban of harmful materials etc and on education on as a « reinforcement of the capacity to think critically about product choices » thanks to the policy instruments that were quoted.
- the “demand side management”. This concept is based on a simple idea: the consumer doesn’t care about the technology embodied in the products he uses as long as he/she gets the convenience he/she is looking for. Therefore the education of the consumer should make him aware of the existence of the technologies and products that have a limited impact on the environment and that education should be made not only by the product’s producers, but also, by public institutions.

The TEM theory has been criticised by many authors who reject its Western centred approach, its focus on local or state pollution problems while the agenda is increasingly on the global level, and its lack of consideration for human beings as independent actors. These criticisms are mostly based on a strict institutional interpretation of the theory.

One more can be added to them that is in line with the technocratic interpretation of the TEM. It is that one of the main environmental problem i.e. the Eco-impact of the energy sector from production to end-consumption (for example, the two main sources of CO₂ emissions are the

⁶ At the household level, we will not use the “equation” because our objective is to focus on the specific input that is brought by the Energy Environment Budgets.

combustion of fossil energy (coal, oil and gas) (80%) and deforestation (Dessus, 1991a) is hardly dealt with by the institutions: for example, it was not mentioned in the final document of the Rio conference. Ten years later, the application of the Kyoto conference may turn into an institutional nightmare. This can be interpreted as the proof that institutions can't really improve as it is suggested in the interpretation of the Ecological Modernisation as a "technocratic project"⁷.

Another example of the TEM as cultural politics is that many scientists have forgotten consumers when recommending policies that will implement energy efficiency as a major criterion for environmental policies. Following the analysis previously quoted, their work focuses, for example, on the study of the global demand for energy and on the opportunities opened by the use of low energy consumption technologies both in the western world and in Southern countries (Goldenberg & al 1988; Dessus, 1991b). But people remains only a part of the production/consumption scheme and households are only considered as autonomous in their daily activities as key agents for the success of environmental policies such as waste separation or using disposable products (Agenda 21, 1992).

To answer critics about the lack of consideration of the human factor in environmental policies and the importance of the citizen/consumer as a key element of the ecologisation of production and consumption, the work initiated by Spaargaren on sustainable lifestyles provides a very interesting framework for further research into the relationships between the consumer/citizen, the environment and the institutional world.

1.2 The importance of the individual in the Ecological Modernisation process.

While staying in the « institutional » interpretative frame of the theory, Spaargaren's thesis (Spaargaren, 1997) has emphasised the fact that the theory should re-consider the role of citizen-consumers in the context of the production/consumption cycles and the role of citizens, individuals or human agents in relation to institutional developments.

He advocates that « the behaviour of citizen consumers is of prime importance since institutional developments at the macro level cannot be detached from the developments at the micro level of society » and stresses

- the relative power of agents in bringing about environmental change

⁷ Page 21

- the importance of the « meaning » of goods and services for people. It is unique for each household but also partially shared with other households.
- the importance of structure on action. This analysis is based on Per Otnes's (Otnes 1988) work about the interaction between the organisation of every day life by actors on one hand and the influence of the institutional context on the other. Otnes states that domestic consumption interacts with institutions through various Socio-Material- Collective Systems (SMCS) that link the household with the outside world. The process can be summarised as a process of “serving and being served by ” SMCS i.e. every time we consume or use one then we participate to its reproduction. Otnes underlines the fact that most of Socio-Material Collective Systems are the subjects of numerous debates and that consequently, actors do not only take part in the reproduction of the system in their role of consumer/users but also in that of citizens.

Otnes introduces also the idea of studying the concept of « provinces of every day_life » i.e. the use context of each SMCS, which is also a linked to a specific meaning that good, and services are going to take within this context. Therefore:

- The question of the sustainability of the SMCS is of great importance together with their connections with the everyday activities of each actor.
- Consequently, we can wonder what should be the role of the institutions in the relationships that occur between the individual and the SMCS. Is there a necessity of a « social balance » between market provision and state provision of goods and services?

Otnes's analysis is inspired by Giddens's structuration theory, which shows:

- that structures are both enabling and constraining. For example, when one switches on the light, it depends on its connection to the electrical network; therefore the action itself is also dependent on the very existence of the network itself.
- the importance of routines in consumers' behaviour. Most of our actions are described by Giddens as made automatically within the structuration system in which we live. However, from time to time our attention is driven back to the automatic act and we have the opportunity to reflect about it. To translate this observation, Giddens speaks about de- and re-routinisation. Otnes considers also that the ecological modernisation of domestic consumption, especially of SMCS, can be conceived as a series of de and re-routinisations. This issue is all the more important for us that most of our negative impacts on the environment are linked to our daily habits, not only our daily use of SMCS such as transportation systems but also to the temperature level to which we tune our heater, the

amount of washing powder we put in our machines etc. It also important because as Shove and Warde (Shove & Warde 1998) analyse, the current sociology of consumption is not of a great help for analysing our “mundane routines”.

On a practical point of view, referring to Huber’s view that the ecological modernisation of the economy requires a process of monitoring all the environmental effects of production and consumption and a monetarisation of these effects, Spaargaren translates these rules and talks about a process of reflexive monitoring of behaviour by capable actors who routinely stay in touch with certain rules of the game i.e. with a set of criteria for ecologically rational behaviour. Spaargaren concludes by emphasising the fact that the behaviour not only depends of the rules and resources to which people have access, but also to the social distribution of the rules and resources involved in a certain social practice. In this extent, Spaargaren studies consumption patterns and tries to bridge the gap between:

- the environmental sciences that analyse the change in consumption patterns according to the way production is organised
- and the social sciences who situate consumer behaviour in the background of change in modern society and its consumer culture while products are seen as indicators of social processes with no connection to the use value or proper qualities of the products themselves. For example, Bourdieu’s distinction theory considers that consumption is a way of establishing one’s world of norms and values as distinct from those of other people, which is valuable in conflicts of positions of social power (Bourdieu, 1979). Douglas (Douglas & Isherwood, 1979) reaches the same kind of conclusions but with a cultural screening of consumption. She considers goods as means of making visible cultural categories, which she defines with a grid/group analytical frame. Those with high level of grid and group culture are going to consume according to corporate /bureaucratic values, those with high grid pressure and poor group culture are behaving with poor cultural values (therefore, one can assume that they are going to be easily manipulated); those with high group /low grid can be defined as sectarian while people with low grid and low group are going to consume according to individualistic values. This analysis is interesting but doesn’t detail the process that guides somebody from one consumption culture to another which is our interest in the EEB experience. Bot theories do not help to understand the conditions for changing our daily routines, which, as we saw, have such great environmental impacts.

Anyway, for bridging the gap between the social and the environmental sciences, Spaargaren suggests to consider the ecological modernisation of domestic practices by referring to the concept of lifestyles. This concept is defined as a system of “social coherence” between the social practices and the « narrative of the self » agents attach to these practices i.e. the way they define their identity: *« the concept of sustainable lifestyles takes into account the environmentally induced modernisation of different sectors of the lifestyle of an individual as well as the way this modernisation process is connected to the identity of the actor »*.

If a person is to maintain a certain level of credibility as regards to the story of its own identity, then a certain degree of coherence in his lifestyle becomes essential (and tuning its action according to it as it gives a sense of ontological security). This evokes the cognitive dissonance process described by socio-psychologists according to which each of us behaves in a way that avoids contradicting oneself (Peretti-Watel, 2000). If we refer to Otnes’ concept of provinces of every day life, one may question, then, whether a specific link exists between people’s identity (narrative of the self) and the various provinces of every day life in which they perform their daily actions.

Spaargaren has detailed his views in an article stating that, because energy, waste and water systems are becoming more consumer oriented, citizens have access to a real opportunity to “shape the way their families will deal with nature in a post traditional way (Spaargaren, 2001)”. Referring to the various acceptance of Nature defined by Van Koppen, we can wonder whether people’s various understanding of Nature are going to influence the type of behaviour that they take and in which provinces of every day life.

Some criticisms can be addressed at Spaargaren’s work:

- He generally considers situations where actors agree to change their behaviour having in mind environmental concerns, it is not always the case.
- Although he refers to the importance of an assessment of one’s behaviour, he doesn’t emphasise the importance of information. If the very existence of a public debate is a sign of the autonomy of the actor vs. the market and SMCS, then the type of information given and the way it is perceived is of great importance.

But, apart from being an impressive relation of the main theories of both consumption and Ecological modernisation, the great quality of his work is that it reintroduces the actor or the household in their complexity and shows by default, the reducing character of the analysis that states an equality of status between actors and consumers or that focuses only on one aspect of sustainable behaviour.

Spaargaren’s work opens the research field to new areas.

- First of all, it doesn't reduce household sustainable behaviour to market consumption but also to the way people deal with their SMCS. This is important because it allows the introduction of saving behaviour while some studies still reduce the ecologisation of consumption to the consumption of « green » products.
- Secondly, it emphasises the fact that consumption cannot be reduced to a study of the consumption of private or public goods seen from the provider's point of view but that there are many things within the households that are not considered. One of them is the way in which actors use « *the various publicly or privately organised environmental arrangements that are supporting daily life* », the other is the influence of the informal economy of the neighbourhood and the family, the last one being the interpretation by the household of the changing relations between the private and the public sector. On this last issue -which also ends his book- he warns that the policy makers' objective of an increased consumption of sustainable public goods (as public transport) might be stopped by the on- going promotion of privatised modes of consumption which have disengaged people from the public sphere and public concerns. In other words people tend to be more consumer than citizen oriented in their behaviour choice.

One may also, interpret Spaargaren work as a translation of The Theory of the Ecological Modernisation of Production and Consumption at the level of the individual. The relationships between "Profit" and "People" are translated into the relationships between people's various identities of consumers (profit) or citizens (people). These relationships could be described in terms of people's perception of the link between private and public sectors i.e. their relationships with the State. However, the translation of nature (planet) at the individual level is not linked to a specific identity.

A second research question for our work is then to explore the issue of identity and of people's relationships with the State and to describe the way they occur and interfere within the French household's sustainable behaviour. Beforehand, it is necessary to understand how sustainable behaviour is mostly understood in France.

1 3 Although improving, the Ecological Modernisation of Consumption is still slow in France.

If we take sustainability as a one of the concepts translating the acceptance of the idea of an ecological modernisation, then it has made obvious progresses in France. "Durabilité" the French translation for sustainability has entered the public sphere and appears regularly in the media. The

impact of household's behaviour on the environment has been recognised mainly by research work financed by or coming from the Minister of the Environment and the Minister for the Research. Few studies were general⁸; most of them are focused on a specific issue. Thus, water pollution by TPP (Tri polyphosphates) issued from domestic use has been well documented since the nineties. It was estimated to represent more than 50% of the TPP emissions into the water (Agences de l'eau, 1997) To answer this problem, the French government has negotiated a 20% decrease in the rate of TPP contained in domestic detergents⁹.

The household's energy saving potential has been the subject of numerous studies. Each of them emphasises one aspect of the household's equipment: hot water production, heating, insulation and renovation, shift of energy sources, electricity savings etc. Formally or informally, all these studies were referring to the broader framework of climate change¹⁰. These studies were complemented by NGO's work (WWF & INESTENE, 1997). All of them acknowledge the importance of domestic energy consumption in CO2 emissions. From 1994 onwards these studies started to focus on the transportation mode as a key issue for atmospheric pollution. The CO2 emissions per inhabitant was estimated to be 3 tons in 1995 among which 1,6 tons i.e. 54% attributed to transportation (Radanne, 1995). In 2000, household's CO2 emissions were estimated to be 16,4 tons per household among which, 25% attributed to people's transportation and 17% to the transport of the goods and services consumed by the household (Chêne-Parizot, 2000). As there are 23 800 000 household in France and 61 387 000 inhabitants (INED, 20003) this suggests a CO2 production of 6,3 tons per inhabitant i.e. a factor 2 increase in a five years time period. As the method for calculating the last figures is not published, I don't know how to interpret such a rise. On the other side, UN convention on climatic changes quotes 8.9 to 7.9 tons per inhabitant (UN, 2001). These figures suggest, on the contrary, that the 1995 calculation was underestimated. Households were regarded responsible for 50% of the French CO2 emissions in 2001.¹¹

⁸ For example, Dobré. M (1994) *La consommation des ménages et l'environnement*

⁹ Données du Ministère de l'Environnement. 1995 (by fax)

¹⁰ For example research studies from

- a) Institut d'Evaluation des Stratégies sur l'Energie et l'Environnement en Europe (INESTENE)
- b) Centre d'Etudes et de Recherches Economiques sur l' Energie (CEREN)
- c) International Conseil Energie (ICE)
- d) CNRS. Programme interdisciplinaire de recherche sur les technologies pour l'environnement et l'énergie. ECOTECH.

and all the publications from the Agence pour l'Environnement et la Maîtrise de l'Energie (ADEME). A Governmental agency working under the Ministry of the Environment and the Ministry of Industry's authority.

¹¹ www.ADEME.fr/presse/communiqués/CP-2001-06.13.htm.

Households were key elements of the recycling policy of the last ten years. Although never compulsory, waste recycling programs were to be implemented in most households as most dumps were to be closed by 2001.¹² The program's implementation is late but there is an ongoing effort from public institutions in its favour. Public research work was first concentrated on the key issues of consumption, but the research has then expanded to other types of behaviours as it has appeared that the way people were using household equipment (including their car) had important consequences on energy or water consumption and air pollution. Hence recommendations to switch off lights, to use low temperature programs, to run a washing program only when the machine is full, to maintain one's car etc...¹³ These advices are promoted through various websites and leaflets and, more recently, through two advertising campaigns. The first one called "Save your money, save the planet" promotes renewable energies and energy savings behaviour at home and driving behaviour when cars are used to go shopping. It was organised by the Agence pour l'Environnement et la Maîtrise de l'Energie (ADEME) and was held mid 2001. The second one started in September 2002 and was called "Thank you says the planet". It enlarged the information to other behaviour such as water, air, noise, waste and nature. These campaigns were the sign of an improvement in the information process. What remains to be studied are the conditions for the implementation of such behaviour in the long run and the limits of communication policies. The second part of the research will try to answer these questions.

However, since the last general elections in 2002, serious cuts have been made in environmental budgets (for example, less 34% for the ADEME). This is the sign of the fragility of the political interest in implementing the green aspects of sustainability. One of the explanations for this is that sustainability is resented by politicians as something unpopular (1). We will see that a detailed reading of the main studies held in France about sustainable behaviour question this assumption (2) all the more so as individual assessment of one's behaviour appears to be poor (3).

1) The promotion of sustainable behaviour is weak because it is perceived as something unpopular among the French lay people.

When looking at the figures quoted at the beginning of this section, the importance of household's sustainable behaviour is obvious. However, while the Ministry of the Environment was developing research programs and promoting sustainable behaviour¹⁴, sustainable behaviour was not part of the

¹² 1992 law

¹³ see the ADEME website. www.ademe.fr

¹⁴ see the Ministry of Environment and Land planning web site www.environnement.gouv.fr

main political agenda. This situation can be explained by the French position as a nuclear energy producer and by the difficulties of a good appreciation of people's expectations by the policy makers.

a) The specific position of France as a nuclear energy producer. For a long time, renewable energies or energy efficiency actions has been considered as a threat to the nuclear energy production. Actually, although specific commissions of the French parliament have worked on the energy issues, especially the budget commissions, there has been no parliamentary vote about the energy policy since 1981 or even before this date because the 1981 vote was what is called a “ blocked vote” (vote bloqué)¹⁵ on the renewal of the nuclear program. Other facts were a sign of this attitude. For example, the report which in 1992 concluded on the importance of the demand side management and energy efficiency policies has led to the ostracization of its supervisor Mr Souviron, despite his prestigious education in the pro-nuclear “Ecole des Mines”. Corinne Lepage former minister of the Environment had to fight to impose flues as compulsory elements in the public housing construction norms therefore opening the way to heating systems other than electric¹⁶. The situation has changed for a while with the emergence of the green movement as a political force and the signature of the Kyoto agreement. Nuclear power and energy efficiency seemed to learn to live together but the reality might be different as the reconduction of the nuclear program will be on the agenda soon (an important number of French nuclear plants are getting old and must be closed in due time). For example, in order to reach the Tokyo's objectives, the Agence de l'Environnement et de la Maîtrise de l'Energie (ADEME) has been granted a new dotation of Euros 8 millions to reach a total work budget of Euros 312 millions¹⁷, the 1999 parliament budget report approves this dotation but immediately after complains about the clouding of the French nuclear policy. The mood was the same in the year 2000 report. In 2002 the ADEME budget was reduced by 34% by the newly elected government which has also “ suspended” laws on water quality and waste treatment. In 2003, the government launched a “National debate” on Energy, aimed at integrating the voice of the civil society in Energy policy making. At the same time, without waiting for its results, the Prime minister was announcing the start of the EPR reactor program. Such an instable situation shows that there is no political consensus on the integration of the Socio-sphere into the decision making process.

¹⁵ The prime minister can submit the question of the government responsibility when presenting a text to the parliament. By doing so the text is considered to be voted unless a censure motion is voted against the government. (French constitution Art 49-9).

¹⁶ Loi sur l'air 1996

¹⁷ projet de loi de finance 2001. www.assemblee-nationale.fr/budget

b) The difficulties of a good appreciation of people's expectations and /or interest in behaviour change by the policy makers. This difficulty is what Ligteringen calls the "lack of accessibility" of consumers to policy makers (Ligteringen, 1999). It is a result of the *"heterogeneous character of the consumer as a target group and the fact that environmental consumer policy can easily invade the realm of personal privacy. The target group is too large for individual consultations with those making public policy and has no legitimate representatives to undertake authoritative negotiations with policy makers on its behalf"*. Actually, the French Consumers organisations are far from being representatives as they represent less than 2 % of the French population (Dobré, 2000).

This difficulty was enhanced by the gap between:

- the fact that people's concern for environmental quality has been documented for years as a major fact (Riffault, 1973; Credoc 2000, RCB Conseil, 2001, Dobré, 2000),
- the scarcity of people's actions. Pro-environmental actions are assessed through the election results of the green party, involvement in environmental NGOs, consumption of "green" or organic products and reactions to local environmental threats. These indicators, as we will see, show a weak commitment. Furthermore, some opinion polls held every two years by EDF are underlying people's reluctance to change, as they would not accept a decrease in economic growth.¹⁸

It is completed by the obvious gap between intentions to take action and proper action taking. For example, 80% of people declare to be ready to avoid using their car in the case of high air pollution level (Hatchuel, Ortalda 2000), which is far from being the case in real life. These gap are interpreted as a lack of real concern or as a lack of coherence without further

inquiries into the socio-technical factors that might provide other explanations of such a situation (Dobré, 1998). With such a social use of the polls' results, the low visibility of pro-sustainable household policies should not come as a surprise. However, the situation is not that clear. To better understand the French situation, the following section will detail the main studies held on sustainable behaviour in France.

2) Results of the main studies held in France about sustainable behaviour question the idea of a lack of concern for sustainable behaviour.

a) Methodology.

The acceptability of an ecological modernisation of the French society can be assessed through the bias of the « sensitivity to sustainability » a notion that is often evaluated through the answers made to questions which usually oppose economic growth and sustainable development. A good example

¹⁸ Barometre Environnement. EDF.

is given by the CREDOC/IFEN surveys¹⁹ that includes questions such as: “*Are you ready to accept less comfort in order to protect the environment?*” or “*Are you ready to accept the slowing down of economic growth for the protection of the environment?*” Or “*A raise of the unemployment level ?*” Or “*A decrease of your living standards?*”. These kind of questions are the product of history (Dobré, 1995) as the first environmental activists criticised economical growth while opponents to environmentalists thought that they were going to raise the unemployment level.

Although such opposition is obsolete in the TEM paradigm, Dobré (Dobré, 2000) recognises that it has been kept for two reasons:

- it allows identification of people who are the most sensitive to environmental problems as they are ready to accept a reduction in growth and their own standards of living.
- the questions have been asked for years in many polls such as Eurobarometre.

It is interesting to see how opinions are evolving on the long run about this theme which has dominated the environmental debate for a while and to which extent, French opinion is ready to accept sustainability as a desirable objective. Actually, according to the Eurobarometre study, the opinion that environmental protection is more important than economic development has doubled between 1995 and 1997 in France; the opinion that both should be attained being the vast majority (at least 70%).

Such an affirmation should take into account that the way questions and problems are formulated influences the perception of this problem and the answers to the questions. The “reflexivity” of modern societies defined by Giddens and Beck (Beck, Giddens, Lash, 1994) works for sociology too. The very fact that the question of the compatibility of environmental issues with growth is still being asked implies for many that sustainable options are not worth considering and reinforce the old ideas according to which environment is a matter for old fashioned hippies while giving the institutions false pretexts for doing nothing. Furthermore they induce the idea that drastic changes are necessary in each household even though such a perception could be questioned (at least by a part of the population) when considering the nature of the behavioural changes that would be efficient on the household’s level (taking showers instead of baths, switching off lights, heating at 19 °C etc).

When the focus is made on sustainable behaviour, it is seldom through specific studies; parts of some opinion polls are the main instrument used for investigating people’s opinion on sustainable behaviour. As Dobré states (Dobré, 2000) the methodology used in these polls (questionnaires sent

¹⁹ These questions are included in all the CREDOC/IFEN surveys. By a curious coincidence these questions are financed by EDF the French Energy supplier.

by post) doesn't help people, as it is not a situation where the determinants of their choice will appear clearly. Furthermore, another bias is introduced by the fact that all polls are based on declarations, therefore the difference in between somebody's intention to do something for the environment, what he/she declares doing and what he/she does might be important. The purchasing of green or organic goods must also be put in perspective with the price of these products and the household's income. Last but not least, as seen at the beginning of this paragraph, the very formulation of the questions has their importance too as well because of the social use of the answers as we have just seen.

b) Main studies.

What French people think of the environment and what they do is mainly known through two pieces of research. The Survey Population- Espaces de vie- Environnement done by the National Institute of Demographic Studies (INED) and the survey « Opinions and attitudes about the Environment » done by the Research Centre for the Study and the Observation of Life Conditions (CREDOC). It should be noticed that most of the French surveys dealing with the issue of environment, resources consumption and the household were produced in the 90's. Since that date, a survey on the representation of the green house effect was the only one focusing on households and the environment (ADEME, 2003) while two other surveys focus on green associations and "ethical" consumption (Credoc, 2002). It might reflect a shift in the institutional interest in "sustainability" issues.

The survey « Population- Espaces de vie- Environnement » was conducted by the INED in 1991 on a sample of 5 000 people, its objective was to study the social representations of the Environment . It starts from the hypothesis that the representation of the environment is based on the experience of the living condition's of an individual since his childhood and includes the type of territory in which one lives and the social environment. This study's results were partly published for a while (Collomb & Guérin-Pace, 1998) then a more comprehensive analysis was published in 1999 after being analysed by the CREDOC, a French Sociological Studies Institute (Maresca & Hébel, 1999) The CREDOC survey "Opinions and attitudes about the Environment "(Dufour & Loisel, 1996, 1997 and 2000; Credoc 1997) is part of the general survey « Conditions de vie et aspirations des

français » that this institute conducts every year on a representative sample of 2000 people²⁰. It includes:

- A study of a « declared sensitivity » to environmental problems i.e. an appreciation of the weight of the environment among other questions.
- A study of the « declared actions favourable to the environment » that have been done by people with a specific focus on waste recycling issues.
- A study of what people think the environmental priorities should be at the government level.

b.1 Perception of the Environment. One of the INED study's assertions is that the very notion of environment has a double meaning in France: one part of it considers the environment as a « milieu » in which people lives, the other considers people as an element of nature. This last definition is linked to the Anglo-Saxon one (what the French call Anglo-Saxon is everything coming from the Northern Europe cultural space). Anyway, according to this study, the second notion of environment is seldom found, most definitions of the environment are spontaneously anthropocentric (which the INED understands as a cultural element) and includes everything that man thinks important for his "well being". Nature is rarely considered as a wild nature but as a reconstructed one, an ideal of nature that « *seems to be the symbolic projection of man himself* ». The very idea of environment requires the creation of a correspondence between a concrete perception (neighbourhood, region and even the Earth) and a benchmark that will allow an evaluation process. However, if Nature as wild or country space is not the mainstream reference to define the environment, it is the benchmark that people use to assess the quality of the environment. The common understanding of the environment integrates the notion of Nature without absorbing it. It is possible to detail this analysis as follows:

- The structure of the residential space is the basis on which is rooted the idea of environment. The representation of environment is based on proximity. Therefore, numbers of representations include quality of life items, domestic references that lead to a personal micro social vision of the environment. « *It is a bubble centred on oneself. The environment never appears as an object from outside on which one can act efficiently.* »
- Representations are the same whatever the geography (seaside, mountains, etc) but differ with the level of urbanisation. It is the personal surroundings that are important.

²⁰ Sometimes together with the French Institute of the Environment (IFEN) and/or Electricité de France (EDF) the French Energy distributor.

- Environmental issues are a matter of concern: those who think that « the gravity of environmental problems has been overestimated » are only 15%, those who think that « the situation of the environment is really a matter of concern » represent 80%. This result is a confirmation what has been observed for 20 years (Dobré, 1995).
- The representations differ a lot according to social criteria: age seems to be a discriminating factor in the perception of environment although it is impossible to distinguish between a « generation effect » and an age one. The younger you are, the less inclined you are to include domestic elements in your definition of nature, the more pessimistic you are for the future. Social and professional characteristics are also differentiating factors among which the education level.

Opposite to the IFEN survey that focuses on the perception of the environment, the Credoc surveys focus on the environmental concern of the French population with high score of positive answers: the issue concerns 9 out of 10 people. Such a concern is constant and can be found in other surveys. For example, in 1995, 76% of the French people considered the protection of the environment as an urgent and immediate concern (Eurobarometre 1995). However, most of the time the importance of people's environmental concern is evaluated in comparison with other issues such as unemployment, Aids, terrorism etc. Preserving the environment never appears in the top two issues, which is another reason to the policy makers for putting the results into perspective and considering the issue as secondary. These kinds of results can be questioned because most lists submitted to people include more than one environmental issue. For example, in the surveys held by the National Institute of Safety and Protection (IPSN) the list includes the safety of nuclear plants and/or nuclear wastes, air pollution, the mad cow disease etc together with an item on environmental degradation. It is therefore impossible to conclude on the importance of the environment in people's concern from those kind of ranking.

b.2 Responsibility for action. The INED reports states that a minority thinks that it is up to the government to preserve the environment and 56% agree that it is a matter of solidarity not of rules to be imposed on people. Spontaneous references to politics are scarce in all cases. This result is surprising in the French context where the State is traditionally in charge of the public good. Comments from the researchers suggests that a majority of French people perceived the environmental issue as a domestic one which is linked to individualism and that the results reflect a fracture in the social body between these people and those that have a planetary perception which generates altruist feelings. However, two findings challenge the simplicity of such a description. They can be found in the research “La sensibilité écologique des français” (Dobré, 2000 p 54).

- The first one shows that the institutions' legitimacy vary according to the issue at stake. The wider the issue, the higher the institutional level.
- The second questions directly the INED finding: the study assesses that the French people think that they can't protect themselves against environmental risks (mad cow disease and forest fires being apart). In that case why should it be a matter of the citizens themselves?

One may question the imprecise character of the definition of the Environment to which people are referring in the INED survey. The question "*Preserving the environment is a matter of the citizens themselves or of the institutions?*" doesn't reflect what people understand as the Environment. More specifically, it doesn't reflect whether they refer to risk issues or not. The various understandings of the Environment are also the determining factor of people's assessment of public institutions that is described in Eurobarometre (1997) which shows that the French people are not only critical of the public institutions but that the more global the environmental issue at stake, the harder the critics.

A second interesting topic in the INED research is that it focuses on the part dedicated to « action in the environmental sphere » on the « acceptability » of a couple of policy tools such as Eco-taxes, bans, trust in information sources but doesn't consider the potential impact of the household's environmental behaviour and reduces its definition of individual environmental action to the participation in an environmental movement (See Box 1). This can be explained by the historic context as the study was decided after the 1989 European elections where the green party had scored 10%. Therefore, the focus of the institutions was on understanding the change and evaluating policy making tools. Nevertheless it shows that 10 years ago, the idea of a citizen who will be an actor of the environmental policy was not common.

Box 1: French people's involvement in environmental movements.

What do we know about the involvement of the French people in environmental movements?

At the beginning of the 90's, 45% of French people had given money to an association among which 11% for animal protection (animal protection is not related to ecological protection but more to the safety and protection of animals) and only 7% for environmental NGOs.

The study defines criteria that have a positive influence on activism:

- Couples 35-44 with kids
- People >60
- Religious practice
- Important cultural practices
- Altruist values
- Exposition to pollution in daily life.

More information on the French involvement in ecological movements is given by CREDO/IFEN surveys. According to the 1997 study, the involvement of the French people into environmental movements can be described as follows: 50% of French people agreed on the fact that « ecological movements should be supported » (Dobré, 2000) but, in 1995, less than 10% of the population were ready to participate in a local environmental association and around 10% were ready to demonstrate against a project that might harm the environment (Eurobarometre, 1995) This information is completed in a 1994 survey that showed that 72 % of the population was not ready to join a green movement, 47% would not fight for the recognition of this issue within a traditional party or association; 49% would not join a local environmental association but 58% would join a work commission within a municipal structure. In 1998, 3% of the population belonged to an environmental association (Credoc, 1998).

b.3 Sustainable practices in the household. Another important aspect of the CREDOC study is that, every year, one particular aspect of both the environmental issues and social values is emphasised. This allows following the evolution of some household's sustainable practices.

The 1995 study shows that:

- 75% of the French people were ready to stabilise their heating temperature to 19°C,
- 72 % to participate in a local action like cleaning a park,
- More than 80% were ready to save water and more 90% to buy recycled paper.

It was completed in 1996, 1997 (Dufour & Loisel, 1997) and 1999 (Taylor, 1999) with a focus on the purchase of low energy consumption light bulbs. The results were that:

- already 25% of the French household have bought low consumption bulbs in 1997. High socio-level segments of the society were buying more of these bulbs than other parts of society.
- in 1999, 35% of the French household were the owner of one or more of these bulbs. The implementation of those bulbs is increasing but not very fast. We will see that a general explanation is the low awareness of the advantages of such products.
- 88% were switching off the light in empty rooms: 25% in order to save money and 63% because it's good anyway.

The 1998 study (Caraire & Dobré, 1998) shows that:

- Constraints associated with lifestyles, social and professional characteristics largely explain the differences in public behaviour. For example, the sorting of the household's waste is twice less frequent in apartments than in individual houses. Parts of those findings were confirmed by the survey « Pratiques environnementales et sensibilité aux problèmes d'environnement » conducted by both the IFEN and the French National Institute of

Statistics and Economic Studies (INSEE) (Dobré, Montero, 1999). It shows the importance of the socio-technological conditions for the implementation of the waste recycling policy. Particularly it underlines the link between waste recycling habits and the type of housing, the financial situation (people owning their house recycle more than the others, unemployed people repair their electrical appliances more than employed ones) and the « sensitivity to the environment » although this last link is qualified as « tenuous ». This finding can be completed by the results of an other survey that shows that the closer to the household location and the more practical the local waste reception centre, the higher the level of use (Maresca & Poquet, 1997).

- Environmental-friendly practises are correlated to people's education level much more than to their income, but income has an evident influence on the adoption of « saving » behaviour.
- When looking at sustainable consumption practices, it appears that 54% of the people were ready to spend an extra 10% for the purchase of ecological products.

The evolution of some other consumption behaviour are described in table 1.1.

Table 1.1 Evolution of some consumption behaviour

c) Answer « yes, regularly »	1995	1998	Δ
Did you buy bio- degradable products for the household?	40	43	+3
Did you choose products for their environmental-friendly packaging?	30	42	+12
Did you buy organic products?	10	13	+3

Source CREDOC/ IFEN

When reading these results the main question is still the indetermination of the answers. How do you recognise environmental-friendly packaging? Are organic products bought only for environmental reasons? Some research work in Belgium has found that health is an important reason to buy (Barbieux, 2001) organic food. In that case, even if it is true that selling more organic products is good for the environment, to consider their purchase as a sign of a « sensitivity for the environment » is more hazardous. An answer was given in the 1999 and 2000 barometers. It shows that the environmental quality is the reason given for buying by 65% of the people, hence suggesting a difference between Belgium and France on this point.

In 2000 (Hatchuel & Ortalda, 2000), the study focused on transportation and waste recycling.

- When looking at one of the key element for CO2 emissions i.e. the change of transportation mode, the main result is that there is an increase in the amount of people who are ready to switch from car driving to public transports in case of high air pollution levels. Women, graduated people, <25 and >60 are the most favourable to a behaviour change.

This attitude is linked to a more general positive « sensitivity to the environment » i.e. 91% of car drivers considering themselves as « very sensitive to the environment » are ready to use another transportation mode; it reaches 94% of people buying organic products. In the middle term, the evolution is positive (Table 1.2) and is a sign of growing acceptability of this idea in the French society.

Table 1. 2 : Evolution of the acceptability of a change in the transportation mode in case of high air pollution level.

Are you ready to leave your car in case of high air pollution levels?

%	1996	2000
yes	82.5	86.0
no	17.3	13.4
Doesn't know	0.2	0.6

Source : CREDOC/IFEN

The substitutive transportation mode is the public transport system: it is chosen by 37% of the people but this figure hasn't grown since 1996. More important is walking (19%) which is now at the same level as cycling (23%). Car sharing is considered by 8% of the people and is now at the same level that the idea of staying home on air pollution days (10%).

Choosing an alternative transportation mode on a regular basis is much more difficult: 76% of the sample has not given up their car for their usual travels 12% did so regularly (11% in 1995). This behaviour depends:

- on the availability of public transport
- on the driving habits i.e. the more you drive, the less you consider other means of transportation. This result emphasises the necessity of de-routinising action as both Spaargaren and Giddens suggest.

An other focus is made on waste separation.

Waste separation is commonly accepted behaviour. What seems to be more difficult to accept is the idea of a behaviour change at the very moment of the purchase and a choice for products with no

packaging but the goodwill seems to be there (Table1.3). The social study of these results show that the more « modernist » you are (i.e. considering family, wedding and women's work) the more ready to accept this change.

Table 1.3 Acceptability of behaviour change for reducing waste production.

In order to limit the amount of waste in your bins, are you ready to

%	<i>Yes</i>	<i>No</i>	<i>Doesn't know</i>	<i>TOTAL</i>
Sort your waste?	86	14	0.2	100
Buy more Eco-refills?	78	21	0.6	100
Bring your waste in waste deposit units?	77	23	0.3	100
To buy some food products with no packaging (rice, pastas, cereals.)?	58	42	0.5	100
To pay a tax based on your own waste production?	52	47	0.8	100

Source : ADEME/CREDOC 2000

The study has been completed by a survey on energy efficient renovation work (Taylor, 2000) which shows that, in 2000, 11,8% of households have made renovation work in order to reduce their energy consumption or to improve their comfort. The results were 12,6% in 1999, 12,5% in 1998 and 11,7% in 1997: the trend is of a slow decrease. It is confirmed by the fact that 13,9% of the people are planing to do so in the following years compared to 15,9% in 1997 and 15,3% in 1998. Therefore promoting energy efficiency is still relevant.

c) These studies all emphasise the general lack of information about sustainable consumption and sustainable behaviour and the feeling of frustration and distrust that it generates.

The 1995 study show that there is a lack of information about the existence of equipment and/or laws facilitating the adoption of sustainable behaviour: 10% of households don't know whether their town is providing cycle lanes, 12% don't know whether the town council has issued rules for the control of water consumption, the figure is 10% for rules limiting the traffic in the city centre.

On an individual basis, in 1995, 28% don't know whether their company has adopted an environmental plan, 27% have never heard about organic agriculture and 80% regard the information given on waste treatment as inadequate. In the Parisian area 85% of households don't know how much water they consume (Maresca, 1994).

This information is confirmed by more recent results about the evaluation of the information's quality by the consumer:

- Evaluation of information about green products :

The 2000 consumer's complaint about the poor quality of information on green products is the highest ever. It appears that the dissatisfaction level has grown among people who were not, until 2000, interested in those products. People who criticised the most the understandability of the information are found among SPCs +, graduated and independent workers. When focusing on low energy consumption bulbs, of the 70% of the population that didn't buy low consumption bulbs in 1997, 33,1% didn't know anything about them and 21,2% regarded themselves as « not informed enough about their usefulness ». These figures were respectively 41,7% and 21,3% in 1996. In 1999 (Taylor, 1999), 45% of the household and 66% of those owning low consumption bulbs were not aware of their safety quality (the danger of burning oneself is low as the heat of the bulbs is low) although 78% of them regard this quality as very important.

- Evaluation of information about air quality

The evaluation of the information about air pollution is not satisfactory either.

Only 20% of the French population regard themselves as well informed about local air pollution (Table 1.4). The level of dissatisfaction is even higher when people already suffer from air pollution 82% (79% on average). This leads to a feeling of frustration as 20% consider being aware of the right behaviour to be adopted in case of high pollution levels. It is also the case (22%) for those who judge the health risks associated with pollution as « important ». This perception is higher in a high pollution zone such as the Parisian area and among educated people. One must understand that this question doesn't mean that people don't know what to do, « being well informed » differs from « knowing ». That's why these answers might reflect a criticism of the institutions or actors in charge of the information.

Table 1.4: Perception of the quality of information about adequate behaviour in case of high pollution level

Do you feel well informed of the behaviour to have in case of a high pollution level?

%	Whole population	People sensitive to health risks associated with air pollution
Yes	20	22
No	79	78
Doesn't know	1	
Total	100	100

More generally speaking, we can observe that, when green products are concerned, the number of people with no opinion about the quality of information provided to them has decreased significantly between 1995 and 2000 on all items to the benefit of dissatisfaction and mistrust (Table 1.5).

Table 1. 5: Evaluation of the information given about green products.

Do you think that the information given about « green products » is

%	1995	1996	1997	1999	2000	Δ 1995-2000
Enough?						
Yes	26.3	29.2	26.0	26.1	24.0	-2.3
No	65.9	62.8	64.1	67.4	71.0	+5.1
Doesn't know	7.8	8.0	9.9	6.5	4.0	-3.8
Total	100	100	100	100	100	
Understandable?						
Yes	53.1	56.9	33.8	29.6	31.7	-21.4
No	37.0	30.3	53.9	64.5	63.7	+26.7
Doesn't know	9.9	12.8	12.3	6.0	4.7	-5.2
Total	100	100	100	100	100	
Scientifically reliable?						
Yes	32.7	36.6	35.8	36.9	40.1	+7.4
No	39.8	31.1	32.3	43.3	49.7	+9.9
Doesn't know	27.5	32.3	31.9	19.8	10.2	-17.5
Total	100	100	100	100	100	

In other words, people pay more attention than five years ago to the information they receive but they are still not satisfied. Furthermore, a majority of people even questions the Eco-friendly aspects of the green products While the number of people who think that the Eco-Friendliness of the green products is guaranteed to the consumer is stable, the number (Table 1.6) of people that don't know decreases in favour of those who don't trust those guarantees.

Table 1. 6 Perception of Eco-friendliness guarantees.

Do you think that the Eco-friendliness of the green products is guaranteed to the consumer?

%	1997	2000	Δ 1997-2000
Yes	37.2	35.2	-2
No	45.4	61.3	+15.9
Doesn't know	17.4	3.6	-13.8
Total	100	100	

Source : CREDOC/ADEME 2000

These results can be explained by:

- ◆ the growing popularity of green products that leads more people to wonder about the information they receive.
- ◆ the food safety crisis, which have led people to question the information they receive.
- ◆ the multiplicity of labels that leads to misunderstandings or ignorance. To this extent, the analysis has to be completed by the 1995 survey's results according to which 52% of the people didn't know the Eco-label « NF Environment » and 26% the Eco-label «preserve the ozone layer». In year 2000, the recognition level of the label NF Environment i.e. the amount of people declaring that they had already seen a label that is shown to them (without words) was only 5% for NF environment, higher for a commercial brand “Maison Verte”. Furthermore, people's knowledge and consumption motivation has not been well analysed. For example, in the food industry, Eco-labels compete with other quality labels, which can lead to the perception of having to make a choice between taste and Eco-friendliness.

Table 1. 7 Recognition level of the main Eco-labels.

%	2000
« NF environnement »	5
« Maison Verte »	12
« European Eco-label »	4

Source : CREDOC/ADEME 2000

- ◆ the growing mistrust in science. Here again, it appears that most people with no opinion have turned into people with no trust in the guarantees given by Eco-labelling. A striking element is that the scientific reliability of the information is the point for which a negative evolution is the strongest: +11points between 1997 and 1999; +7 points between 1999 and

2000. This result could be related to a general growing mistrust in the capacity of science to solve environmental problems (Dobré, 2000). actually, in 1995, on a slightly different question (Which source of information is telling the truth about the protection of the environment?), they were only 19% to quote the scientists (Eurobarometre, 1995). However, on a general level, science in itself is perceived positively (65% think that scientific research should deal with all issues INED 1992). In other words, while Science itself is not questioned, it is not the case when Science is linked to situations in which it appears to be dependent from “marketing” objectives. A third research question to be addressed is then to explore why Science is mistrusted as soon as it gets out of the labs.

To summarise, the French appear to have:

- increased positive answers to the concept of sustainability as something which doesn't reject the idea of growth and which is therefore coherent with the TEM.
- goodwill for taking some sustainable action (energy and water savings, green purchasing) together with difficulties to change their purchase habits,
- a dependence on socio-technical constraints which is almost never taken in consideration by the surveys except for explaining the impossibility of a change in transportation habits,
- a weak involvement in collective actions
- an increasing demand for information
- a growing mistrust in the information they received from the scientific institutions.
- the perception that they can deal with local environmental issues but that they can't protect themselves from wider environmental risks.

Therefore it is legitimate to wonder which kind of information is the most appropriate for helping people to take sustainable action and what might be the consequences of the mistrust that appears when looking at the survey's figures.

3) An exploratory study shows that individual assessment of one's behaviour is poor.

The results of the exploratory interviews held in Valence before the cognitive transfers give a first understanding of the important elements that interfere in the action taking process and give insights on the need for information and individual assessment of the impact of one's behaviour. I was interested in the action and not in the attitudes towards environmental behaviour. Therefore, the questions were focused on the idea of asking whether or not people were taking some sustainable

action and why, with no references to notions such as “intentions” to take action. Details of the design of those interviews can be found in box n°2.

Box 2 Organisation of the exploratory interviews in Valence.

Face to face interviews. Exploratory work. Valence area.

Organisation : The face-to-face interviews were held between July 1998 and March 1999. 48 people were interviewed from various age groups, incomes, and housing locations in order to obtain a wide range of answers. Most interviews were done in people's own home which allowed the checking of the veracity of some declarations such as « I switch off my TV pilot light » etc.

Valence is a middle-sized town (120 000 inh) located in the Rhone valley, Southeast France, 120 km south of Lyon. Environmentally speaking, it is

- at the end of the « chemical corridor » that starts in the upper north in the area of Lyon.
- next to two main nuclear power plants: Pierrelate (50kms south) and Cruas (25 kms south), in Pierrelate tablets of iodine have been distributed to people living in the area of the plant. The nuclear industry is one of the big employers in this area.

The wind blows often and strongly in this area thus conveying polluting clouds.

The city itself used to be lINED by the Rhone River but the railway, and then, in the 60s, the main North-South French motorway (A7) has separated the town from its river. The town is now lINED on its eastern suburbs by the TGV (High-speed train) and rumours speak of the planned construction of a new motorway connecting the A7 to the motorway going to Grenoble and Geneva.

The city has been loosing inhabitants attracted to private housing development programs that have been settled by the suburban towns' local councils. Once only dedicated to agriculture (mainly fruits and vegetables, wine, corn and seeds), some of those areas are looking like suburbs while others have maintained their rural character.

The sorting of garbage has been implemented in most of this area and is now implemented in Valence itself. The big issue in debate while the interviews were being held was the planned construction of a garbage incinerator.

Both the public transportation system between Valence and its suburbs and the cycling facilities are very poor therefore using public transports and a bicycle is a kind of active environmentalist action.

Anyone environmentally aware has quite a few things to feel concerned about and it was interesting to study what the position was of people in this context.

Interview procedure.

Interviews were held in Valence itself, in its suburban area (Bourg-les-Valence, Granges-les-Valence, Portes-les Valence, Beaumont les Valence) and in rural areas (Etoile s/rhône, Montmeyran, St Péray, Montoisson) as it corresponds to different living conditions that have an impact on the environment (garden, public transports, individual or collective housing etc).

The interviews were prepared to last an hour but in fact some interviews took longer

- 1- The first part was formatted with open questions focused on the effective actions made for the environment, to understand their motivation and the influence of other social groups.
- 2- The second part of the interview was a questionnaire meant to check whether there was a gap between what people declared and what they did. For example, some people could declare that they were not doing anything for the environment while having a very sustainable way of living. Another objective of the questionnaire was to give indicators of what were people's position on some ideas often conveyed by the media on science in general, the environment and to check their degree of knowledge of some environmental subjects.
- 3- The third part of the interview was an open discussion about sustainable behaviour.

A detailed interview sheet is available in the appendix.

The result confirms the hypothesis according to which people are not aware of the environmental impact of most of their daily actions. Apart from waste separation, an action that has been widely marketed as “good” for the environment, most people are unaware of their personal impact on the environment. To the question “What are you doing for the environment?” most of them answered “nothing” (Table1.8)

Table 1.8: Sustainable behaviour in the household: comparison between actions and statements in the Valence area.

<i>DECLARES :</i>	<i>DOES :</i>
Claudine: Nothing but sorts the garbage.	Energy and water saving, buy biodegradable products, tries to buy products with less packaging.
Sylvia : Nothing	Sorts glasses, uses low consumption bulbs, not pilot lights
Francis : Nothing	Promotes a petition for a bill of rights of future generations, uses wood as a source of energy.
Claude : Nothing but sorts the garbage	Saves energy and water
Nadine : Nothing but sorts the garbage	Saves energy and water
Sandrine 2 : Nothing	Save energy and water, tries to buy green washing items
Christine S : Stops smoking, sorts the garbage	Energy savings
Joëlle : Nothing bur sorts papers	Energy savings
Pierre : Nothing	Save heating energy
Pierre 1 : Nothing	Sorts the garbage
Frédérique : Nothing but sorts the garbage	Energy saving
Nadine 2:Nothing	Heating energy savings
Frédéric : Nothing but sorts the garbage	Heating energy savings
Valérie : Nothing	Nothing
Bernadette : Nothing	Sorts the garbage, energy savings
Delphine : Nothing	buys organic food, biodegradable products, washing powder without phosphates, saves heating energy, often uses public transports
Franck : Nothing	Heating energy savings
Sandrine 1 : Nothing but sorts the garbage	Buys organic food, biodegradable products, avoids taking her car.
Franck 3 : Nothing	Saves energy, water, belongs to an NPO to avoid high voltage
Huguette : Nothing but avoids dropping papers on the pavement.	Signs a petition, saves energy and water, buys organic food, biodegradable products, sorts glasses.
Christine : Nothing	Energy savings, biodegradable products, sorts garbage.
Dominique P : Sorts papers, plastics	Uses recycled paper, biodegradable products, compost, chooses low packaged items, saves energy and water, uses public transports as much as she can.
Jean : Nothing but glass recycling	Heating energy savings reduces his use of pesticides.
Latifa : Nothing	Walks to the city centre

INTERVIEWS VALENCE AREA. 1999.

When checking people's understanding of the question, most of the interviewees were assuming that "doing something for the environment" would be to join an environmental association or a "green" party. "Doing something for the environment" is therefore strongly linked with the idea of public life, of doing something at an institutional level. Rudolf has shown that the French basic assumption is that "daily life is not the place where reality is built. It is built within the sphere of high institutional decision levels that control society" (Rudolf, 1998). This explains why the

spontaneous understanding is the one of a public involvement. Therefore understanding what is at stake in the sustainable action taking process at a personal level implies to understand what is at stake for creating a link between public and private life in environmental issues. This will be our fourth research question. Moreover, the interviews showed a strong criticism of the government behaviour hence suggesting that this element should be explored during the focus groups. The results will be detailed in chapter 4.

However when they are confronted with a list of daily actions (Table 1.9), using one's car and using detergents are identified as a possible source of pollution while energy consumption is not. Only after I insisted, were they saying that energy consumption might have something to do with the greenhouse effect but half of the people were not so sure about it. This suggests that the concern to enhance, in the Energy Environment Budget, the importance of SMCS' environmental impact is relevant.

Table1.9 Daily actions that have an environmental impact ? (Spontaneous answers)

During the daytime what actions are you doing that have an impact on the environment ?	Number of spontaneous quotations (a person can give multiple answers)
use of washing products	10
water consumption	9
waste production	23
car use	20
CFC	1
heating	3
product consumption	3
energy use	4
paints	1
electricity use	2
pesticides/fertilisers	3
get rid of dirty oil	2
organic food	1
transports	1
cigarettes	3
aerosols	3
chlorine in the swimming pool	1
What I burn	1
Don't know	8

Therefore, it is interesting to observe to what extent a new policy instruments such as the EEB is able to take up the challenge of re-linking one's behaviour with its environmental impact in a background where household's actions are not assessed by the traditional indicators and thwarted by a lack of information.

CONCLUSION

The common understanding of the Theory of the Ecological Modernisation of Production and Consumption (TEM) insists on the importance of a proper use of technology in order to reduce the environmental impact of human activities. For the consumption side, the TEM considers people as consumers or public service users who have to consume in a different, sustainable way products with a higher level of technology. An objective developed by the Eco efficiency approach which insists also on the idea that sustainable consumption should include saving behaviour.

Reference to high technology products underlines the role of artefacts in people's daily life. The structuration theory implies this role too: if structures are both enabling and constraining, the artefacts that put us in touch with structures such as the various SMCS of our daily life plays a role too. The way we use them is going to shape our relationships with those SMCS. Therefore artefacts play a key role in the sustainable action taking process. On an other side, the surveys held on sustainable consumption in France underline the need for information that is expressed by many people. The idea of building an informative artefact such as the Energy Environment Budget allows me to take into account both the importance of artefact and the need for information with the underlying idea that it might help for bridging the gap that obviously exists between the level of intention to take action and proper action taking. All the more so as, I know from exploratory interviews that, although people should be aware of the negative environmental impact of some action, they often are not. Chapter 2 will focus on the EEB.

Moreover, we have to study which information could be considered as appropriate by people while being a help for implementing sustainable action taking. i.e. we will have to find which information level is adequate, as there must be an appropriate level between too many information and not enough.

We can already suggest that:

- because not all sustainable behaviours have the same status, the reason for taking them varies: one doesn't change its transportation mode for the same reason he/she would buy a

low consumption bulb. Therefore we should look for the information that is the most important for each action.

- if we refer to Spaargaren's statement about the various elements that might interfere in sustainable action taking, information will interact with other elements and their combination might generate behaviour that is different from the one expected.

Finally, I will have to study the appropriation process of the EEB. Why does this artefact allow people to stay in touch with the rules of the sustainability game in their daily life and what kind of game they think they are playing in? We will try to answer to this question in chapter 3, which describes the Cognitive Transfer Experience.

Another important lead for our work is given by the TEM most common understanding according to which ecologising society implies institutional learning because it emphasises the importance of the State in the ecologisation process. Therefore we may wonder whether the relationships between the State and the consumers influence people's practices. This question will be recurrent in chapter 4 and 5 all the more so as we have seen that people's lack of trust in the information that is given to them keeps on rising and that many French people think that they can't protect themselves against environmental risk.

We can wonder, then, to what extent could an artefact such as the EEB could be useful for policy makers? In which aspects should it be different from "classical" tools? A first lead in tackling this issue is given by the critics of the "institutional learning" understanding of the TEM which emphasises the importance of a social debate about the kind of Nature- therefore of Environment- we want; all the more so as the IPAT equation underlines that western societies affluence is a component of the society's impact on the environment. Therefore, ecologising the society is not only a matter of using the most efficient technologies. It is also a matter of debating and knowing the aim of their use. How does one integrate such aspects? To which extent people's personal expectations about the kind of environment they want influence their practices and their use of the EEB? To which extent are they connected with the construction of their identity ? If the environment is a socially constructed object, can we draw the outlines of an independent Eco-sphere from its observation? A third and last lead is that there are signs suggesting that elements considered as "irrational" in the Techno-sphere ,such as good faith and trust, are constitutive of this Eco-sphere. Consequently, an other issue to investigate is whether those so called "irrational" elements play an important part in the sustainable action taking process. We will focus on these aspects in chapter 4.

A last lead is given by Otnes and Spaargaren who suggest that the meaning of an artefact might vary according to the type of activity, the “provinces of every day life” for which it is used. Therefore we should try to identify those provinces of meaning when studying the EEB all the more so as two aspects raise from their work.

First of all, the fact that many people’s consumption is part of their daily routines. A subject that is not well known all the more so as most of daily routines occur within the house which is the most private field. Furthermore, as many authors of the TEM underline, habits are difficult to change especially those that are not symbolised by a specific artefact. For example it is much more difficult to avoid purchasing over-packaged items than to sort one’s waste. The issue is then to try to identify the meaning of those provinces of every day life that are built of routines and how it is possible to implement a change.

Secondly, we can raise the question of the existence of a link between people’s identity and their provinces of every day life. We will deal with those issues in chapter 5.

To summarise these research questions, I am wondering whether it is possible to precise the constitutive elements of the Eco-sphere? Which type of “rationality” is involved? To which extent is the EEB able to create a link between private and public life and if so, what is involved in the process? And is it possible to describe which kind of identity is at stake?

Ch 2. A strong hypothesis: to induce behaviour change, information must be supported by artefacts

On one side, after working so many years in the advertising industry, I knew that delivering information through “classical” informative systems such as media, labels, leaflets etc has never been enough for inducing behaviour change. The best that can be achieved is to put a product in the list of “top of mind” items that each individual possesses knowing that it might lead to the purchase of a product “for a try”. The products specific qualities will be at stake, then, for transforming a one-shot purchase into a habit. Many definitions of what is a sustainable behaviour are focused on the production/consumption issues and can be integrated into that information system scheme:

- Purchase of green products i.e. recyclable, non-toxic (CFC or Chlorine free), organic.
- Purchase of energy efficient and water saving houses’ equipment.
- Purchase of renewable energies’ equipment.

Concerns about the marketing of those products is all the more relevant that for example, in 1995 (Credoc, 1995), 3% of the French people were paying attention to water consumption when buying a new washing machine, 96% were not aware of their machine’s consumption (Dufour, 1995).

However, sustainable consumption can’t be reduced to the purchase of green/efficient products. In particular, we saw that end-use of products and savings are part of the Eco efficiency program which introduces waste sorting, compost making, repairing goods, purchasing second hand items and reduction of energy consumption as sustainable behaviour. Furthermore, all the variations in the way products are used or the individual’s lifestyle preferences within the society should be reflected which expand the list of sustainable behaviour to shifts in the way products or services are used i.e. lower temperature for washing machines, preference for public transports etc.

Hence the necessity of considering another informative scheme all the more so as, although information on sustainable behaviour exists in France, the surveys studied in the previous chapter show that there is a gap between intentions to take actions and proper action taking. This assessment was complemented by personal observations: many of the people I knew who were deeply involved in sustainability or in the promotion of environmental issues were not behaving in their personal life with a specific environmental concern. In both cases, the quality of information was not at stake. Something else was missing. From these observations, as described in the

introduction, the idea raised of creating a new “media” which will play the role of its name i.e. being a mediator between people and the environment. The idea was to bring people back to their personal impact on the environment because they tended to consider that environmental issues were a policy concern not theirs (see ch1), the question was then to imagine how. The idea of building an Energy Environment Budget (EEB) arose from the conviction of the key role played by artefacts in the action taking process. A role that is so important that one could say that the difference between the subject and the object is vanishing (section 2.1). The idea of an EEB seemed all the more interesting that some artefacts in France were already playing this role of “media-inducing-action” while others had failed (section 2.2). From the observation of their qualities, the EEB i.e. a tool that would allow people to assess their impact on the environment was created. It was the basis of a fieldwork that was assuming that people would use it as citizens and as consumers (section 2.3).

1. *The difference between subject and object is vanishing.*

Common sense considers artefacts as external and neutral elements and the classical analysis adopt such a paradigm when studying the relationships between animated human beings and inanimate artefacts. However, there are other ways of looking at physical objects, artefacts especially. One is given in the "Actant Network Theory". In an introductory article Callon & Law (Callon & Law, 1997) demonstrate that an other way of looking at reality is to avoid concentrating on the source of action but to examine its constitution. According to this theory, actions are the products of a network of inter-acting human and non-human. An example is given referring to Winner's article « Do artefacts have politics? » (Winner, 1986). This article relates the racist policy of Moses who was in charge of NYC urban planning in the fifties. Moses had to make an express way between NYC and Long Island beaches. In order to prevent poor people, specially coloured ones, to rush on Long Island beaches for the weekends, he had the idea of building bridges that were too low to allow buses to go past. As a majority of poor coloured people was using this mean of transport, he was successful for a while, none of them came. The bridges have maintained Moses' policy (whatever happened to Moses) until the time when cheaper cars have helped poor people to overcome this situation. This example shows the ongoing interaction between people, social groups, artefacts, etc. They form an « entity » i.e. a network of heterogeneous materials, which gives its shape to action and reacts to it. A stabilised entity can be described by its frontiers. It is also simultaneously distributed within all the elements that make the network but all of them can escape any time therefore inducing a re-composition phase. Another issue is that, despite being the produce

of the network, the entity is not reduced to it and has its own influence on the whole action. It can flood from the action frame inducing other actions or an other interpretation of action.

Coherent with such an analysis is the focus made by Semprini (Semprini, 1995) on artefacts as « trials and as actions ». He defines what he calls « the objectal carrier » of an artefact i.e.

- the process, socially and temporally defined, negotiated, that gives birth to an artefact (emergence) which, as a result, will enclose them all.
- the set of practices linked to an artefact once it is physically stabilised.

Artefacts are said to be « social-performative » it means that they are both:

- a practical and inter-subjective emergence, a process and an action within a complex network of practices and actors. This practice constitutes both the frame of the artefact and what presuppose it from a theoretic and methodological point of view
- a « natural » artefact which is going to be used for action by the network in order to give a meaning to its action and to start other « emergence » process within which the artefact will appear as a stable element of the world

Semprini gives the example of a phone booth.

« On one hand, a phone box is the emergence of a specific objectal carrier (technical studies, negotiations between various options, topologic schemes to decide where its place should be). It is an anticipation of usage and it produces scenarii. If the telephone is hanged high, then access to the phone box will be for adults only. The payment system will also have an impact on reality, as it will force people to buy magnetic phone cards. The phone box as an action is performative as it produces a version of reality which is effective i.e. which makes a virtual world (where the telephone works thanks to magnetic cards) coincide with a real world where people must have a magnetic card if they wish to have a phone box in their daily life.

At the same time when it is inserted in their daily practices, people interact with the phone box, put it in a wider frame and, because of their practices, give birth to new objectal carriers. The phone box can be a meeting point, a shelter from the rain, a surface to be painted, a source of finance for a thief, etc. The artefact produced by these objectal carriers are not an alternative to the first one but they are as efficient because the artefact that they produce is different and because the reality that they are referring to coincide with the virtual world embodied in the artefact. Reflexivity occurs when the first artefact embodies in its virtual-and-real world an other world that has been generated by the actant. For example, payment is limited to magnetic cards to avoid burglary. »

From those examples, we can see that the usual differences of status between objects and subjects disappear to such an extent that Semprini states that objects/artefacts are action.

However, going through the emergence phase doesn't guarantee action. In the French environmental field, a good example is given by the « pastille verte » (green tag) that the French government had implemented in 1998. It was conceived as a kind of « acceptable pollution level » certificate in order to reduce air pollution. With such a tag on one's car, it was possible to drive even on peak air pollution days while other cars were allowed in the street on even or odd days depending on their plate's number. The green tag was given to cars on the basis of technical criteria. At the emergence phase a huge controversy has risen involving the following partners :

- the environmental NGO's who wanted green tags on gasoline engines only because diesel engines emit particles that are directly responsible for lung affections, and therefore did not deserve the tag.
- the car industry which was making 40 to 50% of its production with diesel engines and was arguing that diesel equipped with catalytic converters should be able to get a green tag.
- the truck transport companies that were claiming that a new tax would threaten their competitiveness.
- the second hand car retailers who were frightened by a drastic drop in the car's resale value.

Other questions were debated such as linking green tags to car maintenance therefore giving it a renewable aspect.

To sum up, the emergence network was composed of car makers' lobbyists, norms (the definition of a pollution peak), civil servants, hospital & patients, particles, exhausting pipes, the government, car retailers, environmental associations.

The green tag is the product of the negotiation of these actants. It was given to both diesel and gasoline engine cars that were manufactured after a specific deadline (1995 for the oil engine, 1998 for diesels) while trucks were not subjected to the tag. Air pollution norms were defined in such ways that peak pollution levels were reached only a couple of times a year²¹. Action taken by households reflects the negotiation that lies within the green tag: no behaviour change was observed. Referring to Semprini, one could say that green tags are non-action. Why? Some people interviewed in Valence gives an explanation for the non-action.

Pierre: « I was irritated by the fact that driving a car was questioned by the tag but driving a truck was not an issue »

²¹ The ozone level that lead to traffic restrictions was fixed at 360mg/m³ (most other Europeans countries had adopted a level of 240mg/m³.)

Christine : « At the beginning green tags made me aware of car pollution, but now everyone gets one. »

In a way, we could say that people had perceived the limits of the tag and of the negotiation embodied in it: one criticises the specific regulations applied to trucks, the other its lack of strictness: if every one gets it, it loses its meaning. In other words, people were all the more so sensitive to the meaning of this artefact that they were well aware of the problem caused by air pollution, if they hadn't so, the simple fact that the government was creating this tag would have been enough to make them guess that it was an important issue. From this example, we can refer to Spaargaren again and remember his emphasis on the meaning of consumption.

As for the green tag, the meaning of the EEB might exceed the simple relationships between a household and its own environmental impact. We can also see that the very reason why some people will not consider the green tag is a very "non rational" idea: the idea of fairness. Here again, we find another element suggesting that those kind of criteria are part of the Eco-sphere to the extent that we can start sketching its specific ethical frame made of good will, fairness, democracy, agreement on social objectives.

Two other examples demonstrate the importance of the coincidence between the virtual world embodied in an artefact and the world, which is going to be used for action by the network in order to give a meaning to its action.

a) One is the bad performance of Eco-labels in France. We saw in chapter 1 that part of the explanation of such a failure results from a lack of awareness, a lack of trust in the scientific claim of Eco-friendliness embodied in the label, and the multiplicity of labels. Such a situation resulted in a global mistrust in Eco-labels.

Furthermore, we can observe that some people are aware of the importance of the ecologisation of the production chain but that this knowledge was not part of the label's objectal carrier which, most of the time, embodies only the final environmental quality of a product without reflecting the whole production process. *Samuel: " Let's take this bottle of water, is it delivered with a petrol or a diesel engine? It's not possible to guarantee all that".* In that case, the information embodied in the artefact is running late compared to the diffusion of information among the lay public.

b) Another example is given by another green tag i.e. the visual symbol that is put on the packaging produced by companies who are part of the «Eco-Emballage» system. Opposite to what happens in some countries where companies are directly responsible for the recycling of

the packaging they produce, the French system has created the « Eco-Emballage » company who recycles the packaging of its member companies i.e. companies that pay a fee for this purpose. Companies that belong to the Eco-Emballage system are allowed to mention it on their packaging. For this purpose they use a green sign. The logic of Eco-Emballage is not well understood by people who think that the green sign means that the packaging that they are buying is made of recycled material. François, a member of the cognitive transfer group held in Lille, shows that companies are aware of such ambiguity and play on it. In his case, the green sign is hidden at the back of the packaging for which he is in charge. After changing the components of the packaging for ecological ones, he puts the green sign on top of those packaging and claims responsibility for that.

From those cases, we can learn the importance of avoiding ambiguity and being clear-cut about the meaning of all information. We can also see that there is:

- an expectation of honesty in the producer-consumer relationships which is an other element for the ethic of the Eco-sphere.
- a need to justify the existence of artefacts
- an expectation for an appropriation scheme from both the producer and the consumer side.

Together with the elements isolated previously, those items should be kept in mind when working on the EEB. They suggest strong moral and politic demand for the Eco-sphere. Fortunately, several environmental artefacts are successful.

2. *There are some active artefacts for the sustainable behaviour of the French household.*

1) Artefacts are already support for change and mediators.

The recycling bin gives the best example of an artefact as action. Differing in colour, sometimes in shape, they are given to the household. Beforehand, an information campaign is held (but not always well understood). Nevertheless, most people start to sort their waste as soon as they receive the adequate artefact. Furthermore, the bins' physical characteristics have their importance as they have been recognised to influence the amount of waste collected (Le Bozec, 1990). The larger it is, the more waste is collected (Table2.1)

Table 2.1 Influence of the type of container on quantities collected

TYPE OF CONTAINERS	VOL (L)	AVERAGE KG/INH/ YEAR
Standard bags	30-60	264
Bins	30-50-60	269
Other		295
Bags	80-110	
bins	20-30	
Rolling containers	120-1100	317
5m3 containers	5 000	333

Source: A. Le Bozec (1989)

But the action sometimes goes beyond the objectal carrier of the bin and floods from the frame. Then bins transform themselves into mediators, means of expression of social links. This was clear when one of the people interviewed had declared that he was not sorting the waste because of his bad relationships with the town mayor. Such an approach was confirmed by M. Bovy in his thesis on household waste (Bovy, 2000) Finally, an other positive effect of waste sorting bins is that recycling make you think about the volume taken by packaging in the household's garbage and therefore leads to different purchasing behaviour (of less cumbersome, more easy to stock packaging). Details of this studies' results are not available (Eco Emballages, 1997)²².

A less spectacular but still efficient example is given by bills. According to the interviews annual bills that establish the actual electricity (or water) consumption are eagerly awaited²³. They are a reflexive tool because they allow one to evaluate one's consumption therefore giving control over it. This reflexivity lies in the comparison process that takes place with the arrival of a new bill. Studies have shown that this quality has its biggest impact when comparison with people's average consumption is possible. For example, in a study where thermic regulation tools in a collective building were tested (Rabeharisoa.1990), the best performing tool was the one allowing people to compare their consumption to the average one of the building and to know how much it cost to heat at 19 °C or at 22 °C.

²² Eco Emballages Annual Report.1995.This company has refused to give more detailed results (1999).

²³ in France consumptions are estimated every term and the meter is read once a year which leads to an adjustment bill

Such a device is not always available in France but some water bills show a graph of people's previous consumption on a one-year basis, which encourage comparison and savings (Box n° 3). Energy bills don't provide such a service. This was noticed in the field research and explained because of the electricity utility's desire to sell as many kWh as possible. This analysis is acceptable, as the aim of EDF is to regulate the household's consumption during peak hours by encouraging people to postpone some actions such as the use of electrical appliances. However, the global aim is still an increase in sales. The day when a summary of the consumption evolution will be on an energy bill, will be the sign of a drastic change of strategy.

The objectal carrier of a bill is not only made of savings and marketing strategies. As the following examples suggest, it may embody people's family relationships, their relationship to society.

Chantal: « I was able to save FF 4000 (Euro 610), it is worth a week of holiday, I am happy » « If the bill shows a rise in water consumption, it annoys me and I quarrel with my sons for spending too much time under the shower. »

Franco: « My satisfaction is getting a minus on the bill so they owe me money » « We are paying for farmers who dump chemicals in rivers »

Chantal makes a trade off between the savings she makes and the possibility of going on holidays while Franco is happy to win a confrontation with the French tax system. Anyway, reflexivity on one's own consumption with the help of a given or personal norm seems to be the basis of behavioural change in consumption. To this extent, bills are the mediators of such a change and meters are necessary elements of the network. Also meters are not often read per se by the group members, it should be noticed that people are asking for more meters with specific functions. For example, wondering what was the part of her bathtub in her whole water consumption, Anne was asking whether specific meters could be installed on the taps. One could also think that such a device would also help Chantal to document her opposition to long stays under the shower. Anyway, it shows that, when dealing with sustainable behaviour, measurement is a constitutive part of reflexivity.

Box 3 : Example of a gas and electricity bill in France.

VOTRE AGENCE
EDF SERVICES DOUAI
P. L. SECLIN
67 RUE DU 8 MAI BP 249
59472 SECLIN CEDEX

VOS NUMÉROS UTILES
INFORMATIONS, CONSEILS, SERVICES
tél. 08 01 88 38 62
fax 03 20 62 78 49
internet
http://www.edf.fr
http://www.gazdefrance.com

DEPANNAGE 24H/24
électricité : 03 20 90 06 00
gaz : 03 20 90 10 35

VOTRE RÉFÉRENCE CLIENT
01315 578 916 436 166



destinataire **MONSIEUR**

nom du client
et lieu de
consommation

013150026

facture du 17 septembre 1999 détail au verso

montant prélevé le 01/10/1999 **65,95 F.TTC**

Evolution de votre consommation en kWh
Les chiffres en gras correspondent aux consommations relevées.

électricité jour bleu

nov. 96	sept. 97	sept. 98	sept. 99
614	4977	5770	5669

électricité jour blanc

nov. 96	sept. 97	sept. 98	sept. 99
53	716	518	776

électricité jour rouge

nov. 96	sept. 97	sept. 98	sept. 99
0	282	228	261

Cette facture est basée sur le relevé de vos consommations.

électricité	4275,95 F.TTC
solde	-4210,00 F.TTC
montant prélevé	65,95 F.TTC

montant en euros : 10,05 euros

Au 1er mai 1999 baisse HT des tarifs actuellement proposés par EDF et Gaz de France (liste disponible sur demande): 2% en moyenne pour l'électricité, 5% en moyenne pour le gaz. Autres tarifs inchangés.

prochaine facture vers le 23 septembre 2000
prochain relevé vers le 19 septembre 2000

prélèvement automatique
Conformément à votre demande, le montant de votre facture sera prélevé sur le compte dont vous nous avez communiqué les coordonnées.

nom du titulaire du compte :
références du compte : nom de la banque numéro de compte
BNP SECLIN

LA GARANTIE 9 engagements pour mieux vous servir
DES SERVICES

En cas de modification de références de ce compte, merci de le signaler à votre agence EDF GDF SERVICES.

2) Collective actors can be objects

As differences between human and non-human actors become vague, so it is of the difference between collective human actors and non-human ones. From the citizen/consumer point of view, associations are often regarded as tools that will allow them to reach their environmental objectives. It is the result of the awareness of the limited range of individual action and of the difficulty of inducing behaviour change as a result of

one's own action. Collective action was also mentioned by Isabelle and Louis-Marie not only as a result of the limits of individual action but also as an answer to the limit of the collective action that can be taken with NGOs. « *At the associative level, you reach a limit where political action is the last lever that is left to you.* » Therefore, collective actors are going to be evaluated as objects the question being whether they coincide with people's expectations.

3. *Designing energy environment budgets and transferring this knowledge to consumers and citizens assumes the existence of a specific "rationality" of the consumer.*

When looking at the French situation, there are very few artefacts that can be used by lay people for informing themselves of their environmental impact. There are even less tools that can raise people awareness of the impact of their use of the various SMCSs to which they have access although these SMCSs, particularly the energy and the water network, are of prime importance when considering major environmental impacts such as air pollution or climate change. Therefore, we will try to emphasise these aspects when constructing the EEB (section1).

When organising tests of the EEB, we put ourselves in an "institutional" interpretative frame of the theory of the ecological modernisation of production and consumption. The EEB were tested as a potential information policy tool which will allow, if successful, a better integration of the French household in the ecologisation of the economy. Because of this understanding, the test groups were first conceived as a cognitive transfer test. Referring to the criteria that have been defined in the previous chapter, I knew that I would have to organise tests of the EEB that should allow reflexivity and manipulation therefore inducing the beginning of an appropriation process (section 2).

1) Designing an Energy Environment Budget

To build the EEB I had in mind the idea of « Household metabolism » that has been developed in The Netherlands by the Homes Program. The idea is to consider a household as a « body » with flows coming in and out and to identify pressure points and possible ways of improving the

sustainability of the households life (Noorman, Schoot Uiterkamp, 1998). The Netherlands research on household metabolism includes most goods and services. Their study implies going into a product's life cycle analysis and this, in itself, could be the subject of a PhD thesis. Therefore, they were not included in this work. The possibility for a household to choose a kind of « green » purchasing behaviour will only be dealt with in the cognitive transfer. For the same reason, as mentioned in the introduction, while being very aware of the indirect energy use contained in most behaviour, I will study only the direct energy use. However, to be able to study what would happen if environmental impact information could be given for a good, we decided to integrate at least one product: washing powders and to calculate their environmental impact through their phosphates concentration. This seemed relevant to us because phosphate free washing products are easily accessible for people wishing to change their behaviour and because we had access to data allowing us to make a basic calculation of their environmental impact.

Anyway, when creating an Energy Environment Budget, according to the issues raised in chapter 1, we were assuming that:

- Economic information is not enough to induce behaviour change and that other information such as the environmental impact of such change must be useful.
- Practical information on behaviour change that can be taken by the household must go together with the information on the household's impact.
- People are responsible and interested enough to be willing to change their behaviour if given the proper tool. This was a direct consequence of the institutional approach of the TEM and of the way it considers information (ch1).
- People are interested in being given a norm in order to assess their own behaviour.
- Although reflecting average consumption per items, Energy Environment Budget should be tailored according to people's own situation i.e. number of people in the family, housing location, household's equipment etc.
- Simplicity should be the guide in designing EEB. When looking at the existing information tools at the time of the Energy Environment Budget's conception, it appeared that most of them where :
 - either informative and not reflexive. For example, the « Eco-citizen charter » (Ministère de l'Environnement, 1999) proposed by the French minister of the Environment gives guidelines for an Eco-friendly behaviour with no reflexivity. Idem for what was suggested by the consumer organisation « 60 millions of Consumers » (60 millions de consommateurs, 1997).

- or reflexive but very complicated to handle. Examples of such tools were given by the ADEME whose web site offers a way of calculating a household's energy consumption which was inducing a long work into the family's archives or false answers, (for example people were asked what the altitude of their house was, the age of their hot water tank, their wall surface). The Ecocal™ program made in England by « Going for Green » (Going for Green, 1997) had the same defect.

Therefore the objective was to promote the sustainable behaviour thanks to a reflexive tool that will be simple to handle and will show the household major consumption and production and their impact on pollution levels. As this objective can't be reached if one wants to calculate exact figures, the bias was taken to give coherent and easy to handle information without giving too much importance on precision.

- The physical contact with the artefact and the possibility of handling it is of great importance in the reflexivity process. Although reduced to the form of a paper sheet, EEB can be used by people to refine their calculation and choose an ad hoc behaviour. It is in this assumption that this project differs from other experiences such as the one made by Gatersleben who interviewed people with the help of a laptop computer program assessing the direct and indirect energy use of a household. In this experience, people were informed of the range of sustainable behaviour they could take to reduce their environmental impact (Gatersleben, 2000) and were interviewed on their intention to take those actions but they didn't have a tool that they could keep and manipulate.

The objectal carrier of the EEB is made of my conviction that the French people had a capacity for change and that it should be demonstrated, my encounter with Pierre Radanne and his expectancy for such a tool, access to the necessary information, the French data system and the methodological help given by the INESTENE²⁴, the DGXII financial help, the FUL hospitality and all the meetings I had previously with people working on the demand side management of energy. It resulted in what one could call a prototype which is also an artefact but whose objectal carrier was not finished at this stage: it was the basis of a field research whose first results were given to P. Radanne who was director of the ADEME at that time, it was also the basis of this thesis.

²⁴ Institute for the Evaluation of Environmental and Energy Strategies in Europe. Paris.

The conception of the energy environment budget requires many calculations. They are detailed in the appendix. The bibliography that was used is detailed in a specific part of the general bibliography at the end of this document. Two methods could be considered: a top-down and a bottom-up one.

a) Top-down: the construction of the Energy Environment Budgets couldn't be achieved with a top-down method.

To create an EEB, we had to focus on the main flows within a household : water, energy—among which transport will be the subject of a whole section and waste.

For each flow, the ideal situation would have been to refer to general impact formulae such as the IPAT equation : $\text{Impact} = \text{Population} \times \text{Affluence} \times \text{Technology}$.

It implies gathering data on household's consumption/production; taking the socio-economic variables that affect them the most and crossing these variables to establish a breakdown of flow's consumption and production per type of household.

The use of such a method also called « top-down » was not possible as I was never able to find elements that could have been crossed in order to reach detailed breakdown levels. As a matter of fact, it appeared that, in the areas considered (water, energy, waste), households are never taken as a basis for data construction.

For example, in the case of energy consumption, it is possible to start a decomposition of the energy consumed per type of housing and type of energy but the available data doesn't help to go further and to make connections with other parameters such as the housing's location, its equipment's efficiency or its socio-economic characteristics. These data exist but in a separate way. Therefore the ideal situation that would allow to go from the global figures of energy consumption per type of energy to the household level figures according to the household's characteristics doesn't exist (see the demonstration in the appendix). The situation is even worse for water consumption (see appendix).

But the best example of the lack of adaptation of the French global data system to a research work at the household level is given when looking at the waste production.

There are a couple of definitions of household waste in France: Domestic garbage strict definition (ordures ménagères stricto sensu) is the garbage collected from dwellings. Bulky waste (déchets encombrants) are the waste that can't be collected in front of dwellings because of their weight or their specificity (garden waste, gravel, « monsters » i.e. old fridges, furnitures etc.). Together with domestic garbage they compose the strict definition of household's waste (déchets des ménages).

By law²⁵, local authorities must collect other waste such as those of small and medium sized firms (SMFs). This waste is included in a broader definition of domestic garbage called the « classical » definition i.e. domestic garbage + SMF's garbage.

However, the amount of household waste or of domestic garbage is calculated by waste treatment companies when arriving at the treatment plant by either weighing the lorries or weighing the waste flow with the consequence that it is difficult to attribute waste to household or SMFs. It is a good example of a top down approach where the amount of waste, the ratio of humidity, the general composition of waste, are the only elements in which treatment companies are interested in. This is logical, as these elements are important to forecast flows of waste entering the plant. For example, waste components and weight will be studied for recycling plants, the ratio of humidity and the amount of organic matter for compost plants, the calorie potential (PCI),

the rate of sulphur and chloride for incinerators (Morvan, B 1996). This situation follows the logic of waste treatment: what matters is what flows in and not why it flows.

The consequence of such a lack of interest in household's waste is twofold:

- Domestic garbage is considered to be overestimated by 30% in urban areas and by 35% in peri-urban areas because of the importance of SMFs (Le Bozec, 1990), therefore results quoting a lower household waste production in the country than in towns can be questioned.
- Public research has focused on creating models- such as MODECOM (Ademe, 1993) or BILCO (Bureau de Recherche Géologique et Minière, 1990) - that forecast the flows collected but the research to characterise waste per type of habitat or family composition etc has stopped.

This lack of information has been recognised by the IFEN (IFEN, 1999): « *data on household's waste focus on waste treatment not on their origin or on the way they are collected* ». However, the IFEN itself still concentrates on the logic of the supply side, the idea of studying people in order to define targets for implementing low waste policies doesn't seem relevant yet. This can be explained as the waste tax system is based on the value of the dwelling and not on the amount of waste produced. Therefore there is no public need to know about the waste production of a household and there is no incentive for people to change their behaviour. The taxation system has evolved, and it is now possible for local authorities to have a waste tax based on the service provided (garbage collection + treatment) that allows a taxation on the amount of waste produced per household. This

²⁵ Décret N°59-1081 du 31/08/1959 and Circulaire du 21/10/1981 on domestic waste.

new system hasn't been implemented a lot because of a lack of transparency: most local authorities organise separate waste collection and waste treatment while the new tax system is supposed to finance one operator doing both activities. Furthermore, thanks to a transfer of competence, local organisations often handle waste affairs for a couple of municipalities (Guellec, 1997) and a fair allocation of tax resources is therefore difficult.

The available data focus on what goes in or out of a specific geographical area ie at the beginning or at the end of the pipe, never on what goes on in between- that is in households. This in itself is a good demonstration of the French lack of interest in the demand side management for these subjects. It also indicates the minor importance given to households, by public authorities, for the implementation of their policy.

Other difficulties were found in :

- access to existing data. For example, data on heating systems/ households and their energy consumption exist at the CEREN²⁶. The Ceren says that they are available only by approval of the ADEME²⁷. The Ademe doesn't want to make them public because « *France is entering a phase of privatisation of the energy sector and providing these results could be against the rules of competition- especially as these data could be used then by economic actors who didn't pay for them*²⁸ ».
- coherence of data as lots of them come from various sources and are not collected on a regular basis, figures from different years had to be used.

b) Bottom-up: all household consumption had to be reconstructed using a strict bottom-up method (recomposing the household's consumption and pollution starting from each household's characteristics). Correlated pollution levels were calculated from these figures (unfortunately, in the case of household waste, the data sources were so poor that it was not possible to make a bottom-up reconstitution).

For each flow, the general method was then :

- to find or establish the formula that would reflect the household consumption of a flow
- to survey all available data to be able to put figures on the different variables of the formula.

²⁶ Centre d'Etudes et de Recherche Economiques sur l'Energie

²⁷ Agence de l'Environnement et de la Maîtrise de l'Energie

²⁸ Meeting with Mr Bosseboeuf. Ademe. January 1999.

- to use the available data as indicators of big trends and as a background to check whether the results were relevant
- to establish breakdowns of the flow consumption according to the items that are the most important on a household scale.
- when this was possible, to submit the results to someone specialised in the field so that he could give an opinion of their pertinence.
- to calculate the associated amount of pollution
- to use the performances of the best techniques easily available on the French market as variables to measure the technical margin of action for savings.

When looking for statistics, preference was given to data from public institutions such as INSEE²⁹, ADEME, INRA³⁰, INRETS³¹ etc. The 1995 INSEE research on households' budgets (Eneau & Moutardier, 1995) was a reference throughout this work. When the figures couldn't be found, data from private institutions such as INESTENE³² or from professional unions and information centres were used. All sources and references are described when quoted.

From these figures it was possible to calculate:

- The average water consumption of a household according to its average equipment and to the number of people living in it and to its kind (flat or house).
- The average direct electricity consumption according to the same criteria,
- The average heating direct energy consumption according to the location of the household, the type of heating energy, the type of insulation device, the age of the housing, the efficiency of the heater.
- The average direct energy use for the production of hot water.
- The CO2 emission linked to the previous use of energy
- The average amount of phosphate released by the use of detergents in relation with the water consumption of washing machines and the market shares of the various detergents.

²⁹ French National Institute of Statistics and Economic studies

³⁰ National Institute for Agronomic Research

³¹ National Research Institute on Transports and transports' Safety.

³² Institut d'Evaluation des Stratégies sur l'Energie et l'Environnement en Europe.

Other figures of direct energy use in transports and of the correlated pollution emissions were taken from studies about the mobility of the French household in a couple of cities.

We refer to the average waste production of a household knowing that these figures are not precise and referring to the various studies that underline the importance of packaging in waste (See appendix of the Chapter 3)

Finally, for each field selected (water, energy, transports and waste), I study the house's margins of action for water and direct energy use and the correlated variations of pollutants emissions.

All these calculations are detailed in the appendix Ch 2 . 3.

Those tables show the different situations of many households.

From them, it is possible to establish an Energy Environment Budget:

- by referring to the specifics of the households such as:

- 1) position of the households in their family lifecycle i.e. (single, with or without children, age group of the head of the household),
- 2) location of the household (suburbs, country, inner city and region),
- 3) housing characteristics (individual/collective housing, surface, date of construction).
- 4) type of heating system (house and water)
- 5) household's car equipment.

- by looking at the average consumption and pollution that corresponds to that situation in the general tables.

The items 1, 2 and 3 will be the variables used to define an average water consumption and P emission level referring to the tables that have been calculated for this purpose.

The items 2, 3 and 4 will be the variables used to define the average energy consumption of the heating system and the correlated CO2 emissions.

The items 3 and 4 will be the variables used to define the energy consumption of hot water and the correlated CO2 emissions.

The items 2 and 5 will be the variables used to define the energy consumption and the correlated pollution levels of the household's transportation modes. If the housing is located in an area for which a modal split per transportation mode where it's correlated energy consumption and pollution levels have been calculated, the knowledge of item 5 is not even necessary.

- by synthesising these results in an Energy Environment Budget table designed for showing both consumption and the related pollutant emission (Table 2.2).

Table 2.2 Frame of an Energy Environment Budget

	EEB FOR ONE YEAR								
	Consumption		Emissions /Kg						
	l	kWh	CO2	CO	HC	NOx	PS	P	Waste
Water									
Electrical appliances									
Heating									
Hot water									
Transports									
Total									

It is possible to synthesise these kinds of simple Energy Environment Budgets to make comparisons. For example, if we take the case of a single person less than 65 years old living in the area of Lille, in a 40m² flat or a 70 m² house built between 1974 and 1982, with a full electric equipment, it is possible to calculate the influence of the housing location on the average global energy consumption and of the various type of housing (Table 2.3).

Table 2.3 EEB of a single person in the area of Lille according to the various type of housing location.

LILLE AREA												
Equipment all electric	Consumption/year					Pollution						
1 pers <65	l	kWh			gcp	g	Kg					
Per year	Water	Electricity	Gas	Oil	gasoline	P	CO2	CO	H C	N o x	Part	Waste
City centre												
Collective Building	63 510	5 783	0	0	233 495		1 565	109	18	4	0,09	
Sub urban												
Individual house	80 307	11 533			301 165		3 666	135	22	6	0,15	
Collective building	84 970	5 783					1 728	135	22	6	0,15	
Country												
House	67 923	11 533			415 400		3 876	175	28	10	0,17	
Average						800						434

It is possible, then, to calculate (Table 2.4), for example, the influence of:

- the purchase of a fridge class A, and of three low energy consumption light bulbs
- the switch-off of the houses' pilot lights

by replacing the corresponding figures by those calculated in the section about energy savings potential that is detailed in the appendix.

Table 2.4 Influence of some types of energy saving behaviours.

	Consumption/year					Pollution						
1 pers <65	l	kWh			gép	g	Kg					
Per year	Water	Electricity	Gas	Oil	gasoline	P	CO2	CO	HC	Nox	Part	Waste
City centre												
Collective Building	63 510	5 316	0	0	233 495		1 535	109	18	4	0,09	
Sub urban												
Individual House	80 307	11 066			301 165		3 636	135	22	6	0,15	
Collective Building	84 970	5 316					1 698	135	22	6	0,15	
Country												
House	67 923	11 066			415 400		3 846	175	28	10	0,17	
Average						800						434

We can therefore reach a stage where it is possible to produce a basic Energy Environment Budget for people participating in the Cognitive Transfer experience (Table 2.5) and to tell them the kind of margin of action they have for increasing the sustainability of their behaviour knowing in advance the various elements described in the previous paragraph.

Table 2.5 EEB of a household in Lille area (sub urban, family of 5)

	EEB FOR ONE YEAR								
	m3	kWh	Kg						
			CO2	CO	HC	NOx	PS	P	Garbage
Water	395							0,9	
Electrical appliances		3 681	311						
Heating		18 563	3 746						
Hot water		4 116	831						
Transports			2 269	541,1	87,75	22,8	0,585		
Total	395	26 360	7 157	541,1	87,75	22,8	0,585		1740++

From a strictly methodological point of view, several improvements could be made.

The EEB data basis could be improved with access to figures such as the heating and hot water energy consumption per social categories /type of heating/ energy source (CEREN or processing of INSEE figures); the share of nuclear energy used to meet the consumption peak of the winter heating season (EDF), the breakdown of the total quantity of detergents containing phosphates per type of consumer and usage (producers).

Access to various studies will help to build an optimal tool. Among them, we can quote:

- the measurement campaigns of households' water consumption (to double check the results and make more accurate the figures of the water consumed for activities such as gardening or car washing),
- the value of the energy loss for a 1°C difference between the inside and the outside temperature ($W/m^3 \cdot ^\circ C$) i.e. the G factor table for flats,
- the study of transportation's modal split for other large French cities such as: Marseille, Lyon, Strasbourg, Nantes and for people living in the country
- and above all: a study of the households' production of waste per type of lifestyle.

In fact, the launch of this type of study will be the sign of new public institutions' interest in the household's capacity to be a full participant in the implementation of sustainable development policies. Correspondingly, it would also be the sign of a switch to demand-side management from the big supply companies.

We could also imagine the help of a software to establish a link between all tables according to the main variables that have been defined. It seems to exist in The Netherlands (Gatersleben, 2000). Unless this work is done, the EEB has to be calculated by hand for each specific case.

With its conception, the objectal carrier of the EEB achieves a first step. However, if it embodies all the actants that were part of its production, the next step is to follow how people are going to use it and understand it according to their provinces of every day life.

For this purpose, referring to the example of existing French artefacts, we will have to study the influence of the background in which the EEB is going to be used on the very meaning of that use and the type of actors and of relationships that must be taken into account for a good understanding of the action process. The example of the green tag suggests that people's relationships with the institutions play a part in this process which confirms the findings related in chapter 1 and our assumption that values from the Eco-sphere such as good faith or fairness play a role in the meaning that people give to the artefact. Therefore we can suggest that they are also constitutive of its objectal carrier and we can wonder whether they will play a role in the EEB's one. On the other side, people seem to have a very "rational" way of analysing what are their "good reasons" for doing something (for example they sort out their waste if the bin is not too far). In the following section we will describe the Cognitive Transfer experience based on the Energy Environment Budgets that were organised in Lille and we will analyse the theoretical background that can be mobilised, at an individual level, for analysing the results and the rationality at stake.

2) The fieldwork was conceived as a Cognitive Transfer.

Once the prototype of a product is conceived, the usual marketing procedure is to organise a test of this product in order to assess the market's reactions and the changes that appear necessary for making the product as much tailored to the market target as it can be.

To achieve this purpose, the usual methodology is to organise test groups. People are given the product for a couple of days and their reactions to it are recorded during a group meeting. The advantage of the group is that, while giving their personal assessment of the product, people can exchange their views therefore giving to the producer precious information about the core issues that he should deal with when marketing the product.

Within such a framework, this study is specific because:

- Of the nature of the product itself: the product is a non-finalised prototype and is specific in the way that it is an informative one and that it assumes that people need to be able to understand the calculations and to be able to do them by themselves.
- Of the type of question at stake: we are not looking for the reason why people will purchase an artefact but we want to assess whether the product itself was efficient in inducing behaviour change and how.

Therefore the usual test group methodology had to be modified to take those specificities into account. For this purpose we took ideas from the cognitive transference groups that are organised by human resources engineers for implementing changes within companies.

a) The test groups were organised by reference to the cognitive transference method.

Social psychology has shown the normative influence of a group, it has also studied the power relationships that occur within a group. If someone controls these power relationships, then someone controls what will be the group's opinion on a subject.

The cognitive transference method is used by human resources engineers and is based on this work. When a big change occurs in a company (new pattern of production or organisation for example), the engineering company's task is to study how to communicate on this change and how to make employees adopt it. Cognitive Transfer (CT) groups are organised for this purpose. As mentioned, they are based on the area of social-psychology research that explains the relative influence of the minorities and the majority within a group hence determining the « mechanisms of influence» (Paicheler, 1985) that can be used to induce the acceptance of the change. These groups follow a strict organisational pattern:

- i) People talk about their work, the way they organise it and express the pros and cons they feel about the change they are made aware of (cognitive transfer) and the influence it should have on their work.
- ii) Accordingly, they are driven or asked to make a commitment for change in their working practice. A change that, of course, participates in the implementation of the new organisation decided by the company.
- iii) A month later, the same group meets again. A verification is made about which change of behaviour have already occurred, which haven't and why; another discussion is held.

Later again, a third or a fourth session is held with the same objectives.

The result of this work is that the main objections to the change and the way to communicate on these objections are identified. At the same time, thanks to the group phenomena, the change has

often started to be accepted and implemented. The only limit to the number of group that can be organised is the perceived efficiency of the system: once the change is implemented enough the groups can be stopped.

This method is inspiring for organising our test group as it deals with implementing behaviour change and uses time as a variable that must be taken into account for this purpose (while test groups refer to time as a fixed element). This is why we kept the idea of organising a succession of groups around a cognitive transfer that is, of course, not the change required by the company but the importance of taking sustainable action with the help of the Energy Environment Budgets. The difference we bring in is that there is no commercial strain of achieving an effective change of behaviour within the group members. Therefore, we don't pay much attention to the minority/majority theoretical issues used as a tool for manipulating the audience in order to implement the behaviour change. We chose to:

- Concentrate on sustainable actions and the value of Energy Environment Budgets for inducing them
- Let people react without trying to influence them.

A secondary question was whether environmentally aware companies could influence their employees to such an extent that sustainable actions that would not be taken by the participants of a control group will be implemented in the employee's household.

The direct mail company « 3 Suisses » has been a leader in environmental issues and has kindly accepted to host a group recruited among its employees. Hence the decision to organise a test group in the same geographical area (Lille, Northern France) and to refer to it as a control group for assessing the result of the cognitive transfer experience that will be held within the 3 Suisses company.

b) Organisation of the Cognitive transfer groups in the Lille area.

The groups were recruited by a specialist in the group's organisation for the control group and by the company's environment department for the 3 Suisses group. The general objective was to recruit very different people as far as sex, income, house location were concerned. The only constraint was that they should be part of the household financial support therefore involved in the household management and qualified for taking financial decisions. The consequence of such a rule was that no young adult participated in the groups. Let's now detail the recruitment conditions of the two groups that were organised. The Lille Group (control group) and the 3 Suisses Group.

- ♦ **Control group:** people were recruited by phone, knowing the group would be about environment. Each of them received a compensation of FF 100 (Euro 15,2) for transport and time. A sandwich dinner was served during the sessions that were held after working hours.

Group's composition (Lille):

Gaël, 31 years old, textile buyer in a big company, married, two young kids. Lives in an individual house in a new residential development in the suburbs.

Chantal, 40, sales representative, married, two kids (13, 14). Lives in an individual house in the country 30 km away from Lille.

Christiane, divorced, no kids, lives in the city centre.

Franco, 43, maintenance agent, married, three kids, lives in an individual house in a residential development in the suburbs.

François, (>50), responsible for the packaging in a textile industry, 3 kids (21, 18, 16), lives in Lille's residential suburbs.

Anne, 40, secretary, lives in the city centre, one daughter (18)

Elizabeth, 45, director's assistant, one son (15), lives in the city centre.

Samuel, 30, salesman, no kids, lives with his girlfriend 10kms away from Lille.

- ♦ **3 Suisses group:** the recruitment was done by the company's Environment department on the brief to find very different people with no hierarchical links between them in order to avoid speech self-censorship. The recruitment was done on a voluntary basis for 2 hours sessions that would be held during working hours. All the people had been exposed to the information about the environment that had been displayed for years by the company in offices and in the factory through specific information boards (Table 2.6). Some of them had also accepted to attend info groups (about the environment) that have been organised-always on a voluntary basis- in the company for the past seven years. Each of such groups meets once a month during a year to learn about various environmental issues. One of the participants belonged to such a group and his comments were interesting for evaluating our own groups.

The company has given us an example of the teaching material that has been used. If we refer to sustainable behaviour, the table on the following page shows the information that people were likely to know one way or the other. The meetings were held during the work hours.

On the day of the session, among the 10 participants recruited, only five appeared. All of them had been working in the company for more than 20 years. The absence of the younger elements might be the sign of a difference in the company's culture it could also be explained by the fact that most participants had good relationships with the person in charge of the recruitment who

was of their age and wanted to please her. Anyway, a decision had to be taken on whether to cancel the whole project or not as it was not possible to accept new participants after the first session. Finally it was decided to carry it on knowing that the results should be read according to the specificity of the group.

Group's composition

Daniel, textile buyer, married two daughters (18, 24), has been in the company for 30 years.

Pierre, computer's maintenance, in the company for 25 year. He was attending the training sessions organised by the company on the environment and had just begun the program.

Roselyne, secretary in the Competition & Environment dept, in the company for 24 years. Married, 2 kids.

Ginette, order registration, in the company for 24 years. Married with kids at school

Gérard, audit department, in the company for almost 35 years. Married with grown up kids that don't live at home anymore.

Table 2.6 Information given on sustainable behaviour in households by the 3 Suisses company

FIELD	ACTIONS TAKEN BY 3 SUISES	ACTIONS RECOMMENDED BY THE 3 SUISES
Air	Ban the use of CFC by supply companies, give up the use of coal for heating, maintain the car park, organise a car free day for the earth day.	Buy CFC free aerosols; control your car pollution level.
Water	Supply companies selected on their water saving capacities, use of non-polluting paint, use of water saving taps (has saved 20% of the water consumption), treatment of wastewater with stockage and use of a bacteriological process.	Use phosphate free washing products, use environmental friendly paint, beware of what you reject in the sewage system, save water in you daily life.
Land	The next parking sites will be conceived to avoid a full sealing of the surface.	
Energy	Implementation of a heat pump, use clocks to stabilise the electric consumption, recycle the heat of a building, and use two windmills for the electric supply of a production site.	Maintain your heating equipment, use public transports, use wood as a complementary source of heating energy,
Waste	reduction of the packaging inked surface by 75%, sorting out the company's wastes, press cardboard to facilitate recycling, lighten packaging	Sort out your garbage; try to buy one- material-made products, as they are easier to recycle.
Noise	Soundproofing of equipment, respect law on noise levels	Wear your ear protection, avoid disturbing other people.
Paper	Supply companies have to use recycled paper as the company itself, use chlorine free products	Reduce your paper consumption, buy recycled paper.
Textile	Ban the use of Chlorine for the whitening of textiles, ban an excessive use of formaldehyde, and control the use of such products at the suppliers' level.	
Packaging	use of 100% recycled cardboard, reduction of plastics used in packaging by 47%, belongs to the « Eco-emballage » group, re-use of the 40 000 wooden pallets received from suppliers.	Buy products with light packaging, and with the green label; educate your family and neighbours.

Source: 3 Suisses

Dates of the meetings.

Table 2.7 shows the dates of the different sessions and the major environmental headlines in the meantime as they obviously had an influence on people's concerns.

Table 2.7 Meetings schedule

	TEST GROUP	3 SUISES GROUP
Environmental headlines	Nothing special	
First meeting	November, 30 1999	February, 17 2000
Environmental headlines	Shipwreck of the Erika on the Brittany coast, dumping of Arsenic in the Rhine river (in Rumania), hunters demonstrate against the French Minister of Environment who wants to apply the EU regulations on hunting dates for migratory birds. A huge storm destroys a great deal of the French forest.	
Second meeting	February, 17 2000	
Environmental headlines	It is confirmed that volunteers for beach cleaning after the Erika wreckage have been exposed to products that may cause cancer and that the government was aware of it. A « secret » agreement between Total and the government is said to have been signed to prevent Total from further law pursuits.	
		April, 4 2000
Environmental headlines	Chernobyl's anniversary. While forbidden in France, 200 ha of GMO rape were planted by mistake. The manufacturing process of some traditional sausages has to be modified in order to avoid a potential contamination by prions.	
Third meeting	May 19 2000	June, 9 2000

c) In both cases, the construction of the EEB of the participants to the Cognitive Transfer Experience was a preliminary condition for the group organisation.

According to the way of calculating an Energy Environment Budget mentioned in the previous chapter, it was possible to calculate the EEB of the participants to the cognitive transfer groups. Each participant was asked to answer a few questions a couple of days before the first meeting. These questions permitted an EEB to be established on the basis of 325 days- to take into account holiday time-and, if possible, compared to people's water and electricity bills in order to validate the results or to understand the reasons of gaps. In every case, the electricity consumption was coherent with the model. Differences appeared when looking at heating energy consumption but we could find an explanation for the gaps that were observed. It was linked mainly to the variation in heating temperature. According to EDF, a reduction of 1 °C reduces the energy consumption by 7% in average. It was particularly the case for:

- Anne: she was consuming 6 684 kWh per year, and our model was quoting a consumption of 9 687 kWh. After inquiring on her habits, the difference could be explained by the heating temperature: the model was based on a 19 °C temperature while Anne used to heat at 15 °C with

an increase to 19 °C for a couple of hours in the evening and was shutting down the heater during the night.

- François whose expected gas consumption was 25 000kWh, his real consumption was 23 000 kWh. Here again the difference could be explained by the reduction of the heating temperature.
- Franco had a big differential of 10 000 kWh that can be explained by an average temperature of 15 °C (instead of 19 °C) which can explain around 7 000 kWh difference. He also had a fully insulated house (walls, windows, roof) that can explain most of the remaining difference.

All water consumption levels were coherent with the exception of Samuel's one that was much smaller (100m³/ year) than what could be expected for a 5 people family (around 395 m³). The explanation was found during the evaluation interview: the group recruiter gave me the family description of somebody else. Samuel's household was composed of two people, hence the miscalculation. This was not without consequences. When interviewed about the EEB Samuel said that he didn't pay much attention to it because he knew that his results were much under the average. As he couldn't understand why, he didn't study the EEB that he considered irrelevant.

Differences in water consumption for a household with the same number of people are mainly linked to the mode of body wash (bath or shower) and to the presence at home during day time. We could not take into account the difference linked with the efficiency of washing appliances.

Each EEB was completed, then, by a detailed breakdown of its energy and water consumption, which was allowing people to play with the figures and realise where they could make savings. Table 2.8 is an example of what was given to François.

Table 2.8 EEB documents given to François

Water consumption

François							
		Equipment	Flow (l/min)	Usage (min per day)	Vol (l)	Number of usage/house/day	Consumption per day in litres
bathroom	bidet	0	10	3	30	0,08	0,00
	bath tub	1			120	2	240,00
	shower	1	16	2	32	2	64,00
	washbasin	1	10	0,5	5	8	40,00
	<i>Hand wash</i>		10	0,3	3	8	24,00
Toilets	WC	1			10	11	110,00
kitchen	sink	1	10	3	30	2	60
garden							30
car		0	25	8	200	0,016	0,00
washing	w a s h i n g machine	1			80	0,5	40.00
	dish washer	1			30	0,5	15,00
leaks							0,00
						Total/day	579,00
						l/person/day	145
						l/person/year	47 044
Phosphates (g)	1000						
people in the house	4					l/household/year	188 175
						m ³ /household/year	188
With flow reducers you can achieve a 20 m3 reduction.							

Energy consumption

François		hours/week	w	Consumption	KWh/year	kg de
		duration of usage/week	Average power	kWh/week		CO2
cold	combi	168	62,1	10,4	552,9	36
washing	dishwasher	3,43	1651	5,7	300,1	19
	w a s h i n g machine	2,6	874	2,3	120,6	8
lightning	incandescent			8,83	468,0	30
	halogeen			0,00	0,00	0
	fluorescent			0,00	0,00	0
	low consumption			0,0000	0,00	0
leisure	TV	27,19	110	3,0	158,5	10
	2eme TV	9	110	1,0	52,5	3
	video player	1,5	25	0,04	2,0	0
	computer (PC)	0	120	0,0	0,0	0
	hi fi	12	55	0,7	35,0	2
cleaning	vacuum cl.	1,86	211,1	0,4	20,8	1
	iron	1,69	405,4	0,7	36,3	2
pilot lights	TV	46,396	11	0,5	27,0	2
	2 nd TV	15,3	11	0,2	8,9	1
	Hi fi	156	12,5	2,0	103,4	7
	video player	166,5	14	2,3	123,5	8
	computer (PC)	0	30	0,000	0,0	0
cooking	elec. oven	2,92	717	2,09	111,0	7
	plaques gas	5	2023	10,12	536,1	108,2
	micro wave	1,13	991	1,12	59,4	3,8
Total kWh appliances					2 716	249
o t h e r appliances					965	62
heating					18 563	3 746
Boiler					4 116	831
Total					26 360	4 887
gas consumption is 23 215 kWh						

François (4 persons)	EEB FOR ONE YEAR								
	m3	kWh	Kg						
			CO2	CO	HC	NOx	PS	P	Garbage
Water	188							0,9	
Electrical appliances		3 681	311						
Heating		18 563	3 746						
Hot water		4 116	831						
Transports			2 269	541,1	87,75	22,8	0,585		
Total	188	26 360	7 157	541,1	87,75	22,8	0,585		1740++

As it was not possible to go through each people's EEB during the session, the EEB of one participant was presented in an anonymous way in order to explain its mechanism and how could people refine what had been calculated for them. People's EEB were distributed afterwards to each participant (Table 2.10) together with information on sustainable behaviour that is composed of the following documents (they can be read in appendix):

- «The Eco-citizen Guide» displayed on The French Minister of Environment's web site.³³
- « Housing: Control the energy» a supplement to the consumer magazine " 60 millions de consommateurs » dated 1997.
- A part of a document of the French Minister of the Environment about phosphorus and nitrates emphasising that people should reduce their phosphate consumption (Agences de l'eau 1997).
- A table of subsidies given for the purchase of a solar water heater. Such subsidies had been launched for a few months-without advertising-when the groups were organised.

During the sessions, some behaviour were suggested to people in order to reduce their environmental impact. They are summarised in table 2.9.

³³ www.environnement.gouv.fr/infoprati/charteco.htm

Table 2.9 Actions suggested to people to reduce their environmental impact.

DIAGNOSTIC	ACTIONS
1) CO2 Pollution due to:	
- Heating systems' energy consumption	- high efficiency equipment, insulation, lower heating temperature
- Hot water energy consumption	- 60°C in the boilers not more, reduces consumption, solar energy use thanks to new state funding of solar panels.
- Electricity consumption	- reduction of temperature when electric heaters are used, use of low consumption bulbs and energy efficient equipment, switch off lights and pilot lights
- Transports	- use public transports, bicycle, reduce speed, maintain one's car, and avoid air conditioning in cars. Car-pooling.
2) Water consumption	- Use efficient equipment, water pressure reducers, and take showers instead of baths.
3) Water pollution	- Avoid washing powders with phosphates, fill entirely the machines before starting the program, beware of the quantity of detergent that is used,
4) Other pollution	- Choose « green » products and food of organic or « reasoned » origin.
4) Garbage	- Choose products with little packaging, be serious when sorting out the garbage, use recyclable or recycled products. Make your own compost.

Hence, the cognitive transfer itself is made of the three elements: EEB + Documents + Suggested actions. The group itself was run according to the scheme described in the appendix.

During the meeting, prior to the cognitive transference itself, a voluntary bias was taken i.e. to consider behaviour as “sustainable” only if people refer to it as such. The difference between our list of sustainable behaviour and people's statements would be a good indicator of the fields where the education in sustainable behaviour would be the most needed. At the opposite, some behaviour that we didn't consider might be considered as sustainable by people and it will be interesting to identify them and the reasons of their sustainable character.

Tables 2.10 Calculation of the EEB of the group's participants in LILLE

GAËL (4 persons)	EEB FOR ONE YEAR								
	m3	kWh	Kg						
Water	72		CO2	CO	HC	NOx	PS	P	Garbage
Electrical appliances		2 889	122						
Heating		4 542	1 400						
Hot water		2 100	135						
Transports			4 323	325	52	16,3	0,273		
Total	72	9 531	5 980	325	52	16,3	0,273	nd	1740++

Chantal (4 persons)	EEB FOR ONE YEAR								
	m3	kWh	Kg						
			CO2	CO	HC	NOx	PS	P	Garbage
Water	130								
Electrical appliances		3 619	234					0,9	
Heating		4 819	312						
Hot water		4 095	265						
Total Consumption									
Transports			2 828	682,5	110,5	30,9	0,325		
Total	130	12 533	3 638	682,5	110,5	30,9	0,325	0,9	1740++

François (4 persons)	EEB FOR ONE YEAR								
	m3	kWh	Kg						
			CO2	CO	HC	NOx	PS	P	Garbage
Water	188							0,9	
Electrical appliances		3 681	311						
Heating		18 563	3 746						
Hot water		4 116	831						
Transports			2 269	541,1	87,75	22,8	0,585		
Total	188	26 360	7 157	541,1	87,75	22,8	0,585		1740++

Elizabeth (1 person)	EEB FOR ONE YEAR								
	m3	kWh	Kg						
			CO2	CO	HC	NOx	PS	P	Garbage
Water	70								
Electrical appliances		4 947	320					0,9	
Heating		25 000	5 045						
Hot water		2 940	593						
Total Consumption									
Transports			26	0,26	0,1625	2,11	0,033		
Total	70	32 887	5 984	0,26	0,1625	2,11	0,033	0,9	430

Samuel 2 persons	EEB FOR ONE YEAR								
	m3	kWh	Kg						
			CO2	CO	HC	NOx	PS	P	Garbage
Water	100							nd	
Electrical appliance		1 477	96						
Heating		14 167	2 859						
Hot water		3 234	653						
Transports			2 164	488	80,3	22,8	0,6		
Total	100	18 878	5 771	488	80,3	22,8	0,6	nd	870

Christiane 1 person	EEB FOR ONE YEAR								
	m3	kWh	Kg						
			CO2	CO	HC	NOx	PS	P	Garbage
Water	38							1	
Electrical appliances		1 855	120						
Heating		4 974	322						
Hot water		1 365	88						
Transports			357	96	15,6	3,3	0,1		
Total	38	8 194	887	96	15,6	3,3	0,1	1	430

Anne (2 persons)	EEB FOR ONE YEAR								
	m3	kWh	Kg						
			CO2	C O	HC	NOx	PS	P	Garbage
Water	102							1,4	
Electrical appliances		2 682	305						
Heating		5 728	1 156						
Hot water		1 200	78						
Transports			357	96	15,6	3,3	0,1		
Total	102	9 610	1 896					1,4	870

FRANCO	EEB FOR ONE YEAR								
5 persons			Kg						
	m3	KWh	CO2	CO	HC	NOx	PS	P	Garbage
Water	263							nd	
Electrical appliances		6 706	434						
Heating		11 694	2 360						
Hot water		3 234	653						
Transports			767	143	22,8	8,5	0,3		
Total	263	21 634	4 214	143	22,8	8,5	0,3	nd	870

3 Suisses group

ROSELYNE									
3 persons	m3	kWh	Kg						
			CO2	CO	HC	N Ox	PS	P	Garbage
Water	120							0	
Electrical appliances		5 150	330						
Heating		14 000	900						
Hot water		3 700	240						
Transports			652	164	24,5	6,6	0,1		
Total	120	22 850	2 122	164	24,5	6,6	0,1	0	1300

GÉRARD	EEB FOR ONE YEAR								
3 persons	m3	kWh	Kg						
			CO2	CO	HC	NOx	PS	P	Garbage
Water	100							3	
Electrical appliances		2 900	180						
Heating		13 000	840						
Hot water		3 800	250						
Transports			2 151	538	86	23	0,4		
Total	100	19 700	3 421	538	86	23	0,4	3	1300

PIERRE	EEB FOR ONE YEAR								
3 to5 persons	m3	kWh	Kg						
			CO2	CO	HC	NOx	PS	P	Garbage
Water	120							10	
Electrical appliances		4 472	320						
Heating		50 000	12 800						
Hot water		3 800	250						
Transports			308	80	13	3	0,1		
Total	120	58 272	13 678	80	13	3	0,1	10	2000

DANIEL 4 persons	EEB FOR ONE YEAR								
	m3	kWh	Kg						
			CO2	CO	HC	NOx	PS	P	Garbage
Water	140							7.5	
Electrical appliances		4 800	360						
Heating		34 000	6 800						
Hot water		3 800	240						
Transports			1 789	392	64,9	20,8	0,4		
Total	140	42 600	9 189	392	64,9	20,8	0,4	7,5	1740

GINETTE	EEB FOR ONE YEAR								
4 persons	m3	kWh	Kg						
			CO2	CO	HC	NOx	PS	P	Garbage
Water	140							7	
Electrical appliances		5 000	330						
Heating		50 000	3 200						
Hot water		6 000	380						
Transports			1 250	257	41,7	14,7	0,3		
Total	140	61 000	5 160	257	41,7	14,7	0,3	7	1740

As it was not our purpose to achieve a behaviour change but rather to study its condition, referring to the « influence » theory that is mobilised in usual cognitive transference groups was of no help. In order to measure, who influence who and on what, this would have meant that extremely precise benchmark should have been defined for a couple of criteria and that each individual's reaction could have been measured referring to the benchmark. As this was not the paradigm in which this work took place, we had to find tools that would help to understand what could be at stake within the group and that would provide guidelines for the result's interpretation.

Conclusion

The French data system doesn't take into account what's going on at the household level as far as sustainable behaviour are concerned but it was possible to build Energy Environment Budgets thanks to bottom-up calculations. The study of the artefacts that happened to be a success for inducing sustainable behaviour change in France shows that the more reflexive the artefact, the better for inducing behaviour change. Accordingly, EEB were not presented to people through the informative form of a simple table. The basic underlying calculations (water and energy consumption) were joined and explained in order to make people able to recalculate the consumption for themselves and to assess the variation of environmental impact that a behaviour change will induce. The EEB were transformed, then, into something with which people could interfere, therefore acquiring the form of a very simple artefact while introducing the "measurement" dimension that is expected from reflexive artefacts.

Moreover, when artefacts, such as green tags, have failed to induce behaviour change it is often because they were meaningless for people. Referring to the theoretical work that considers artefacts as both embodying and enabling action, we can suggest that part of the situation could be explained by the fact that the artefact was not embodying people concerns as citizens : the green tag was design to minimise its impact on production and consumption which was not what people was expecting from it (health condition). Therefore, we can wonder whether as soon as an artefact is aimed as inducing sustainable behaviour-i.e. is positioned in both the Eco-sphere and the Techno-sphere- it shouldn't embody elements of the Socio-sphere such as honesty, trust or fairness that appear through the various studies that we have reviewed in this chapter and in the previous one. We also have to wonder about the meaning that the EEB will take when in use. What would be the meaning of savings translated in utilitarist terms of money and pollution? How people's are going

to seize the EEB? According to which rationality? By organising the study of this specific case of knowledge transfer, the cognitive transfer experience has turned out being fruitful for understanding what was at stake. The next chapter will detail its results.

Ch 3 Results of the Cognitive Transfers show that much more than the rationality of the consumer-product relationship is at stake in sustainable action taking.

The Energy Environment Budget assumes that once confronted with the environmental impact of his/her behaviour and once able to assess the impact of a behaviour change thanks to this artefact, people will be encouraged to modify their behaviour even though we could consider that other elements, such as people's relationships with the State, could interfere. As consumers people will be aware of the economical advantage of an efficient use of natural resources, as citizens they will be aware of the benefits of sustainability.

From a theoretical point of view, the simple fact of making the hypothesis that giving information supported by an artefact could induce a behaviour change implied that, according to the TEM, a « rational » behaviour could be expected from the layman: once informed of the good reasons for which sustainable action was worthwhile taking, he would tend to do so.

As mentioned previously, these “good reasons” could be of two sorts. The first one is derived from economics: the consumer is a rational actor and will purchase products and services that allow him/her to maximize his/her profit (utility). The second one expands the understanding of utility to positive environmental impacts: once knowing that his/her behaviour change could improve the quality of the environment, one would adopt the behaviour change because it will benefit to his/her quality of life and to the other's. In other words as citizens, people are supposed to react according to the same scheme that they are using for consumption purposes. Such a transposition that mixes the rationality of consumers to the rationality of quality of life and citizens is never questioned in the UN documents about sustainable behaviour that I could had access to³⁴. And yet, the idea that these two rationalities are confounding themselves can be questioned. At least, one can wonder how they interplay with each other.

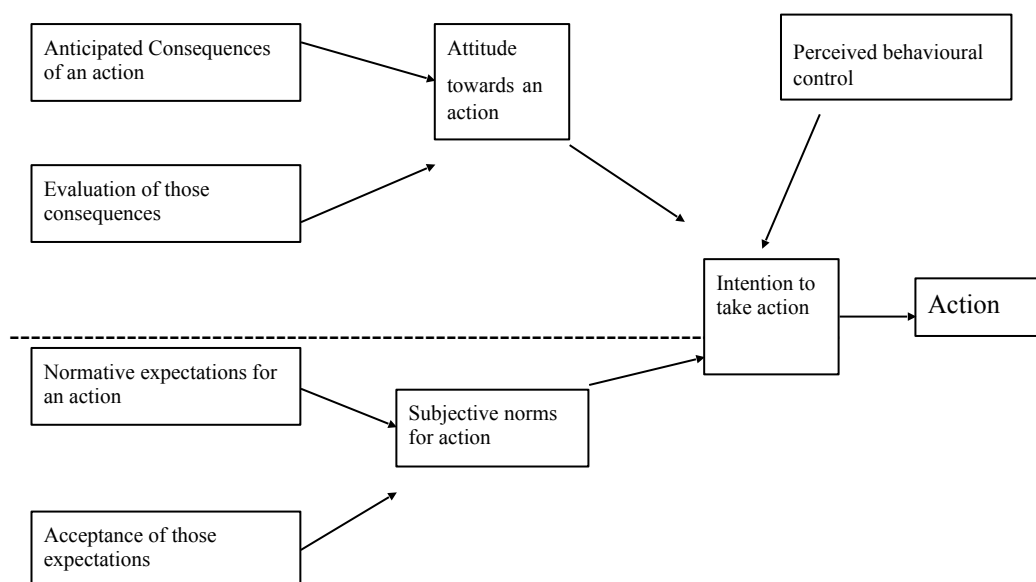
For understanding the reasons for behaviour change at an individual level, a couple of theories assume the necessity of an awareness of the consequences of one's behaviour as a prior condition for the implementation of behaviour change. They are inspired by the Attitude-Behaviour theory, which concentrates on the individual's relationship with action taking.

³⁴ see chapter 1

The Attitude - Behaviour theory is based on the hypothesis that favourable attitude leads to behaviour, the main problem being to define exactly what should be understood as an « attitude ». The most famous model made by Fishbein (Fishbein, Ajzen, 1975) defines one's attitude towards an action as the produce of one's anticipated consequences of that action and of one's evaluations of those consequences (Fig 4). The influence of the society is taken into account by another variable called the "subjective norm". One's subjective norm is the produce of one's understanding of what other people expect one to do and one's acceptance of this expectation. Both of these variables determine what Fishbein calls the « intention » to take action. His assumption is that intention to take action and actions are highly correlated.

This model is the basis of the « Theory of Reasoned Action » (TRA) and focuses on the behaviour that is under the voluntary control of the actor. As its test results were a little disappointing (For example, Archer, Petitgrew & al 1987), it was refined into the « Theory of Planned Behaviour » (TPB) which introduces a new variable of the behavioural intention called the "perceived behavioural control" i.e. the degree of control the individual perceives that he has over the successful performance of the behaviour. This model was tested with much more success.

Fig 4 The basic Fishbein Ajzen Attitude Behaviour model (1975)



The Fishbein Ajzen model has generated numerous research works in social psychology and has been a reference for 20 years (Manstead, Parker, 1995). Suggestions for the improvement of the variable's definitions were numerous:

- Some have criticised the model basis according to which the intention to behave in a certain way depends on the expected social and personal utilities of the action in question - which are often translated in ground research work by the words “advantage” or “disadvantage”. This basis doesn’t pay attention to personal beliefs grounded on more abstract principles. This is the reason why socio-psychological scientists have suggested integrating other items such as personal norms, affective evaluations, behavioural beliefs, moral attitudes, habits etc. (Gorsuch & Ortberg (1983); Eagley & Chaiken (1993)).
- Others have suggested that this type of models can’t reflect variables, which play a part in people’s energy conservation behaviour such as for example, the importance of knowing someone capable of minor repair (Archer, Petitgrew & al 1987).
- Referring to energy conservation programs others have shown that general attitudes towards energy issues shouldn’t be used as a variable. At the opposite, specific attitudes towards specific conservation behaviour could be useful. Stern & Garner quote American studies that have shown that attitudes (norms, beliefs and behavioural intentions) closely related to specific energy using behaviour are predictive of this behaviour (Stern, Garner, 1981). For example, positive attitudes towards the control of the heating temperature. This is important, as the studies that were looking for a link between general pro-environmental attitudes and sustainable behaviour have never found any (Gatersleben, 2000). Such a position can also be understood as in line with Otnes’ concept of the “provinces of the every day life” (see chapter1) because most of the behaviour changes that are suggested to achieve more sustainability are related to a different use of a socio-material system.
- A couple of research program’s results are studied by Olsen (Olsen, 1981) who shows that an anticipation of direct personal consequences from the energy problem especially on the health and comfort and money saving issues are likely to lead to action. Hence reflecting the importance of utilitarianism in sustainable action taking. In France, policies intended to modify people’s attitude while relying on utilitarian incentives were held mainly after the second oil crisis through general advertising campaigns that were promoting “waste hunt” together with fiscal incentives which are still in place. It is generally recognised that this public policy was a success but in my opinion, largely because it was a time of a full mobilisation of the whole French society against adversity.

If we look at the cognitive transfer group method through the TRA loop, a couple of elements appear in line with that theory:

- the idea that one's anticipated consequences of an action and of one's evaluations of those consequences (attitude towards action) can lead to action.
- among these anticipations, the idea that utilitarian information (savings translated in terms of money and pollution) could have an importance.
- the idea that precise information should be given for each behaviour and that action will not be taken on the basis of general attitudes: the EEB wants to take into account the difference between the routines of daily life that are often connected with the use of SMCs and the extraordinary consumption.
- the idea of the importance of a perceived behavioural control thanks to the EEB.

In other words, cognitive transfers based on Energy Environment Budgets assume that modifying the elements of the superior part of the Figure 5 describing the attitude behaviour model will induce behaviour change.

The results of the Cognitive Transfer (section 1) show that this was often the case (section 2).

However, referring to this kind of rationality is not enough to understand what was at stake during the cognitive transfer experience. The normative expectations for an action and subjective norms of an action also interfere in action taking but they can't describe fully the process that is at stake (section 3).

3.1 The experience of the CT based on an Energy Environment Budget was a success : all participants but two changed their consumption practices.

Before analysing the impact of the Cognitive Transfer (1), we will analyse the situation of the participants to the group before the Cognitive Transfer was made (2) in order to identify the main rationalities at stake and to see whether the cognitive transfer had an impact on them. We will also describe, if necessary, the difference between the control group and the 3 Suisses Group.

1) Before being exposed to the Cognitive Transfer, all participants to both groups were already taking some sustainable actions on a regular basis.

However, these actions were taken for very different motives that were not always related to environmental issues. This reinforces the results of the preliminary interviews that shows that many people were unaware of the possible adverse environmental impacts of their daily behaviour. In the

following pages, we will describe the type of actions taken by the groups' participants before the cognitive transfer and the reasons they acknowledged for doing so.

Waste separation All participants were sorting their garbage, because it is resented as

- compulsory (Gael, Chantal),
- fun (Samuel),
- civic (François),
- good for the environment (Franco),
- convenient (there are casters under the bins and a special compartment for garden waste).

As far as convenience is concerned, the participants often criticise the organisation of the collection which leads to discomforts or lacks of convenience (Elisabeth complains about the smell, Anne about the difficulty to organise waste separation in a collective building, Chantal because cardboard is not picked up if it is not in the adequate bin). We could also notice that, because it is convenient, Anne empties the car's ashtray out of the car window.

Civic behaviour is counterbalanced by the perception of the tax system. According to Chantal, the worst aspect is that the waste collection tax keeps on rising while people have more and more work to do, it is therefore perceived as very unfair. She is also worried because she has heard that a new collection tax calculated according to the weight of the waste is going to be implemented. She thinks that people will react by dumping their garbage elsewhere.

A positive impact of waste separation according to both Anne and François was that it raises awareness about environmental issues.

As far as knowledge about the environmental issues linked to waste separation is concerned, Franco is aware of the dioxins emitted in the air by most waste incineration plants. He has received an assessment of the activity of the local waste reception centre and found that it was interesting.

The same type of behaviour is found in the 3 Suisses group: everyone sorts his/her waste at home, some complains about the organisation of the collect (in that case, Roselyne complains about the size of the bins: they are too big to be used inside the house. Therefore she has to organise an intermediate sorting level. The collectors don't care about where they leave the bins; she always has to put them back in place). However, there is a main difference: all participants are voluntarily recycling their batteries by using the facilities provided by the company. Such behaviour is only taken by Elizabeth in the control group on the grounds of her strong pro-environmental convictions. She is also the only one to bring back out of date medicines to the chemist. In the same line of idea of being civic, Gérard respects the watering bans when they are implemented.

Energy saving behaviour is taken by all participants in the control group but two (Gaël, Samuel) who think that there is no specific need for doing so: nuclear energy provides a “clean” resource that is always available. Energy saving behaviour is materialised in:

- containment behaviour: switching off the heater when leaving, or in a specific room (Christiane, François); or at night (Chantal, Franco, Christiane, François) and sometimes far beyond the recommended temperature of 19 °C (16 or 14 °C), switching off lights; night use of dish washer and washing machine (Chantal); switching off the video player’s pilot light (Franco)
- energy efficient purchases: low energy consumption light bulbs (François), energy efficient white products (Chantal)
- use of public transports (Christiane, Pierre).

3 Suisses group: If we focus on energy savings at home, this type of behaviour is only quoted by Daniel (switching off lights, efficient white products, 19 °C at home, showers). However, contrary to what happens in the control group, he and his fellow participants refer to insulation devices as an efficient means of saving energy (roof and/or wall and/or windows insulation). Daniel is the only one to talk about the energy efficiency of a heater. On this issue, it seems that there is a difference in means between the two groups that might be explained by a different type of knowledge. While the idea of containing oneself occurs “naturally” when considering savings, the idea of investing for saving is less obvious. Insulating one’s house was one of the 3 Suisses company’s recommendation. Therefore, it might explain part of the difference between the two groups where we can find a common concern about the need to save energy. Another explanation might be linked to the age of the participants: they were more likely to remember the oil crisis’ campaigns for energy savings or to be influenced by the generation effect that has been described for environmentalist ideas (J.P Bozonnet 2003).

Water savings. There is no specific difference between the two groups on water saving behaviour. It is mainly materialised by containment: taking showers instead of baths (Anne, Chantal, Franco, Christiane). However, Samuel is considering buying a new efficient dishwasher. Other containment behaviour is found with Chantal who uses plastic balls in her washing machine because they allow using less detergent. She is in constant war with her two sons to make them have shorter stays under the shower. She and her husband never take a bath. In the 3 Suisses group, Ginette uses the bath’s water to water the garden and quotes flow reducers as a mean of saving water, Gérard uses a water tank for his organic garden.

Both types of savings (containment and energy or water efficient purchases), are taken for financial reasons: people refer to the level of their income (Anne, Samuel, Gérard, Ginette, Daniel). Looking for savings is sometimes a major issue in their lives. For example,

- Chantal explains such behaviour because she lives in a big country house, which is “all electric”. Electric heating costs a fortune.
- Franco refers to the value of things, the waste of energy but also to the scarcity of the resource and links the issue to the price policy: as water is getting scarce, we will have to pay more and more for it.

“Subjective norms for action” are introduced when Samuel says that looking for savings can become ridiculous. An idea close to this one is Daniel’s concern of not being considered as stingy (He will switch on all the house’s lights if necessary when inviting friends). It can be noticed that the participants in the 3 Suisses group although considering Ginette’s use of bath water as a little eccentric, don’t discredit it. According to them, for doing so, one must have a bathroom at the ground floor; it will be too inconvenient otherwise

While resource scarcity is a concern for the participants, only a few of them (Elizabeth, Pierre and Daniel) develop concerns about the environmental impact of resources’ consumption.

However, a general concern for environmental issues exist. It is interesting to notice that:

- People often verbalise their concerns in terms of threats and risks. For example, Christiane is worried by the impact of air pollution; Samuel is concerned about health issues. The unsuitable drinking water for drinking that was provided in many Brittany towns shocked him. He speaks about a “state of war”. He also makes a direct link between the environmental impact on food quality and cancers. Elizabeth shares the same concern and bought a special kit to test the quality of the tap drinking water. She didn’t get good results. Therefore, she buys bottles. Gérard has stopped burning his garden waste when his neighbour told him that it affected his son’s breathing
- When considering the way environmental concerns are expressed, there is no big difference between the two groups.
- When concerned by a specific environmental issues, people tend taking voluntary action coherent in the field of transport and/or green purchasing. For example, Samuel’s concern about water scarcity leads him to buy an efficient dishwasher. François’ concern for energy issues leads him to buy low consumption bulbs. Roselyne buys recycled paper and a green washing powder because they can be recycled etc.

This is also the explanation of the **rare actions in the field of transport** that were reported. For example, Christiane was already very sensitive to environmental issues and to their consequences for human health and, particularly, to the consequences of air pollution. Actually, she often uses public transports, she is very aware of foreign experiences such as what is done in some Swiss towns that promote public transports by increasing access to them (a bus stop is always close to where you are while parking in city centres is difficult). By contrast, she is very critical of the behaviour of local public institutions. She finds them inconsistent in targeting the issue. Samuel who thinks that the consumers have always “been had” by the institutions shares this suspicion. This is the reason why he will not consider buying a LPG car. So does Pierre of the 3 Suisses group (but he avoids taking his car as much as he can for the environment’s sake). Daniel has practised car sharing with his neighbour for a while, because they were working in the same department and living in the same building. Convenience is also the reason given by Roselyne, Daniel or Ginette for not walking to the work place or not using public transports: one must take her kids to school, the other thinks that the journey is too long, the last one that connections between suburbs are uneasy.

Green purchases. In terms of purchases, a more general link can be found between sensitivity to environmental issues and action or between a will to save money and the purchase of eco refills (Chantal). For example, Daniel buys chlorine-free paper, recycled bin bag, he states that is concerned by the waste especially because paper is made of wood and water that are precious resources. He is shocked by over-packaging, especially by the plastic folders that often wrap the cardboard. He thinks that over-packaging should be taxed and he is worried because a rumour says that the waste carefully sorted are mixed up again and buried. However he is an example of the misunderstanding of the green tags which according to him, means that a product is recycled. He thinks that coercion is good, as it is the factor that makes part of his family sort their waste. So does Gérard who expects the government to ban the use of phosphates in detergents.

The main difference between the two groups is that employees of the 3 Suisses have all bought CFC-free products when their distribution within the company was organised even though they don’t consider themselves as paying specific attention to environmental issues.

We should notice that Daniel doesn’t want to pay attention to the components of detergents because he thinks that it is the responsibility of the industry and because he remembers the controversy brought 10 years ago, by the advertising campaign of “Le Chat” a phosphate free washing powder whose ecological claim was questioned by other detergent makers. Finally, the purchase of eco-refills can also be the sign of seeking for financial savings as in the case of Chantal.

Collective action is almost never found in the control group. Chantal reflects the common feeling when she says that she never interferes in the collective life because her public image could be challenged (people think you're just a trouble maker) and because it could be physically dangerous. The situation is different in the 3 Suisses group. While Roselyne's and Ginette's positions are similar to those of the control group, Pierre, Daniel and Gérard have already participated in a collective action.

- Pierre has joined a local environmental association that fights the next-door factory's smelly air pollution. Decisive for doing so was his wife's sense of smell "*at the beginning I didn't smell anything, but my wife who stays longer at home could smell something, so...*" But having said so, he refuses to get more involved in the association as it is hard work and money consuming. For example, the association had to demonstrate what she was saying by renting a special "odour analysing" truck, the energy consumption of which was a big charge for the person who had let it plugged on at his house.
- Daniel joined an association fighting against the next door factory air pollution and is happy because the association has succeeded in imposing the purchase of filters. However, he would not do so for less local causes, as he doesn't feel concerned by what goes on elsewhere. He has also joined the neighbourhood association that he considers also as an environmental association because it takes care of looking after the neighbourhood aesthetics and safety. He likes it because the association gets very practical results and because it gives him the opportunity of social insertion in the neighbourhood.
- Gérard has signed a petition against the next-door factory air pollution and has tried to obtain the burial of electric lines in the village but he doesn't want to have further involvement on the environmental issue. He thinks that other people are more qualified than he is and that the individual can't do much about it. According to him, politicians are obsessed by their next re-election and don't care about anything else. He found a confirmation of that point when the mayor, after telling him that he will ask for the electric lines to be buried, didn't do anything. He doesn't trust the big environmental associations either, as they change their mind on the relative toxicity of pollutants or products. However, he thinks that they are useful to take legal action against the government or the industries. He thinks that the government is responsible for the environment and should use his coercive power to protect the citizen and nature.

Finally, apart from waste separation, **no pro-environmental action** is taken by Gaël and Anne of the control group.

- Gaël doesn't think that it is necessary because the institutions are dealing with environmental problems. He acknowledges the existence of ground water pollution that he links to agricultural practices and to the hole in the ozone layer. Although he traces back his awareness of the environmental issues from the acid rain problem, he thinks that pollution is something that concerns foreign countries and that most of the problem will be solved by an agreement between industry and the institution. Consequently, he does not pay attention to the environment in his daily practices.
- Anne doesn't pay much attention to environmental issues. She says that she worries about the nuclear threat but that she was reassured by the COGEMA advertising campaign saying that everything was under control. She is impressed by the cleanliness of Belgium where she often goes as it is nearby. She considers that French people lack discipline and that is the reason why they keep on using their car when there is an air pollution peak. She does it herself (it's easier, more practical). She refuses to buy compact washing powders as she thinks that they don't wash the clothes well. Finally, she defines herself as selfish and states that she is going to pay attention to what has been said during the group for a few weeks and that she is going to forget afterwards.

To summarise, before the Cognitive Transfer, we were in a situation where people were clearly mobilising both:

- a) The anticipated consequences of their action: they were saving water and energy mainly on economic grounds, seldom purchased "green" products or reconsidered their transportation mode unless having a specific environmental concern. Some people, who were already concerned by environmental issues and were directly affected by pollution, were taking collective action on a local basis.
- b) The normative expectations of an action: they sorted their waste because they had to do so and because they could do it. This emphasises again the role of artefacts in actions taking that was developed in the previous chapter.

At this stage, even if the "utilitarian" rationality seemed to be the predominant one, this was not without creating conflicts in the family or questioning one's norms of convenience. However, some differences existed between the two groups that could be interpreted as a difference in knowledge and access to artefacts (CFC free products and efficient light bulbs).

Finally, some participants expressed their environmental concern was by referring to the threat it represents. This is interesting because the unwritten communication rules about the environment always stress the fact that one should avoid talking about the risk.

We will see how this situation is going to evolve after the cognitive transfer.

2) In this background, the experience of the cognitive transfer group was a success: all people but two have changed their behaviour for a duration of 6 months (Tables 3.1; 3.2 and 3.3).

- Energy and water savings were the behaviour that was implemented the most. A particular success was both the implementation of savings linked to the use and/or the purchase of light bulbs and pilot lights and the reduction of heating temperature. Most of these changes were implemented after the first meeting and were kept all along the experience.
- Fewer people modified their purchasing habits and chose another washing powder or less packaged products.
- Nobody changed their transportation mode although one person had the criteria of being next to a subway station in mind when choosing new housing.
- One person slowed down her driving speed after three meetings.
- Three people from the control group took collective action at their work place.
- One person decided to join a local environmental group.
- The experience was not only a success but also a lasting one as new sustainable actions were taken between group meetings on 6 months duration.
- Two people took some sustainable action and gave them up afterwards.
- Three people decided to boycott the TOTAL oil company after the wreckage of the oil tanker ERIKA on the coasts of Brittany.
- Most people also took new actions between the second and the third meeting.

To help understanding those results, there were a couple of assessment questions at the end of each meeting and face to face evaluation interviews were held in Lille after the third meeting of the control group. Details of those interviews are presented in the appendix.

Table 3.1 Results: Sustainable behaviour within the household before and after the cognitive transfer (control group).

	SAMUEL	CHRISTIANE	ELIZABETH	GAËL	CHANTAL	ANNE	FRANÇOIS	FRANCO
Before	- Sorts garbage - Buy Eco refills.	- Sorts garbage - Takes public transports. - Buys organic eggs. - Saves electricity (heater off at night, when she's away and in the bathroom)	-Sorts garbage -Brings back batteries and old medicines to the shops. - Buys bio-degradable products - Saves energy and water when dish washing and takes showers.	- Sorts garbage	- Sorts garbage - Switches off lights -Pays a lot of attention on energy savings (16° at night, 18°C during the day), use electric programmers for electrical appliances -Uses wash balls Eco-refills and compact washing powder. -Saves water (showers) -Tries to educate the kids to water and energy savings behaviour.	- Sorts garbage but not well -Saves water and energy (heater off at night).	-Sorts garbage -Switches off the heater at night - Uses low consumption bulbs	- Sorts garbage – Save water and energy 16°C, puts thermostat everywhere. - Buys « red label » products
After	-Switches off the heater at night in his bedroom - Buys low consumption bulbs - Switches off lights in empty rooms and pilot light	- Pay attention to water saving while tooth brushing - At work, asks for the repair of the dripping taps - copy the information papers given at the end of meeting 1 and gives it to colleagues. - buys liquid washing detergent	-Changes the time programmation of the washing machine. -Gets rid of her halogen lamps -Talks about the sessions at work -Pays attention to the city's environmental policy (compost, LPG buses)	- Tries to buy CFC free aerosols and products with less packaging. - Pays attention to the water bill.	-Buys her new washing machine looking for an A rating in energy saving and a good water saving level. Switches off pilot lights. - Tries to use less the halogen lamps. Talks about the sessions to a couple of friends. Save water while washing her hair; Buys liquid washing formulae.	- Tries to convince her daughter to take showers. - Sorts out garbage correctly. - Switches off lights in an empty room.	- Gets rid of PVC elements in the fabrication process of the packaging elements he is on charge with. - Boycotts TOTAL	- The heating temperature goes from 14°C to 12°C at night. -Switches off pilot lights -Puts a low consuming bulb in the kitchen. - changes his toilet's flush for a water saving one. - Boycotts TOTAL

Table 3.2 Results: Sustainable behaviour within the household before and after the cognitive transfer (3 Suisses group).

	DANIEL	PIERRE	GINETTE	ROSELYNE	GÉRARD
Before	Sorts garbage and batteries Insulates walls roof and windows Switches off lights in an empty room. Pays attention to save paper and buys made without chlorine. Buys recycled garbage bags. Buys local food products. Buys a high efficiency heater. Takes showers only. Heating temperature at 19°C. Has been car pooling with a colleague during two years Has joined an a non profit organisation to fight against the next-door factory's air pollution. Has joined the neighbourhood association for the quality of life in his neighbourhood. .	Sorts garbage and batteries Saves water and energy. Insulates windows and roof. Joins a local NGO against the next door's factory air pollution. Uses public transports to go to the city centre. Buys labelled food.	Sorts garbage and batteries. Walls, roof and windows insulated. Saves water (uses bath water to water the garden) Heats at 18°C.	Sorts garbage and batteries Double-glazing. Uses « green » detergents. Buys recycled garbage bags and paper.	Sorts garbage and batteries Insulates walls, roof, and windows. Produces his own fruits & veggies without lots of chemicals. Respects the bans on watering during summer times. Has a water tank. Boycotts TOTAL Has signed a petition against noise. Has stopped burning garden waste. Has contacted the mayor for the burial of the electrical lines.
After	Is careful of the way he uses paints and dilutants. Buys a class A fridge. Gets information on pilot lights' energy consumption.		Switches off the heater during daytime. has checked whether there were phosphates in the washing powder. Has given the documentation to her nephew and has talked about it in the family.		Switches off pilot lights when he leaves for a holiday.

Table 3.3 Results: New actions taken between meeting 2 and 3.

SAMUEL	CHRISTIANE	ELIZABETH	GAËL	CHANTAL	ANNE	FRANÇOIS	FRANCO
Has read the instruction book of his heater and has put it on the « summer » position. Is careful of labels, looks for eco-refills.	Talks about water savings with friends (flow reduction).	Has decided to move away from the city centre but next to an underground station. Pays more attention to what she consumes. has decided to be involved in local politics.	None. Give up the idea of saving water	Refers to the EEB to study her consumption. Thinks the household still consumes too much water. Is more careful about the dosage of washing powder. With her husband has talked, about the opportunity to invest in solar panels and water tanks. Drives more slowly to consume less.	None. Give up trying to convince her daughter to take showers	Refers to the EEB to check all his consumption in details. Changes his electricity subscription Reduces the hot water temperature by 10°C. Switches off all lights at work when they are still on at the end of the day.	Missing
DANIEL	PIERRE	GINETTE	ROSELYNE	GERARD			
Talks about sustainable consumption at home. His daughter buys fly-tox pads and not aerosols.	Avoids burning leaves and uses the special « green » bins. Uses a spray and no aerosols anymore.	Buys ozone-free aerosols.	None	None			

Each action is not taken by everybody and not on the same grounds. A couple of groups appear: those who take collective action, those who focus on increased saving behaviour, and those who don't do much. Against this background, we will follow the participants to observe their

progression keeping in mind the “rational” path that they are supposed to follow as consumers and citizens.

3.2 Analysis based on the “rationality” of the actor and on the informative and reflexive role of an artefact in action taking are a help in understanding part of the cognitive transfer’s results.

A « rational » anticipated consequence of action and evaluation of those consequences described in the Attitude behaviour model can be mobilised for describing part of the behaviour changes that were implemented. Those "utilitarian" considerations explain much of the increased savings implemented by most of the participants; they interfere to a lower extent in the modal choice of transportation (1). However, utilitarianism is also a factor that limits action taking (2). Against this background, the Energy Environment Budget fully plays the informative and "support for behaviour change" role that is expected from artefacts but it also plays on the normative aspects of the Attitude Behaviour model (3).

1) The importance of the economic «rationality» appears clearly when observing the reason why people took energy or water saving actions. They are all referring to very utilitarian reasons to behave and there are no noticeable differences between the control group and the 3 Suisses group on this issue. All the participants in the groups but one (Gaël) are interested in energy and/or water savings

For example,

Elizabeth:

- switches off pilot lights,
- programs her washing machines to work during the night. Another participant (Chantal) evoked this issue during the first meeting and when presenting the EEB the curve of the night and day electricity supply was shown. However, her behaviour can also be partly explained by the will to fight against the power cuts that are frequent in her neighbourhood and that she will evoke in the following meeting.
- changes her light bulbs. She gets rid of the halogen bulb as it is said in the EEB that it is the highest energy consumer but replaces it by classical light bulbs. Elizabeth refers to that element of the CT and to the fact that she could read it as well in the documents she had after the first

meeting. However, she doesn't like the quality of the light provided by low consumption bulbs. This is why she buys classical ones.

After the second meeting, she says that she is paying even more attention than before to what she buys without saying what and how.

To summarise, if Elizabeth has changed her behaviour in coherence with the action she had implemented already and according to both financial constraint and her sensitivity to the environment, her new behaviour reflects the change in the expected results of action that was given to her by both the EEB and the participants. It is the product of a negotiation between this information and her personal norms.

François: Having the EEB in his hand, he went through all his household's energy bills and

- reduced the temperature of his water heater by 10°C
- changed his contract with EDF (the National Electricity Provider) as it was not adapted to his consumption pattern.
- was considering patenting a heat conservation system and switches off all halogen lamps at work.

The CT can explain this behaviour, as it is the only time when savings, resulting from the change of the hot water temperature, were evoked. The CT has encouraged him also to have a further look at the energy bill and to switch off the lamps at work. Another element might have influenced him: the perspectives opened by increased savings. During the second session he realised that the amount of money saved by Chantal was worth a week holidays.

People immediately implement all actions that increase their saving capacity. They do so without paying too much attention to the environmental impacts, which are considered as the cherry on the cake, «a plus» as Chantal and Franco say. We have to remember that most participants had already implemented energy or water saving actions before the cognitive transfer, which only reinforces that trend. *Daniel: « They have succeeded in making us save water because of the price's increase; it was much more efficient than saying water is precious, save it. »*

This is a good reminder of the importance of the socio-economic background within which a behaviour change must be implemented. For example, numerous researches have studied the elasticity of water demand to price (Pouquet, Ragot 1997; Nauvues & Thomas 1997; Amigues 1996; Boistard 1992; Saitsati 1988). Most of these researches found that there was no short-term demand elasticity to price, but the long-term elasticity was not 0. The latest studies (Cambon 1996) have questioned this position and Cambon thinks that what matters is the local elasticity (including

local political and socio-economic factors). Nevertheless, prices are bound to rise as France has to apply the 1991 European directive on water quality: in December 2005, towns >2000 inhabitants will be responsible for the funding of collective water treatment and will be responsible for the quality of private water treatment. This will lead to a 65% water decontamination rate in 2005. The estimated cost of FF 75 billion (Euro: 12,5 billion) will be partly supported by consumers.

Water bills have already started to rise as the price of water has been deregulated (private companies provide 75% of the French population with water which is 20 to 30% more expensive than water provided by public services) (INC 1995).

Table 3.4: Evolution of the French households' tap relative water consumption
(basis 100 in 1980)

	1960	1970	1980	1990	1994	1995	1996	1997
Volume (l)	35	69.8	100	111.9	111.1	112.1	113	113
Value	4.1	19.3	100	225.3	319.9	343.8	366.2	381

Source : INSEE « La consommation des ménages en 1996 »

Consequently:

More and more people are aware of the price rise of water in their service charges. More and more private building's councils are considering specific actions such as (Ministère de l'Environnement, 1993):

- generalisation of individual meters although it seems that their influence on water consumption reduction doesn't last very long if not combined with an information program
- taps maintenance
- seek for leaks
- distributions of an information guide.

The perspective of the water prices' rise has been the subject of large media coverage.

This subject has been also largely discussed among public housing authorities. In 1998, a charter to validate the most efficient water saving tools has been signed between their representatives, water agencies and the Minister of Environment (Ministère de l'Environnement 1998).

The price factor also explains the observation made in Valence, which shows that most people had implemented energy or water saving action without being aware of their positive impact on the environment.

Utilitarianism has been used after the oil crisis by the government to promote energy savings. As Pierre says: « *I think saving energy and heating has become part of every-day-life* ». In the interviews made in Valence, all the participants were aware of the financial subsidies provided by the government for housing insulation and the purchase of new efficient heaters that were implemented during the last oil crisis.

Another utilitarian reason to take action can be observed when the choice of a transportation mode is at stake especially when one considers the transportation of the whole family. In that case, a rational calculation shows that it is cheaper to use one's car.

Chantal, for example, has calculated very precisely that buying a bus ticket to allow her kids to go into town was much more expensive than driving them herself to the city centre.

This also holds for Christine in Valence.

Utilitarianism is not only a matter of money, it can be a matter of time. For most people, taking public transport consumes too much time.

Daniel: "It is a 15 to 20 minutes drive to commute in the morning. If I take the bus, it takes 45 minutes minimum with no guarantee to be on time: I have a bus change, if the first bus is late, I must wait 20 to 30 minutes". This example reintroduces the importance of the structure of the social life and of the qualities of the supply. Anyway, the source of action taking lies in utilitarian grounds. And, actually, apart from Chantal's difficult efforts to reduce her speed in order to spend less money, there was no change in the transportation habits of the group. This can be explained by elements referring to the Attitude behaviour model:

- A misunderstanding of information (No anticipation of one's action). For example, Franco doesn't care about mobility issues because he is convinced that buses and public transports pollute more than cars. As a demonstration he quotes the black smoke from many buses' exhaust pipes. He doesn't trust the technical control that is done every year on those buses.
- The pre-eminence of other utilitarian elements. For example, Samuel didn't change his way of driving even knowing that it is a source of both expenses and pollution. Taking his time would mean having fewer appointments per day and it seems that he can't afford it in his work.

In this last example it is shown that utilitarianism is also limits action taking.

2) Utilitarianism is also a factor that limits action taking.

Most of the time the balance made between price and environmental impacts is not in favour of environmental behaviour. The price is not the only utilitarian issue : lack of information and time pressure interfere also in the process.

- Anne says that she pays more attention to the labels of washing powders but doesn't buy any organic products, as she can't afford it.
- Chantal's behaviour change in the purchase of detergents was limited by the lack of complementary information "*you have to know what you are looking for*", by contradictory information (the washing machine manufacturer recommends washing powder or liquid detergents and no tablets therefore Chantal thinks that they are less efficient), by the strength of her habits: the time dedicated to shopping allows her to choose a different packaging (a bottle of liquid detergent instead of a box of washing powder) but it doesn't allow her to take the time for reading the washing powder labels. She was still using liquid detergents after six months. Utilitarianism also explains why she didn't encourage her kids to take public transport (too expensive).
- Franco buys "red label" chickens as he is reassured about their quality but doesn't pay attention to other labels as he doesn't know, as Chantal, what information he should look for and doesn't trust the labelling organisations.

→ In the case of green purchases, the informative aspect of the Cognitive transfer has worked but has been limited not only by utilitarian factors such as time pressure and the quality of information but also by the power of purchasing habits. Trust appears again as an element of decision in the purchase of a labelled item all the more so as there are so many of them that people don't know what to choose.

3) An informative artefact such as the EEB has led to behaviour change by mobilising the expected consequences of action but it plays, also, on the normative aspects of the attitude behaviour model.

Information given in the Cognitive Transfer was dominant in implementing behaviour changes especially in water and energy savings. It was less efficient for inducing green purchasing but in any case was inducing a change in the family norms or, at least, a discussion about them. To this extent the EEB was able to mobilise or to challenge the expected norms of an action.

- **Savings:** Anne started to switch off the lights when leaving a room, she asked her daughter to take shorter showers. This behaviour change has lasted longer than she had planned as there were a couple of months between the two meetings. She mentions that she has read the documentation that was given to her and that she has learned new things about energy saving. It is interesting that she has started some kind of bargain with her daughter who accepts to reduce her water consumption if her mother stops throwing away her cigarette butts. This bargain will not last. Anyway, the EEB brought the opportunity of re-opening a debate.

Chantal bought a new washing machine with water and energy savings as her main purchasing criteria, she tried to turn off the tap while washing her hair, she switched off pilot lights half the time, cooked during low tariff hours, tried to use the halogen lamp less and bought “*the bulb that gives less light*” for the kitchen. Those elements show that changing one’s habits is not an easy task even if you are convinced of the value of the change. It also shows that the value that you give to a product can impede the behaviour change.

Anyway, this behaviour is explained by the information that was provided by the CT especially for the purchase of low consumption bulbs and the use of pilot lights. Opposite to Elizabeth’s perceptions, the savings that are considered by Chantal largely compensate the inconvenient aspect of the lightning quality given by low consumption bulbs. The CT has also given precise information on the energy and water efficiency labelling. They were used in the purchase of the new washing machine.

Furthermore, as mentioned before, Chantal has already experienced the possible rewards that can be had by her savings: she has been able to save FF 4 000 (about 666 Euro) per year thanks to her behaviour. This achievement has turned into a challenge: her aim is to maintain the water and electricity bills and it is reinforced by the idea that it is good for the environment as well. Achieving such a challenge is a source of pleasure “*I am happy, I have personal satisfaction*” and the EEB can contribute to it. Within this framework, she tries to control her speed when driving in order to spend less but changing this habit is very difficult because of the time pressure. However, this could lead to a rebound effect as she is expecting to spend the money saved for taking holidays (Beckhout. P.H.G, 2000).

After the second meeting, she reduces her water consumption again by collecting rainwater in a tank for watering her garden. She did so after studying her EEB as her consumption level was higher than the average figure that was indicated. Also, she could refer to one of her neighbours who uses a water tank for toilet flushes and the kitchen sink. He told her that his savings were

important. Maybe Chantal was led to talk about this subject because of the CT meetings but she didn't refer to it.

After the third meeting, she improves her respect of the speed limit and explains this behaviour by the "conversation we had" during the group. As a matter of fact she was always interested in the subject when the group discussed it. Of course, it is a translation of her will to save money. What is interesting is that she acknowledges the influence of her kids who kept on telling her that she was driving too fast and that therefore she didn't have anything to say about their behaviour (when she was worried for them). It is a bargain on safety. We can also think that it might be difficult for her to bargain with them a shorter stay under the shower for the environment's sake while keeping on driving fast. On this matter she could be the counter example of Anne's failure to impose a shower instead of a bath to her daughter. Saving behaviour appears to be a matter of normative discussion in the family.

Franco represents the extreme case because he increases savings even if it generates tensions in his family, especially with his wife who complains all the time that she is freezing. He has reduced the heating temperature from 14 °C to 12 °C at night. He is happy because his wife didn't notice the difference, which seems to be for him the proof that her complaints are not serious ones. He switches off all pilot lights and has put a low consumption light bulb in the kitchen. Those changes are linked to the CT not only because the group presenter mentioned the possibility of those savings but also because it was a matter of discussion. François mentioned that he was using the low consumption light bulbs and a discussion was held about whether it was better to switch off the heater at night or whether it was better to reduce it only. The change is also linked to the pleasure that Franco gets when his bill is lower than the previous one. He likes having a minus on his bill.

Finally, Samuel has also taken energy saving actions. It is all the more surprising that he was convinced, before the CT, that they were not necessary. He implements energy savings by switching off the heater at night, switching off the light when leaving a room and buying low consumption bulbs. He who was saying that a "nuclear" light bulb will not make any difference now buys low consumption bulbs. However, the financial rewards of energy savings are important. During the face-to-face interviews he stated that he had discovered the importance of pilot lights and light bulbs consumption in his global electricity bill. As he didn't want any waste, he bought his new low consumption bulbs because they were for sale and he would use them only when the current ones are out of use. He seems to have discovered that burning gas produces air pollution. However, switching off the heater at night is also a source of an increased comfort. He sleeps better. Here

again, we find a participant talking about the automatic way of doing things. Referring to it, Samuel says that each time he sees a red pilot light he switches it off.

Anyway, we must notice that, after the second meeting, Anne has reversed her behaviour, while she kept on increasing the quality of her waste separation, she has given up trying to save more water and attributes it to the good weather.

To summarise, in terms of water or energy savings, the EEB has induced behaviour change by giving information and helping to establish a benchmark to which people confront themselves. However, its influence is limited by the confrontation with people's habits and with the norms of other people in the family.

- **Green purchasing** increases in the group after the Cognitive transfer but to a lesser extent than savings. The CT insisted on the issue of over packaging and as mentioned when looking at the informative and utilitarian aspect of the CT, this has had an influence. It has interested Anne who made a link with her waste separation habits and decided to sort out her waste better despite the boring aspect of such action. However she thinks that after a while, it "turns into a habit and you don't think about it anymore". The boring aspect disappears. Other examples are given by Samuel who says, after the third meeting (face-to-face interview), that the CT has changed his shopping behaviour and that he looks now for Eco-packaging. As far as the other green purchases are concerned, he confirms his plan to buy a dishwasher for which he will pay attention to the energy and water consumption. The CT has refined his demand for a dishwasher as this subject was discussed: Chantal has renewed her dishwasher on those criteria. She has decided to buy liquid washing detergent because "it was said during the group that it was better". She has looked for the presence of nitrates on the labels of the water bottles. Such behaviour is clearly linked to the Cognitive transfer because the group presenter talked about the phosphates issues and mentioned that there were usually less phosphate in liquid washing detergents. It is also linked to Françoise's assessment about nitrates (there are more nitrates in tap water than one could think, the tests she made proved it). It could be understood that nitrates are bad for the health whatever their level of concentration in the water.

→ The variations of behaviour between purchases and in-house consumption suggests that these two types of behaviour design the frame of two types of "provinces of every day life", therefore the existence of two types of rationalities.

From those cognitive transfers stories, we can observe the importance of both written and sizeable information in the EEB (a) which also act as a reminder of other environmental issues (b)

a) Written information providing knowledge intended to encourage behaviour, increases the perceived behavioural control and plays a role in sustainable action taking.

Evaluating the consequences of an action is at the heart of a cognitive transfer based on the production of Energy Environment Budgets. It is done, also, to enhance one's perceived behavioural control because it allows reflexivity on one's action thanks to the EEB.

Actually, the CT groups confirmed the importance of an informative artefact for sustainable action taking. Both during the meetings and the evaluation interviews, people were referring to the Energy Environment Budget as a « proof » of their behaviour impact. The use of such a word is a sign that a tangible element is necessary to materialise what normally stays at a discursive level. If we observe in more detail people's appreciation of the EEB, it appears that, it is more than a simple informative tool:

- It materialises an opportunity for taking action *«I've always dreamt of doing such a thing »*
- It gives new information. Among them, two elements are often quoted: the energy consumption of a household's electric bulbs and pilot lights, the environmental impact of phosphates. This is coherent with the observations made in Valence that show that they are the two actions that people ignore the most (Table 3.5)

Table3.5 Frequency of some types of energy saving behaviours. Valence

	Always	Often	S e l d o m	Never	I don't feel concerned by that
I use Low consumption bulbs	2	11	9	26	0
I have pilot lights on	18	5	10	14	0
I switch off a light when leaving a room.	29	16	2	2	0
I reduce the heating temperature at night	30	8	3	5	1
I switch off the heater if a room is not occupied	21	13	4	5	4

Source: Valence Interviews.

- It helps establishing a benchmark of the household's consumption (see previous paragraph)

The figures of the EEB themselves are not very important; what is important appears to be the relative weight of the figures and the fact that the figures exist when it is not the case, the information might be considered as untrustworthy. It seems to be the case in the 3 Suisses training sessions as Pierre says: *«They say that a pilot light consumes more than a device that is switched on but as long as we don't have figures I hesitate (to trust the company).»*

- It enhances personal control: the actions to be implemented are not huge but they are a succession of little tasks that are on the layperson scale.
- As expected, the reflexivity of the budgets has been appreciated. There was a demand for more reflexivity, which suggests ways for improving the EEB construction: some people would have appreciated participating in it and having more specific goals « *It would have been good to have objectives and ways of reaching them* ».

The use of an artefact was not the only reason for taking action. The kind of information that was given to people was important too.

- Information to people was efficient particularly for inducing energy and water saving actions. It was less the case for sustainable purchases. Therefore, criticism can be made of the EEB: it didn't insist enough on consumption such as those of organic food or recycled items. They were mentioned during the group but not in the written suggestions for action taking that were given to people and there was no specific section on the issue on the EEB. Improvement should be made on that side.
- Information given by the participants themselves was sometimes as important as what was said during the cognitive transfer. All the more so as some people, like Roselyne, were reluctant to refer to written information. In that case, a testimony was the most efficient.

From this fact we can make assume that a cognitive transfer is all the more efficient that the information is provided through numerous sources.

b) The EEB is a reminder of the existence of some environmental issues.

Elizabeth reckons being more sensitive to environmental issues and she thinks that the CT helped for making new connections between things. For example she has paid attention to the Eco-gardening process that the local authorities have implemented in public parks, she says that she would not have bothered beforehand.

Samuel is more attentive to the environmental news in his work field. He notices that two brands had just issued a new kind of tetra pack that can be washed and after the second meeting, there is no noticeable behaviour change except perhaps for more attention paid to packaging but Samuel is not very precise about it. " *I've paid attention to labels on packaging, I can't remember which label*" After the CT he had mentioned already that packaging were disappointing as they made you think that you had bought a huge quantity which was much reduced after getting rid of the packaging. However, the second meeting might have made a mark too, as it was then that François, another participant, showed the strong commitment he made for the reduction of the packaging used at his

work place. Samuel's awareness could have been increased by it. Therefore, the CT might have had a slight influence which was not enough to support real behaviour change and may be because of the lack of awareness or trust that exist towards the labels or may be because they are not very visible "*it's hard to know whether a product is recycled or not*". The defect of the artefact is a curb to action.

3.3 The group impact is difficult to explain fully by reference to the Attitude Behaviour models.

1) Stories of collective action taking and of no action show that the categories of the attitude behaviour model can't account for all the observations made in the CT experience.

It is necessary to tell the stories of behaviour change or of the absence of behaviour change in the control group to underline that while norms or expected results of action are always present, they are always intermingled with other aspects which are less easily accountable for with the attitude/behaviour theory.

If we follow Christiane, for example, we can observe that the main change is that she has taken collective action by asking for the repair of the dripping taps at work and by making copies of the documents that were given to her during the CT in order to display it to colleagues.

- She makes a clear link between this behaviour and the cognitive transfer by saying that she felt invested of "*something*" and she was not frightened to say when things were wrong.
- However, even though she is concerned by the planet's future she is never going to consider taking other action. She feels that one is quickly discouraged for doing so and she refers to the metaphor of one's action being like a drop in the sea. When considering participation in one association she declares that she is frightened and that she doesn't know whether she would be able to stand it. It is interesting that she doesn't say that her co-citizens frighten her but that she is "frightened by France" which suggest a stronger criticism of the functioning of French society. We can notice that expressing oneself about environmental concerns is linked to ideas of fear.

Some questions are raised by this example:

- First of all, we can wonder why there is such a double way of considering collective action. Defiance of French society and fear of the consequences of personal involvement don't prevent collective action at work. What explains the boundaries?

- Second, concerns for the planet's future appears as an underlying element which was not verbalised as such before the cognitive transfer: her main concern was the impact of pollution on health. We can wonder whether there is a link between the two.
- Finally, even though she is doing many things herself, she still expects a lot from the institutions. If we refer to the institution role in the TEM, we can wonder to what extent this influences her actions?

These questions are also raised when studying Elizabeth's and François's progression that follows the same scheme: increased savings at home, collective action taking at work, (and may be, in the case of Elizabeth, in an association). Let's notice that all of them declared to be concerned by environmental issues before the cognitive transfer.

Let's detail the context of collective action taking.

Elizabeth first speaks about sustainable actions at her work place and with family members. We can suggest a relationship between this action and:

- The discovery of the other participants' concern for the environment. Elizabeth likes the fact that there is no indifference and that she could discover that other people shared her concern and that it was possible to talk about it. Following this path, she reckons that one should talk about environmental concerns with politicians if one wants to do something about it. What was precisely attributed to the C T is the influence of witnessing the behaviour changes implemented by the other participants. Elizabeth declares that she was impressed by those changes.
- A feeling of responsibility. She often speaks about responsibility. The parent's responsibility in the environmental education (everything should not be on the school's shoulders), the consumers' responsibility (you can't delegate everything); she considers boycotting products, the citizen's responsibility (voters have to show that they don't agree). It is also a responsibility towards what goes on elsewhere (Chernobyl).

All of this has to do with changes in the subjective norms for action. Anyway, after the second meeting she wants to join an environmental group or an association.

- She is encouraged to do so because she feels less anonymous in the suburb she has just moved into and because she is now aware of the limits to individual action. She reckons that she can do little things only, details and that she does many sustainable actions already. Collective action is a mean of achieving more.
- Also it is possible, to link to this decision the fact that Elizabeth found out that it is difficult to convince other people, groups especially. People can be aggressive. It makes her think, that coercion is sometimes the only means that will change people's behaviour. We can suggest that

joining a collective actor allows her to be able to speak on behalf of it and not on a personal basis anymore and that it makes inter-personal relationships easier while offering an alternative to coercion. It shows also that she has a minimum level of trust in the capacity of associations to fight against the environmental risk.

- However, even though she recognises that she is ready to write to her local MP and that action at this level is compulsory if one wants to be efficient, she doesn't trust politicians. She considers that they are only concerned by the next election. Such a perception, which includes a disappointment of green party action, might also explain why she will join an association and not a party.
- Finally, Elizabeth doesn't forget the other social actors and thinks that those industrial and institutional polluters should pay for what they do. She criticises the big companies as they should be an example and they are not. She thinks that companies should redistribute to their employees part of the savings they would have contributed to make. The Erika wreckage reinforces her opinion and she doesn't feel discouraged by the occurrence of such a catastrophe. Her defiance towards social actors seems to be generalised. She behaves as if she was only trusting herself.

Risk and trust are difficult to frame in the attitude behaviour model. We find the same elements in the story of François.

François has taken the opportunity of his position as head of the packaging line to change it all: he got rid of PVC and replaces them by cardboard. He is very pleased of this change and reckons to have been thinking about it for a while. He was feeling guilty because the green tag that was used as a proof of subscription to the Eco-emballage company was misleading the consumer (see previous chapter).

The CT has helped him to the extent that it spoke about the packaging issue and suggested paying attention to the type of packaging that were used by the producers. Anyway, while being conscious of his own responsibility on a global point of view, the packaging waste at Christmas, shocked him and might have pushed him to action. Furthermore, he has always been convinced that the consumer's action is limited because he/she is an end-of-pipe element that can hardly question what has been decided by the industry. All of these elements can explain his progression to action.

Furthermore, François has reacted to the Erika's wreckage too. He boycotts Total and sent back his Total "card for presents" to the company with a letter saying that a real present would be that Total would commit itself to clean the beaches and the sea. He is convinced that consumers have quite a lot of power, all the more so as:

- The production of many items is concentrated in the hand of a small group of companies, which have therefore the financial ability to react to the consumer's opinion.
- Politicians have given up.

On this issue, Franco- who boycotts Total too- joins him. This boycott seems temporary, as he hasn't sent back his purchasing card as François did.

François explains the reasons why he doesn't take public action. First of all, it is time consuming and complicated. Secondly, a personal public action is useless and can be physically dangerous. Thirdly, participation in a demonstration or any kind of collective action results in the fact that you are labelled as belonging to such or such a group. Being perceived as belonging to the green party is not something that he is looking forward to. Fourthly, institutions should be exemplary and they are not. Worse they promote behaviour which is opposite to sustainability. For example, tap water is hardly drinkable; you have to pay taxes while having to compensate the institutional shortcomings by buying bottled water. Idem for waste separation which is not promoted by the increase of the waste collection tax. Furthermore, like Christiane and Elizabeth, François thinks that coercion should be greater.

At the opposite, if Chantal talks about what she has learned in her family and with friends and links this behaviour to the participation to the group (her general awareness raised, she felt also that it was important for the future of her kids) even though she believes that changing the future is a matter of will, she explains that she is not attracted by any collective actions as many associations have a bad reputation for abusing their funds and because her past attempts to do something at a collective level have failed. The mayor hasn't done anything for the young people of the village even though she had visited him a couple of times to talk about the issue. Anyway, she didn't participate in any local meetings. According to her it is an old people's business. Her image/reputation doesn't fit into it.

In these stories of collective action taking we can observe the importance of:

- The perceived social conditions in which action had to take place,
- The existence of a fear associated with any public involvement
- The expectations about the normative actions that the institutions should take all the more so people might perceive themselves as too "weak" to confront themselves with other social actors.
- The emergence of a construction of the environmental action in which personal action seems impactless although there is a strong perception of one's own responsibility towards the environment.

- The lack of trust in the institutions' capacity for dealing with environmental concerns which is sometimes enhanced by personal experience
- The impact of the perception of the geographical area to which one feels related.
- The impact of the group dynamic specifically as an enhancing one's responsibility

These elements appears as well in the discourse of those who take minimum actions and give them up afterwards.

Anne and Gaël belong to this group but have very different story lines.

Anne explains her apparent lack of concern by saying that "*she doesn't want to know*" and is fatalistically adopting a day-by-day way of living. She repeats this kind of idea when an environmental risk or a health issue is discussed. She feels powerless that's why she prefers to keep her fear to herself.

The group plays against this feeling: she says that she was surprised to discover that the issue was a concern for others and she appreciated that other people gave practical examples of what they did. However, the security feeling given by the group is the highest in a demonstration. She feels strong among the mass of people. The category of a change in the subjective norms of Anne can't explain the process of change. Anne introduces also the idea of a social complex as she insists on the fact that both workers and executives should participate in the same groups if CT were generalised and that she did appreciate the fact that nobody in the group was lecturing anyone.

For his part, just after the CT, Gael's perception of environmental issues changes. He declares that he is now aware of the big issues and of what people can do. For saying so, he uses the metaphor of the little drops in the sea. At the beginning of the second meeting, he is going to refer to the Erika's wreckage and to the pollution of the Danube River (1999) by cyanide by saying "everybody plays". We are far from the control of environmental issues that he was asserting in the first meeting. Hence a change in his behaviour that he considers more "ecological". He wonders why there is not more advertising for Eco-friendly products. As a matter of fact, he has

- looked for CFC-free aerosols and finds more proof of industry concern for environmental issues when noticing that all aerosols are now CFC-free. Samuel answers that this is no wonder as it is compulsory.
- bought big no-packaged yoghurts but finds it inconvenient as it can be broken in the trolley.
- checked his water bill and he is very disappointed by the fact that the subscription is more expensive than his actual consumption. He considers that such a structure of the bill encourages water consumption.

- switched off his pilot lights without explaining why.

He mentions why he hasn't done a couple of things:

- low consumption bulbs are too expensive,
- he bought a diesel car as he is going to travel a lot but he confesses that he feels a little guilty about it. He doesn't reduce speed while driving.
- he keeps on starting the dishwasher even when it is half empty as it is more convenient

All of this fits into the attitude- behaviour analytical frame. However, in Gael's case, the changes that were born after the CT don't last because of the lack of support of the socio-technical environment. As a consequence, artefacts supporting behaviour changes became disappointing.

For example, after the second meeting, he will give up the idea of saving water, which is logical if we consider Gael's analysis of the water bill. He also gives up the idea of buying recycled products because in a similar way, he doesn't think that it is fair to have to pay increased waste collection taxes. Therefore, he chooses to boycott the end-of-the chain products of the recycling process. However, he thinks that the companies should provide training on sustainable behaviour at the work place and that traineeships such as those imposed on bad drivers should be compulsory for polluters. If such sessions are organised for children, he will send his own kids to them. He is expecting the State and the institutions to be more active as there is no support for the individual if he/she wants to take action. As a conclusion Gaël states that the economical consideration always prevails over environmental ones which is a lot different from what he was saying at the beginning of the first meeting.

2) The 3 Suisses group reacts according to the same rationalities as the control group

The impact of the cognitive transfer is quite different on the 3 Suisses group but the rationalities at stake are the same than in the control group .

The difference with the control group lies in three points.

- First of all, there was only one collective action taking limited to the family may be because all collective actions that could be taken by environmentally aware participants to the group were already done.
- Secondly some participants didn't do anything.

Let's follow Roselyne for example. After the CT, she doesn't do anything. This situation can be explained by a couple of reasons:

- She participates in the group to please the women who was in charge of its organisation not because she is especially interested in the group. Motivation to participate seems to be rule n°1 for the group success.
- She doesn't trust information when it comes from any intermediate body. For example, when the group was discussing the impact of low energy consumption bulbs, the organiser of the meeting was still in the meeting room. She declared that the company had organised a sale of those kinds of bulbs because of their energy saving capacity. During the second meeting, Daniel makes a false and farfetched estimation of this saving capacity. Roselyne giggles and approves him. She trusts him more than all the information she could receive. This reaction might be reinforced by the fact that she doesn't like written documents, that she doesn't find "easy" to take time to read.
- She is convinced that the impact of individual action is limited and she doesn't want to be involved in any kind of collective or public action except signing a petition.
- Her perceptions of some sustainable action are negative. For example, she refers to her mother in law's water tank and says that the water is black and there is no way in which she could use such water to wash herself.

As a general point of view, it seems that the Cognitive transfer realised by the company and enhanced by the fact that some artefacts were put at the disposal of its employees has achieved all what Roselyne could accept doing. As in the control group, the issue of trust, of the social perception of one's action and the perception that one's action hasn't got a great impact are present.

- Third, most actions were taken in the field of purchases with less savings action that were concentrated in containment which can be explained if we consider that the 3 Suisses employees had concentrated their action in the purchase of efficient items before the cognitive transfer.

However, Gérard and Ginette pay more attention to energy saving behaviour and modify some of their purchases. Gérard switches off pilot lights when going on holidays. He says that he has done so because of the CT and says that he realises that he has done good things for the environment without knowing it. He was tempted to buy a low consumption bulb "*to be up to date*" but has given up doing so because he remembered that it was worthwhile only if for a use of more than 15 hours (the CT transfer mentioned 3 hours) which demonstrate that his bad memorisation was not counterbalanced by the reading of his documents.

Ginette switches off the heater in the daytime when there is nobody home; she looks for the presence of phosphates on the washing powder labels “*it’s a question of information, I will not use Ariel anymore*”. She reckons that she is used to looking at labels but that such information is written in very small letters, which doesn’t help. She has also given the information package to her nephew who is interested in the environment.

After the second meeting, she says that she pays attention again to the aerosols labelling.

→ Here again we find the issue of the quality of labelling and the difficulty to modify one’s habits to take time for reading them.

Daniel, talked about the CT with his colleagues but was disappointed by their lack of reaction. On a private side he has decided to switch off all the house’s pilot lights as well. Following his habit, he is looking for information³⁵. He is intrigued by the pilot light issue and looks for the consumption of his own electrical appliances’ pilot lights. Such looking for information is sometimes counter-productive. Because his own calculation was telling him that it was not worthwhile buying low consumption bulbs on a financial point of view, he didn’t do it. In fact, instead of referring to the documents, he took wrong figures for the light power, which explains his result. This was discussed during the second meeting. He is also confused by what he has heard about the environmental impact of a product cycle. Is it better to take one’s waste to the local waste deposit centre and to pollute the air with one’s car or to throw it away with the other waste? Such kind of question leads to no action.

However, he changed some purchasing habits and some behaviour. He changed the way he uses paints and solvents. Instead of using large quantities of White Spirit, he bought a special cleaning product, filtered the paint and didn’t throw away the deposit when liquid. Such behaviour can be linked to the CT influence because the toxicity of certain paints and painting practices was evoked in the first meeting. Daniel didn’t want to buy paints with the official eco-label “NF Environment” that was mentioned during the CT, because he was frightened that they will give less coverage. He made a compromise by modifying his painting behaviour.

After the second meeting, he talked about the CT with his family and his daughters decide to buy anti-fly pads instead of aerosols. He thinks that they seem efficient. Such a change might reflect as well the discussion of the previous meeting where Gérard quoted the company’s CFC free policy. The elements brought in by the CT and his investigations had led to behaviour change.

³⁵ before the CT, for example, he went to a conference held by the local river basin agency about water scarcity.

→ Daniel's story underlines another aspect of information: even trustworthy, it can be confusing. Like Anne of the control group, it shows that green products are often suspected to be less efficient than "classical" ones. This is why some people like Daniel might prefer changing the way they behave instead of changing their purchasing habits.

→ However, the same factors appeared to be important: group dynamics and trust. This is very important, for example, in the case of Pierre.

After the first meeting of CT, Pierre doesn't modify his behaviour very much. The second meeting seems more decisive because Pierre was more impressed by his colleague's testimony than by the information he received. This could be observed on three subjects:

- He uses the bin's compartment dedicated to garden waste. Pierre says that, because he was impressed by Gérard's assessment according to which burning leaves was not good, he has used this compartment.
- He looks at his video player's pilot light energy consumption. The CT had shown the importance of pilot lights without convincing Pierre neither did the environmental group to which Pierre belongs within the company. Pierre explains that he is sceptical about such information, as it is difficult to believe that an electrical appliance's pilot light can consume more energy than the appliance itself when in use. For this reason he doesn't trust the company when it justifies its request for switching off computers at night by the willingness to save energy. According to him, it is much more a question of preventing an electric trip out in case of a power failure when all the computers will be switched on again at the same time. During the second meeting, Daniel says that he has looked for the electric consumption of his own electrical appliances and that if some were 2 to 3 Wh, others could reach 15 Wh. Pierre answers that 15 Wh every day is not a negligible figure. Gérard also says that he switched off his TV pilot light. Finally, in the third meeting, Pierre says that he has tried to switch off pilot lights but that he couldn't do it for his video player because it would have cancelled all the programming. The video player itself counteracted his good will.
- He buys sprays instead of aerosols. Pierre says that he has done so because he remembered what Gérard said in the previous meeting. It is interesting to notice that Gérard had just mentioned the company's policy for preventing the use of CFC but from that point, Pierre has gone further.

Pierre also tries to know Gérard opinion about the Green Party. It is the only time in the CT groups that somebody has appeared to such an extent as an opinion leader.

The CT results underlines the importance of:

- Utilitarianism mobilised in the assessment of the expected results of an action
- the group dynamic as a factor for change in subjective norms,
- the impact of the perception of risk for human health and future generations in the perception of the environment,
- defiance towards the institutions and institutionalised collective action, the influence of pragmatic information.

Scanning those results with the help of the inputs that were provided by the Attitude-Behaviour theories doesn't help to understand everything particularly the mechanisms, the process of the group's influence nor the importance of the relationships with the State i.e. with the other actors of society.

3) Inputs from the work of scientists working within the Attitude Behaviour theory frame don't help to describe fully the process at stake.

If, according to the Fishbein Ajzen model, the subjective norms for an action are composed of both the normative expectations for an action and the acceptance of those expectations, they should be very weak because taking sustainable behaviour is far from being a norm in the French society. Hence the question of explaining the solidity of the norms created during the group meeting when confronted with the daily life social norms, all the more so that their observed maintenance lasted 6 months at least. To this extent, this result seems to consolidate the opinion of those who think that social factors don't influence intentions to take action and behaviour and that most people are behaving on personal grounds only (Yzerbit, 1999). Accordingly, we can observe that the Attitude Behaviour Model explains action taking if we take into consideration:

a) The reintroduction of personal norms and affective evaluation and habits according to Gorshuh & Ortberg advise (see ch 2). It might give an explanation of some people's behaviour and of the solidity of these norms. For example, a couple of people in Valence have referred to the importance of their education in their behaviour towards energy conservation. People within the groups were also stating that a culture of energy saving has been transmitted by the Second World War generation: to switch off the light when leaving a room, to close doors, are things they have heard during their whole childhood. It is not the case for teenagers and the under 40 adults. The consequences of this observation can be seen in public life where children are now often enrolled as

their parent's prescriptors of sustainable behaviour³⁶. We saw also that the family's saving norms were not accepted by all the family members, teenagers specifically. Such analysis is close to the one of those that consider the group of which people think belonging to, as determining the subjective norms i.e. social identity would be the main social factor of the individual's behaviour (Yzerbit, 1999). However, this would mean that people identified themselves very much with a specific group, which is not always the case even in a family background.

b) Specific personal norms that were mentioned when people referred to their appreciation of comfort when explaining their action taking process. These elements appear to be of great importance because much of the reluctance to behaviour changes was expressed with a reference to them (preferred temperature level, preferred lightning quality, convenience etc). It confirms what Shove had foreseen when suggesting that *"convenience, comfort and cleanliness have real potential when it comes to understanding the dynamics of the invisible, mundane and ordinary features of everyday life which have far reaching environmental implications"* (Shove, 2001).

All of these norms are pretty individualistic and can't fully explain the group impact while its existence is asserted by the numerous participants who gave credit to the group for making them aware of the existence of a common concern in environmental issues. Therefore I have suggested that it might have modified the subjective norms for action. But how is it possible to explain the process at stake? Insights in what was going on could be looked for when studying the impact of a work group called the Eco-team. It is based on behaviourist theories that are developing the Attitude-Behaviour frame and is conceived within the same scheme than the cognitive transference groups. However, even though there are many similarities between the experiences that refer to the behaviourist ideas and the experience of the cognitive transfer, the results are of little help in explaining what we could observe.

Dutch or Flemish Eco-teams and cognitive transfer group are laid out in similar ways but can't provide adequate tools for the analysis of the cognitive transfer's results.

Global Action Plan (GAP)³⁷ an environmental NGO with headquarters in Sweden has launched the Eco-team program, first in the U.S, then in Europe, to implement sustainable behaviour within the household. With the hypothesis that many people don't know what to do, or think that what they

³⁶ cf Pachacama, UNEP programs www.uneptie.org, 3 Suisses school program, Greenpeace program, Ushuaïa foundation etc.

³⁷ www.globalactionplan.org

can do is useless, the Eco-team's objective is to make them realise that they have means to do something positive. To such an extent, Eco-teams are an alternative mean for the implementation of sustainable behaviour that allows overcoming the inaccessibility of household as a target group (see chapter 1).

Organisation. Eco-teams work on a simple scheme: a representative team of 6 to 10 households meets once a month for 8 months. The objective is not to talk about environmental issues but to act in six fields: waste, water, gas, electricity, transportation, and daily consumption. The first meeting led by a representative of the Official Eco-team organisation, is an introduction and an explanation of the program. The last meeting is dedicated to assessment. In between, each meeting focuses on one of the above-mentioned theme. For each theme, the participant has a document where he is going to find explanations about the reason why taking action, a sample of the different useful actions, an assessment form which allows to quantify his results; for example, variations in his electricity's consumption or in his bin's weight. At each meeting, the participant will make an official commitment to do one thing and will discuss its feasibility with the group. Each Eco-team is kept informed of the other Eco-team results by a newsletter. In the Netherlands, thanks to public funding, the GAP office has a computer program that allows a consolidation of all the results, which, of course, improves the quality of the feedback.

In many ways, Eco-teams resemble the Cognitive transfer group: use of group meeting, use of an artefact, behaviour control, knowledge on one's environmental impact etc. Their results are positive as well. They were assessed by two studies held by Harland & Staats from the Leiden University in The Netherlands (Harland, Staats 1995). The results are the following:

- A general improvement of the participant's behaviour and a continuation of the behaviour change (sometimes improving) over a two years period.
- That behaviour change was not confined to the household but has expanded to work places, local communities and leisure activities.
- A change in people's attitude evaluated with the help of an Attitude Behaviour model. This change mainly occurs in "perceived behavioural control" and "habits". They are factors that "promote the use of more environmentally friendly transportation means".
- The information given to people is not understood as a threat to individual freedom.

Those results are explained by reference to the behaviourist models and particularly to Geller's ABC model.

According to Geller (Geller, 1995), behaviourists follow an Activator-Behaviour-Consequence approach (ABC) in which they “systematically arrange conditions or events preceding (i.e. activators) and following (i.e. consequences) a designated target behaviour in an attempt to increase or decrease its rate of occurrence”. This approach has been referred to as a “behavioural engineering” (Geller, 1989). Geller has suggested a taxonomy of behaviour change techniques, which is based on it and can be summarised as in table 3.6.

Table 3.6 Brief descriptions of the interventions strategies of the modified taxonomy of behaviour change techniques.

Activators
<i>Passive/individual</i>
1. An individual can be exposed to written information that provides knowledge intended to encourage target behaviour.
3. A person can be assigned an individual goal for engaging in some target behaviour
4. Environmental alteration refers to designing a part of the environment in a way that forces or encourages a target behaviour (e.g. a low-flow shower head)
<i>Passive group</i>
5. Assigned goal for a group to engage in some target behaviour
<i>Active-Individual</i>
6. Commitment from the individual to engage in some target behaviour
7. A personal goal selected by individual to engage in some target behaviour
8. Competition between groups regarding level of some target behaviour
<i>Active group</i>
9. Team goal established by group consensus
10. Competition between groups regarding level of some target behaviour
Consequences
<i>Individual</i>
11. Feedback signalling direct, explicit and reliable rewards or penalties
12. Feedback signalling only indirect, uncertain and distant rewards or penalties
13. Reward to the individual
14. Penalty to the individual
<i>Group</i>
15. Feedback signalling direct, explicit and reliable rewards or penalties
16. Feedback signalling only indirect, uncertain and distant rewards or penalties
17. Reward to the group
18. Penalty to the group

Source: Dwyer & all. 1999

The ABC model doesn't deny the concept of attitudes. Attitudes change is just considered as the necessary mediating variable. As the Attitude-Behaviour Model, it implies that people have access to proper information.

Geller (Geller, 1995) has also studied intervention programs based on the ABC typology. He makes the hypothesis that those uninfluenced by the initial exposure to such policies require a more intrusive and costly intervention program. His main proposal is that people influenced by an intervention program should not be targeted for further intervention but should be enrolled as "intervention agents" for the next intervention. Intervention agents are "people who care enough about a particular problem to implement an intervention strategy that could make a beneficial difference." He suggests that they correspond to what has been defined in psychology as "actively caring" people i.e. "people who intervene to reorganise or redistribute resources in an attempt to benefit others, they are actively caring from an environment focus." Then, Geller develops an "actively caring model" to predict the propensity of an individual to actively care for the environment and /or to increase this propensity (with the help of ABC tools). According to the model, a person's propensity to actively care is influenced by variable that can be described as in Table 3.7:

Table 3.7 Factors influencing the propensity to actively care.

Variable	ABC tool
Self – esteem "I am valuable"	Communication strategies/leadership styles/opportunity to learn/rewards and punishments.
Belongingness "I belong to a team/a group"	Team building discussions/group goal settings and feedback/group celebration for achievements/self-managed work team.
Personal Control "I am in control"	Breaking down overwhelming tasks into smaller ones/setting short-term goals/offering frequent rewarding feedback for sustainable behaviour/providing opportunities to set one's own goals/teach colleagues or group's members/providing opportunities and resources for applying a technology to environmental management.
"Self effectiveness" "I can do it"	
Optimism "I expect the best"	

Source: Geller 1995

These five factors define what Geller calls "Empowerment" i.e. the conviction that one can make a difference.

The Eco-teams fit within this analytical frame in a couple of aspects.

- ◆ They belong to both the active individual and the active group activators with both group and individual consequences. They also answer to the critics made to this taxonomy by other scientists among which we were aware of Dwyer (Dwyer 1993), Stern & Garner (1981), Skinner's ones. Dwyer and al found that:
 - Activators using commitment demonstration and goal setting strategies were generally most effective in encouraging responsible behaviour. This is the case in the Eco-teams where a goal is fixed for the next meeting.
 - Consequences conditions were effective in producing behaviour change during the experiment's duration. However, the few follow-up measures that have been held showed little maintenance of behaviour change. This contrasts with the Eco-teams results.
 - Stern & Gardner enhance the ineffectiveness of information strategies when they are not parts of a broader policy. This finding, which has been confirmed continuously, support Skinner's statement that human behaviour is selected by its consequences and that we should not expect people to change their behaviour as a result of activators alone, especially when the information is about a distant or intangible future. This could be one of the explanations of the weak echoes that information policies on household's sustainable behaviour held by the French Ministry of the Environment in the mid-nineties have received. It could be also the explanation of the Eco-team's success as the Dutch government did support the program a lot.
 - State that strategies to influence energy conservation should study the different psychological background linked to the various energy use situations (curtailment, one-shot actions etc).
 - Show the effectiveness of feedback strategies that both provide the motivational and informative components that are necessary for taking action.

Eco-teams are dealing with both of the last issues as they receive financial support to consolidate the team's results at a national level while dedicating each meeting to a specific issue and detail specific behaviour for each of them.
- ◆ They are fully applying Geller's model of "propensity to actively care": breaking down overwhelming tasks into smaller ones, setting short term goals, offering frequent rewarding feedback for sustainable behaviour, providing opportunities to set one's own goals, teach

colleagues or group's members, providing opportunities and resources for applying a technology to environmental management. However, the same kind of analysis could be made for the Cognitive Transfer Groups.

The big difference between the two layouts is that while the cognitive transfer doesn't provide tools for enhancing the "group consequences", the Eco-team provides numerous tools for this purpose (goal settings and feedback/group celebration for achievements/self-managed work team), which contributes to the people's perception of "belongingness". It is not the case in the CT group, which is made of passive "activator" with individual "consequences" emphasising the importance of feedback tools (the EEB). It is therefore difficult to refer to the "group" items from the ABC model for interpreting the CT's results linked to the group dynamic while the individual results are coherent with the analysis suggested by the Attitude- Behaviour model.

However, the critics of both the ABC taxonomy by Dwyer or Skinner and the assessment of Harland & Staats emphasise issues that are a guide for our analysis:

- The importance of checking the maintenance of behaviour changes over time.
- The importance of an insertion of individual information strategies within the broader policy. This is especially accurate when considering the French background of sustainable action taking that has been analysed in the first chapter all the more so as the people we could interview all insisted on the ambiguous relationships between the Institutions and the Eco-teams programs. In The Netherlands, the Eco-teams organisers see public intervention³⁸ as a fundamental factor of success: thanks to government policy, participants to the Eco-teams can find information and help when calling energy providers or local institutions. On the other hand, it is better to avoid advertising on the institutional support to the program because people seem to avoid any relationships with the institutional sphere.

We can add that the team spirit which explains the success of the Eco-teams reaches a limit. The Dutch target of 50 000 participants at the end of 2001 was not reached. The estimation is 23000. The explanation given in both Flanders³⁹ and The Netherlands is that Eco-teams are too demanding in terms of time or relationships: people are not always keen on interfering with their neighbours. Interviews made in both the Netherlands and Belgium Flanders suggest that this difficulty could be overcome thanks to the creation of a "lighter" group on a town scale basis: people will follow the

³⁸ Interview of Miranda Van Kuik in charge of household Ecoteams in The Netherlands. The Hague. April 25, 2000

³⁹ Interview of Yvo Aerts in charge of Ecoteams for Flanders. Leuven May, the 4th 2000.

program on an individual basis while knowing that that all the voluntary participants follow the same phase of the program at the same time. The local press will be the feedback vector and will keep people informed of the number of participants, the achievements. Such a program was tested in the town of Gouda (NL) with the local supplier giving the following incentive: a share of the local windmill will be won for each achievement of a 10% reduction of CO₂ emission. This is an individualistic interpretation of group's belongingness, which allows people to feel part of a group while not suffering from the pressure made by a proper team. Another interpretation of group dynamic was made in Belgium Wallonia with the Plans Communaux de Réduction des Déchets (PCRD)⁴⁰. Its aim is to convince people to reduce their consumption habits in order to produce less waste i.e. compost making, use of returnable packaging etc. For this purpose a partnership is made with local authorities and local associations around two themes that have appeared to be stimulating money and household's comfort. The association's members commit themselves to a behaviour change while local authorities use various incentives. The leader gives a feedback through a quarterly audit. In this example, the group belongingness is not created from zero but is based on pre-existing group links therefore it seems to be more efficient in overcoming people's individualism.

Nevertheless as there were no specific tools enhancing the team building in the CT, the question remains open as to what elements had an influence on the team building process.

The Eco-teams' experience and its foundation on non-official but strong institutional support together with the opportunities for green action given to their consumer by many Dutch companies, suggest that part of the explanation could lie within the institutional involvement in the promotion of the household sustainable behaviour.

Lots of criticism of the lack of institutional involvement for sustainability were made during both the cognitive transfer and the interviews with the consequences that one will limit his/her behaviour change for this reason. Numerous people were referring to the idea of a "social contract" for the environment that was not respected by the social actors and to the fact that individual action taking was not worthwhile in this background. Even though people took action, they resented the limits of their action very quickly (from the second meeting) To this extent; the third meeting was in both groups, the meeting of the awareness of the limits of one's action. *Chantal'' We are very aware of the importance of*

⁴⁰ Phone interview of Gilles Meeus and Jean-Marie Savino. InterEnvironnement Wallonnie. May 2000.

sustainability now but it's like having our wings cut, we are not sure of the results of our action, we are not sure that public money will go to the right place". In both groups, the conversation was going round in circles referring to the same theme as those of the previous meetings: importance of the media for the widespread of behaviour changes, importance of tax policy etc. In the control group, two participants confirmed that they were giving up most of what they have tried to do before because they thought that their action was not worthwhile. In the 3 Suisses group, the main improvement was the purchase by two participants, of fly-tox pads instead of aerosols and no new sustainable action was considered for the future.

This result

- confirms the importance of the insertion of individual information strategies within a broader policy, which has been mentioned already.
- underlines the importance of the dichotomy between institutional interventions and their publicity but in a way that is opposite to the Dutch one: people would rather be aware of increased institutional commitment.
- might explain why much action taking were first centred on issues that were providing immediate reward (savings) rather than other actions.

However, if we recognise the importance of this parameter in the analysis, the behaviourist model doesn't provide much more help in the understanding of what is at stake in the relationships between people and their institutions nor in the process of action taking itself.

Furthermore, other questions can't be explained by these theoretical references. For example when we observe that the two people (Roselyne and Anne) who were taking action with difficulty or not taking action at all were also the two people who belonged to the lowest SP Group; when we remember Anne's worries about being patronised, we can suggest that this observation might be the sign of a class differentiation in the way of reacting to the CT. However, the interviews made in Valence with women with comparable incomes suggest that the differentiating factor might be, in fact, the education level. This would be in line with the results of national surveys (see Ch1). If Social-psychology gives some guidelines to look for elements such as the importance of education, it doesn't explain why, with comparable education level, some women take action and why some others don't. Other questions remain unsolved: Why did two people from the 3 Suisses company not take any action while the others did? Why did some actions seem to be more difficult than other ones? Why is the metaphor of "the little drop in the sea" met so often? Is the success of energy and

water savings behaviour only linked to utilitarian reasons for taking action? Why did some people take action first and then give them up afterwards? Why do people never consider participating in local political life in order to solve environmental problems? Why does participating in an environmental association seem to be the ultimate action that one can take?

The Attitude Behaviour or behaviourist tools don't provide an analytical frame that could help to understand how things work, why are the limits to action drawn in such or such way and to identify the link between all those elements. At the best they figure in the endless list of elements that can be drawn to explain the "anticipated consequences of an action". But adding items to others or replacing them by another in this category- according to which situation you observe- is not a satisfactory way of analysing things and shows the limits of the models.

Another way of reading the results had to be found. A sociological reading was necessary.

Conclusion

The general hypothesis of this research according to which there is a field for an application of the theory of the modernisation of consumption in France and that it can be expanded to the way people use products or supplies was confirmed by the results of the Cognitive Transfer Groups. They have shown also that, according to our hypothesis, many people had no idea of the environmental impact of their daily actions.

When considering the way the EEB has worked as an information-leading-to-action tool we can observe that:

- a) Some specific and unknown information such as the hidden consumption of light bulbs and pilot lights has led to action. All the more so as the EEB was allowing one to measure his/her energy consumption and its environmental impact.
- b) Information hasn't led to action in all the fields that were considered. This finding should be read in connection with the notion of the "provinces of every day life" that was developed in chapter 2. The efficiency of information for inducing action might vary according to the province that is considered. However, the fact that the EEB was emphasising consumption linked with SMCs might have influence the results as well.
- c) Information carrying both environmental and utilitarian characteristics has turned out to be very efficient. It is the sign that the idea of playing on one's identity as a consumer can work at least for some of actions.
- d) Even if the precision of the measure was not a very important matter, as we suggested before building the EEB, it can't be too imprecise and must stay coherent. If not, EEB will not be taken into account
- e) The groups offered also an opportunity to criticise information conveyed by other artefacts such as food labels: in many cases, it has appeared unclear, embodying the producers' concerns but neither the consumers' nor their level of environmental awareness (life cycle analysis for example). However the labels' claim was also perceived as untrustworthy and there were doubts about the capacity of green products to achieve the same results as conventional ones. This result is coherent with the findings of the first chapter according to which people did not trust green labelling. This general distrust of quality claims could also appear if an artefact such as the EEB was marketed as well. It enhances the fact that the

provider of the artefact should be very cautious on what its distribution channel would be, marketing conditions, trust in the provider reliability etc.

The groups also confirm the importance of artefacts as embodying action. When observing what is said about the various bins that are provided for waste separation, the type of bins and the organisation of the sorting within buildings or households appear as having a major impact on the action taking itself and if taken, on the quality of the sorting. However, EEB are still in their emergence phase and the condition of their use can't be compared to the bins' very socialised ones.

Having observed the importance of an informative artefact, the fact that information given by people was as important as information given through the EEB was a sign of the importance of the social factor in the sustainable action taking process.

In this situation, the Theory of Reasoned Action couldn't explain many of the things that were observed. Considering action as the result of attitude towards action and subjective norms for action, it helped to describe anticipated consequences of action that were often very utilitarist but couldn't help to describe fully the social process at stake. Particularly, it emphasises the importance of subjective norms as a product of normative expectations for action and acceptance of those expectations in a field where normative expectations hardly exist even though people seem to expect an increase of environmental norms (on phosphates concentration for example) or seldom inherit their behaviour from their family. However, even though some academics think that there is no social factor in the action taking process which should be considered only as a relationship between one's personal norms and attitude towards action and action, we think that it just means that social factors can't be identified that way.

Another weakness of this theory is its postulate that actions are "reasoned". They are not always expressed as such and might be formalised only because the group or the interviews give to somebody the opportunity of doing so. Therefore there is much so-called "irrationality" in the action taking process that can be observed through the diversity of people's reaction to the same information or to the same situation and can't be reduced to a simple cause-to-effect description. Particularly, it appeared that much more than the strict producer-consumer relationships are involved, that people referring to notions such as fear and risk, that they were expecting a lot from the institutions and were referring to the break of a social contract. We saw a constant criticism of the institutions and unexplained variations in people's reaction to the cognitive transfer.

New elements such as pleasure, the reward given by lower energy bills, the power of the family pressure for implementing behaviour changes and the difficulty of changing habits appeared in these stories. They also confirm the importance of precise and empirical information for behaviour change.

Therefore we had to look for new interpretative tools that would allow understanding the field results: hence the idea of looking for what we could learn from a sociological approach. Hence also the idea that the previous observations could be considered as another sign showing that the eco-sphere was not following the same rules as the Techno-sphere (see chapter 1 and 2). Utilitarian and reasoned action to behave could be linked to the Techno-sphere while more “irrational” factors were designing the frontiers of the Eco-sphere.

Criticisms of the TRA have introduced the notion of social identity as a factor of action taking. It can be linked to one’s perception of being part of a group but also to the perception linked to the repetition of an action: we would consider ourselves as waste sorters, for example, once having performing it for some time. This idea together with the idea of de-routinisation introduced in the first chapter suggests that a sociological reading of the result should pay attention to one’s daily action as much as one’s specific involvement in a “declared” sustainable action.

Having those issues in mind, without being able to modify the field research because it was already done, we had to look for a way of reconsidering the field results that would allow a sociological reading.

We choose to refer to what J. C Kauffmann calls « the comprehensive interview » (Kauffman, 1996). According to this method, the objective of sociological research is to be able to understand « from the inside » people’s knowledge and to build a sociological study from grounded observations i.e. constructed day after day from what people say until the theoretical model that has emerged is saturated (i.e. the analysis of more interviews doesn’t bring anything new.)

Even though we couldn’t build a day-by-day theory, this method was inspiring as it shows that we should let the problematic rise from the conversations themselves rather than checking the presence of such or such pre-determined issue. Therefore we had to go through all our material again in order to allow new connections between ideas and to let new explanations come out.

The findings that were made thanks to the use of this new reading of both these field results and the interviews made in Valence are the subjects of the next part of this work. It introduces the idea that

sustainable action taking must be reconsidered within the wider construction of the environmental issue and should particularly take into account people's perception of a lack of hold on their environment.

2. To adopt sustainable behaviour, the household must conquer a hold over the environment

Why do people resent so quickly the limits of their action? The central idea of this work is that people don't perceive that they can have a hold over the environment because of the powerless perception that results from the scale gap between their action range and the dimension of the environmental issues (Ch 4). To regain this hold, a link must be created between one's action and the resolution of the environmental risk issues. The conditions to create such a link can be observed in the cognitive transfer experience (Ch 5). Therefore implementing sustainable behaviour in the French household needs not only the appropriation of proper artefacts but also the socialisation of the environmental issues and of their related sustainable behaviour in order to give back a meaning to action.

To have a hold (avoir prise sur) on the environment is different from the idea of control that suggests one's ability of mastering it. To have a hold just means that you can have an influence (a power) on something and that you are able to assess it in some way. This notion is also different from the notion of "affordance" defined by Chateauraynaud (Bessy & Chateauraynaud, 1995 p 239) which means "to provide" and "to be able to" altogether. "*Affordance is a way of describing the relationships between men and things in two ways: one is to have a hold on (avoir prise sur) which often translates the power of human beings on things and on his/her environment; the other one is "to lay oneself open to" (donner prise à) which gives a kind of indomitability to the bodies*". In our case, this notion doesn't help to understand the field research results because people are too fragile to "lay themselves open". Therefore I have chosen to refer to a "hold" on the environment.

Before exploring people's perception of environmental issues, we have to underline a methodological aspect: the use of the comprehensive interview method for a new reading of people's verbatim doesn't take away the fact that the Cognitive Transfer groups were not designed for sociological study. Therefore, our new reading is made of connections between what somebody says in the CT group and what is answered by another group member, of paying new attention to the noddings or gigglings recorded on video. It refers, also, to the observation that, on a couple of important issues such as their perception of the environmental issue, many people had the same vision, were saying the same thing but in a different way. Consequently, we choose to quote the most significant or detailed sentences. Sometimes, this might give the impression that the sentence

is specifically chosen to illustrate my interpretation rather than representing the group member's representations. The only solution for getting rid of this ambiguity would have been to quote in a row all people's sentences on the same issue. It would have been quite boring, at least very repetitive. This why I have chosen to keep quoting the most representative sentences and to assume this imperfection.

4. *The individual is overcome by the scale gap between his action range and the dimension of the environmental issues.*

During the first meeting of the cognitive transfer it is striking to observe the immediate interest in the environmental issue. The conversation between people was intense and lively but, as mentioned in the previous chapter, most people ended with the idea that the impact of their personal behaviour- even if improved- was limited anyway. To understand why, let's listen to the end of the conversation:

Christine: We've got the impression of being a little drop in the ocean which has its importance but monstrous things happen meanwhile.

Interviewer: Why don't you consider writing about them to your local MP, to the mayor?

Christine: The town hall keeps its lights on all night long. I would prefer asking them whether I am paying for that.

Chantal: If you do something you are considered as a pain

Anne: They are not aware of those things

Chantal: They don't pay therefore they are not concerned, they never pay attention to the environment anyway.

Four themes arise from this conversation:

- there is an environmental threat (monstrous things) that can't be solved on the individual scale.
- there is no involvement of the public institutions in those issues and, to the contrary, the idea that they transfer their responsibilities on to the other social actors.
- it is not socially rewarding to raise environmental issues
- the importance of down-to-earth behaviour and actions as a proof of involvement (with the relationships with money in the background). People judge their institutions on what they do, not on what they say. It is as if people would not acknowledge the institutions as a recognised spokesperson as long as they did not behave in an exemplary way.

All of these themes were constantly present in a very interlocked way during all the group meetings. They need to be defined more specifically and, first of all, the nature of the environmental threat and of its relationships with individual action. All the more so as the existence of the environmental risk was an ongoing theme of the interviews that were held in the Valence area a couple of months before. In both field studies, we could find a similar range of perceptions. Then, referring to both field studies, it was possible to try to find the similarities and the common themes that were prevailing in people's declarations.

1) The first common theme is the existence of an environmental risk that is threatening human health to the extent that the survival of the human species is at stake.

In the ground research, the idea of environment is often associated with the idea of risk and more specifically, to the impact of pollution on human health. There was almost no reference to the idea of Environment as wild nature apart from two people who mentioned the forests.

➤ This finding is coherent with the INED analysis quoted in chapter 1 and according to which, the environment is a self-centred notion i.e. « what is around us » by opposition to Nature conceived with no connection to human beings. At best, following such a definition, the Environment could be perceived as “Nature around us”. This was rarely the case in both field researches. On the contrary, most people made immediate references to the environmental risks and especially to those that have direct consequences on their living conditions. However, we have to keep in mind that concerns about the environmental risks could also be explained, partly, by the fact that the areas of the field research were, like most French residential areas, close to industrialised zones where many environmental risks are present (nuclear, industrial, etc. . Anyway, France has turned into a country of big cities and suburbs interlinked with the industrial network, and most of the population lives in them (farmers are less than 3% of the active population). Therefore, we can consider that those results could have a wider scope.

Anyway, people refer to environmental risk as a cause of diseases: lung diseases and allergies as well as cancers were the diseases most frequently quoted as being linked to environmental issues. While lung diseases are clearly linked to air pollution, cancers are linked to the nuclear threat, GMOs and, generally speaking, to all the pollution that goes into a human body. *Sandrine: «We have cancers because we drink, we eat and we breathe polluted things»*. If we consider that air pollution is, as well, something that goes in the body, and if we remember the latest food chain scandals (hormones, BSE etc)⁴¹, such a conception might also explain the specific importance that

⁴¹ but the interviews were made before the dioxin scandal

is given to the lack of good agricultural practices. As Samuel said in the first Cognitive Transfer Group: « *If I've got a cancer, I know it will be because of food (quality)* ». Another expression of this risk perception for the human being is that people feel that they are not respected anymore. There are numerous verbatim that associated the environmental issues and the idea of respect. For example: Sandrine: « *People don't respect each other anymore, ... I respect Nature* ». Mme A: « *The end of the century is characterised by a lack of respect for life at every level* ».

Such a conception of environmental risk as a threat for health dominates an older one, which is still lying underneath, where environmental health risk is linked to the diffusion of bacterial diseases in the local environment. People aged 50 and plus remember the poor hygienic conditions that used to be commonly found – and that had sometimes remained well after the sixties- and talk about rats, open-air sewage, etc. If one remembers that the first reason to asphalt the roads was to fight the Koch bacillus that were inhaled when walking in dust, the association of the environment and health risk is not surprising. What is left of it is the idea that a healthy environment is a clean one. MS: « *There are some regions in France where everything looks cleaner, neat* ».

Referring to the origin of pollution: atmosphere, food etc it can be stated that what affects the environment, affects the human being who, therefore, can't escape from his environment and shares its destiny. This is even more so when the environmental risk can be defined as what Luhmanns calls a « threat » (Luhmann, 1993) i.e. a risk with a low probability but the occurrence of which could destroy the planet: the nuclear threat is one of those. As a matter of fact, Chernobyl is still in the participants' mind.

- It is interesting that people always refer to issues that can be handled or assessed by their senses and don't talk about the other ones. For example, Chernobyl has turned the nuclear threat into something tangible even though nuclear contamination escapes all perception (Beck 1987, 1993). On the contrary, global warming has been heard of but many people still mix it up with the ozone layer problem. It represents a diffuse risk that is less taken into account. This result confirms what has been documented in previous studies (Dobré, 2000). An explanation of such a situation can be given referring to U. Beck's (Beck, 1987, 1992 a and b) work when he states that the invisibility of modern risks makes it hard to be taken into account at the layman's level. The previous results could be different in 2002 after great floods in western France were attributed to the green house effect.
- Environmental threats are a source of deep anxiety. Very pessimistic views were often associated with the discussion on the environmental risk. For example, a woman gives a good demonstration of the anxiety linked to the difficulty of assessing the environmental risk when

talking about the local impacts of the Chernobyl cloud (a difficulty enhanced by the official denial of its presence), *Christine S*: « *We were told that there was no risk from the Chernobyl cloud, but in fact, those who live in the valley become ill, doctors in Valence are overbooked.* »

This anxiety seems to be quite common: just after talking about the environmental risk, a doctor immediately stated that generally speaking, people were not feeling well, not because of bacterial diseases but because they were in a very bad psychological state. As a result, he had to prescribe anti-depressors. Another woman was associating environmental risk with the idea of collective suicide. It was also a way of acknowledging the human origin of this risk and of criticising it. Such criticism, together with the idea of a common destiny of man and its environment, is also formalised by those who express concerns not only for themselves but for the human mankind in general with frequent references to children or « future generations »: *François (cognitive transfer group)*: « *For years, we've been having a « laissez- faire » behaviour and now we are all aware of that (the environment issue).... for our kids, future generations* ». *Huguette (Valence interview)*: « *It's the life of our children and grandchildren, of those who are coming after, which is at stake because, if we keep on like this, it's going to be very bad* ». Those verbatim show the existence of an explanation of the origin of the environmental threat: the way in which the development has been handled. It is considered as the main factor of the threat that hangs over the human beings and their environment.

2) The second common theme is the analysis of our Western societies as responsible for environmental risk.

It was a surprise from both field researches to observe that the criticism of the environmental situation was linked to a very strong political criticism of the development scheme whatever type of person we were talking to. Before anything, ultra-liberalism was held responsible for environmental degradation and threat. For example, *Annie*: « *The root of the problem is money, the love of money, productivity and efficiency at any price ; the mad cow disease, it's a matter of productivity* ».

Productivity, efficiency which all are values from the Techno-sphere and the basis of the western societies' development are considered to be opposite to the respect of the environment. If we make a connection with the very self-centred understanding of the word “environment” and the perception of risk which is linked to it that we saw in the previous paragraph, the western development path is therefore opposite to people's health and to the survival of the specie. This kind of thought concerned with the issue of existence can be referred to as “ontological”. Therefore, we can describe a situation where the development path that has been chosen is perceived as incompatible

with people's ontological concerns, with their perception of ontological safety. To this extent these results are coherent with the quantitative data according to which there is a growing importance of the idea that protecting the environment appears more important than economic development (see chapter1). Even though people can place themselves within an economical frame and take rational actions according to their own interest, it doesn't mean that they carry this type of perception all the time. They can identify themselves to other things too. We observe that they adjust to the Techno-sphere while being conscious of its limits.

Science doesn't help to reconcile growth and the environment : it is often perceived as not able to resist the pressure of the economy. Actually, some people question the integrity of science when facing productivist criteria. They mention that some scientists are depending too much on who funds their research. It is not the majority yet, as scientists are still considered by most people as working for the general good, but it is a sign that the unchallenged status of Science as working for the improvement of the human being condition is changing. It could also be the sign of a discrepancy between people's perception of Science which, at a global level is considered positively while its practical applications generate defiance because people are aware of their instrumentalisation. This result reflects what can be found at the quantitative level: the trend is on an increase in the thinking that science and technology create an amount of risk bigger than the one they help to suppress (Dobré, 2000) and scientific assertions on labels aren't considered as reliable (ch 1). A few people go further and explain that environmental risk is the direct consequence of an uncontrolled technological development. This idea is expressed by establishing a link between the climate change at the local level and the presence of the Chernobyl cloud or by the idea that the satellites represent a threat: *Christine(Valence) « they are all going to fall down on us »*. It reveals an attitude that is far from common scientific knowledge and more in line with some ontological fear or fate. The perception of the environmental risk is far from the techno-sphere. This attitude is also supported by the fact that, as we've seen before, nuclear clouds and satellites-like many environmental risks- are out of control and can't be spotted with common tools and senses. However, criticisms of the technological development are minor compared to those of the majority of the people who hold liberalism responsible for the environmental threat. What is still common to most people is the anxiety -that sometimes turns into fear-, which is linked, to their powerless perception.

4.1 The conjunction of an environmental risk that threatens the human being and of an analysis that makes the economic system the cause of this risk generates a powerless perception that generates fear, anxiety and withdrawal.

The domination of both liberalism and the consuming society is resented so heavily in people's life that it generates a deep impression of powerless. It is expressed with words referring to the idea of an unbalanced fight, of a fate. For example, *Franck*: «*Money is stronger than anything, you really have to be super strong to be able to resist it* » ; *Huguette* «*We are caught in a spiral of consumption* »; *Bernadette* «*We are told that cars are heavy polluters but who can live without a car around here?*» Other people will have a more detailed analysis by saying, for example, that action for a sustainable environment is considered only if it can be translated into marketing opportunities therefore curative actions are more likely to be taken than preventive ones. People spot this domination and its environmental consequences in every aspect of life. Their perception of powerless is all the more important as they perceive that State institutions are not playing their protective role anymore.

1)The environmental risk is all the more threatening since the actors that are usually in charge of public interests are not answering people's environmental concern.

In France, the government is traditionally in charge of the « public interest » i.e. everything that might be decided for « the good » of the majority of French people. As it is often said the French political consciousness emphasises equality. Almost everything is of public interest's concern and it only stops at the people's doorstep. A common statement reflecting such a position is the following: «*We are electing people to take care about those things (environmental issues) it's part of politics* » To this extent, the idea that one should be in charge of his environment that was described in chapter 1 seems to be more the sign of a will to control one's life at the local level than the sign of a will to deal with pollution and the big environmental issues. Anyway, such a political culture is very specific and opposite to views that consider the State's function as being only a regulatory one. Rudolf has shown (Rudolf, 1998) that the French basic assumption is that “daily life is not the place where reality is built. It is built within the sphere of high institutional decision levels that control society”. In contrast, in Germany, the assumption is that “if the individual changes, the whole society will be changed too.” Hence, for example, the difference, of the Eco-counsellor function which is defined as tool for targeting the institutions (in order to influence their decision)

in France and as a tool for helping people and companies in Germany. In such a background, the environmental risk is all the more threatening that the State and the institutions that represent State legitimacy are not perceived as being concerned by environmental issues. Worse, they are perceived as having given up their task of defending the public interest in favour of the defence of some specific categories' interests such as those of private or public companies hence playing the game of the liberalism. Such a situation is perceived through three aspects.

- First, the State has given up both its normative and control functions. As one of the participants said talking about phosphates in water, « *If it is dangerous why isn't it forbidden? Although paid to do it, the government doesn't do anything for the environment* ». During the cognitive transfer groups many references to the normative responsibilities of the government could be heard and many references to its lack of control.
- Second, as quoted at the beginning of the chapter, the institutions are transferring their responsibilities to other social actors, mainly to the consumers-citizens who have to bear the costs of the government's lack of normative courage in front of the industrial lobbies. It is the first thing that is said (by Daniel) on the first meeting of the 3 Suisses group. In the other group, Samuel gives the example of the focus that is made on the pollution generated by private cars and diesel engines while such engines have been promoted for years thanks to tax incentives. The underlying idea is that the system of responsibilities has been broken down.
- Third, the government manipulates the information that can be found in the media: people remember the numerous scandals that France has discovered in the last 15 years.

Once again Chernobyl is an ideal-type example. After the Chernobyl accident, the French government has maintained that the nuclear cloud didn't go over the French frontiers and that therefore it was possible to keep on commercialising and eating milk, vegetables and fruits. This assertion was contradicted by the German government ban on some vegetables and by some NGO's assertions that the cloud had indeed crossed the frontier. But the government refused letting its nuclear office make radioactivity measures. What wasn't assessed didn't exist. Satellite monitoring later showed that the cloud has indeed passed across France (Dessus, 1991b). For most people, such an attitude is a clear demonstration that the State is now trapped into laissez-faire options and is more sensitive to the interests of some specific lobbies than to what should be its major concern: public health.

Such a perception results in a huge trust crisis. The State is not trustworthy anymore. This perception affects all kind of information received from the institutional world whatever the form taken. Huguette : « *After Chernobyl, nobody knew anything. We ate lettuce and everything and knew*

only later that it was dangerous, we can't trust them (people from the government) anymore». The contaminated blood crisis, the scandal of animal's food has reinforced such an analysis. At a lower level, situations that used to be widely accepted are questioned. It is the case for tobacco sales, which are controlled and taxed by the government although tobacco smoking induces cancer. It is also the case for truck air pollution that the government appears to control less than the private car's. The suspicion reaches :

- local institutions. Pierre « *My parents use the same ground water as the town. My parents are not allowed to drink it but you can do it in public building. It's odd.* » and materialises itself into general mistrust of politicians. Bernadette « *We have had so many political promises that are not fulfilled that nobody trusts anybody for anything anymore....everybody lives the way he/she wants within a day- to-day perspective* ». (a)
- local MPs who are accused of being interested in their own image only and not in answering to public expectations.
- and even associations who are suspected to favour the local institutions that often finance them.

to the extent that it seems that we are in a situation where the lack of trust in the institutions becomes generalised. Isabelle : « *There was a problem in my kid's school : most parents thought that the tap water was not drinkable and had forbidden their children to drink it. Analyses were made that later showed that the water was good. We (as a parent's association) have organised a meeting on this subject with all the actors involved. No parents came*». To understand why nobody came to this meeting we can consider that it was because the parent's association was not popular. But it was not a meeting for the association, it was a meeting with all the local health and sanitary authorities and the school administration; people could have been interested in listening to what they had to say on the water quality issue. It was not the case. Isabelle analyses this reaction as a proof of people's lack of rationality. They prefer staying home forbidding their kids to drink water instead of going to a meeting where they can get some information. We can wonder whether it is not also the sign of mistrust : people hold on to their fear, as they don't trust anything that could reassure them on the grounds that the institutions lie and protect themselves. These kinds of reactions could be found during the cognitive transfer groups with people referring to all institutions as being untrustworthy with the consequence that most of them challenged the information received from the institutions. They are in line with the analysis made in chapter 1 according to which a growing mistrust in information could be observed in the data's evolution.

People's reaction is also a sign of withdrawal. We saw (a) that Bernadette talks about a day- to- day perspective.

2) The anxiety linked to the absence of the State as a mediator and a regulator between the layman and the environment generates a withdrawal.

When people trust the State's action in the environmental field, they have no fear. Gaël gives a good example. He thinks that the nuclear wastes are controlled, that companies and institutions are « environmentally aware » and expresses no specific concerns about both the future and the environment. At the opposite, all the others perceive a gap between the environmental risk and the scale of their range of action in a society where the individual can't rely on the State anymore. A consequence of such a situation is that they feel powerless: if the State is not doing anything, individual action is meaningless. Verbatim such as Frédérique's « *The layman can't do anything* » are very common. They reflect the reaction of many people who:

- avoid thinking about those issues- as Anne who expressly states that she doesn't want to know about them while recognising that she is anxious.
- will therefore convince themselves that individual action is not possible. Hence the use of many words referring to the idea of fate such as « *French people are like that* », « *Nothing can be done about it* » etc.

Other will have to build specific psychological strategies to be able to stand the psychological strain through which they are going. For example, they will have a dual way of thinking and behaving. Eric : « *My father in law is a great chicken producer, he has thousands of them. He always says that they are for sale and not for food and he has his own little poultry yard.* »

Others are resisting by questioning everything they can hear in the media about any actor's involvement in sustainable action. It is the case for Suzanne. While taking as much sustainable action as she can, she questions everything from the reassuring ads she watches on TV about the quality of nuclear waste handling by the Cogema, to the information given by the town authorities about their will to compost green waste.

These reactions in facing environmental risk are closed to those described by Giddens (Giddens, 1994). He emphasises that the consequence of the anxiety linked to the presence of the environmental risk, is a psychological reaction :

- aimed at protecting the individual's psychological balance, as it is impossible to live in constant fear.
- built on the idea that it is impossible to do anything at the individual level and that the probability of an occurrence of a severe environmental risk is very low.
- leading people to maximise their short term benefits, as they can't think about the future.

Giddens calls this reaction « pragmatic acceptance ». Anne is the best example of such a reaction in the cognitive transfer group but there were many others such as Roselyne, Franco and some of the people interviewed in Valence.

Giddens also describes:

- Stubborn optimism that is a constant faith in a providential Reason. It could be a description of Gaël's position. In his case, faith into the ability of the social actors to deal with the environmental risks would be the translation of faith in "Reason".
- Radical commitment a practical challenging of what is considered as a source of danger. People with radical commitment claim that one can and must take action. It is an optimistic point of view that often goes together with a protest attitude more than with faith in rationality. Suzanne corresponds well to this description. She had a practical opposition to everything perceived as a source of danger as she kept on looking for information about various risks and their related counter behaviour (GMO's identification, water quality tests etc) she was deeply convinced that people must get involved themselves in order to make a difference.

However, it doesn't seem possible to demonstrate the truth of such profile descriptions from only one observed case.

Last, Giddens's description of Cynical pessimism where cynicism is a way to smooth the emotional impact of anxiety is not very detailed in his book and it is difficult to refer to it when studying people's reactions.

All these descriptions can be related to psychological adaptation strategies referring to what the psycho-sociologists call a "cognitive dissonance". This theory (Beauvois & Joule, 1981) focuses on the relationships that exist between action and cognition, this last word being a cover-all one referring to our opinions, values, knowledge, beliefs etc. According to the theory, each of us behave in a way that avoids contradicting oneself i.e. we are careful to keep a minimum of coherence between our actions and our ideas. Such a need for coherence can be considered from two points of view:

- according to the "rational model" our preferences determine our choices. This is what many economists assume as a pre-condition for their analysis. Such understanding is part of the Techno-sphere. Coherent with this model is our first assumption that proper information will participate in behaviour change therefore in the ecologisation of economy.
- according to the "cognitive dissonance" model, people rationalise their behaviour ex-post in order to make it coherent with the risk they have taken. People are not rational, they are rationalising. They behave according to circumstances and try to make their action fit with their

cognition afterwards. They do so because being in a state of cognitive dissonance i.e. knowing that their behaviour is not coherent with their ideology is something very uncomfortable that most people can't take for a long time. In other words the dissonance is a motivation to behave.

If we apply this perspective to the risk issue, we may wonder about the circumstances that lead someone to accept a risk that he will rationalise afterwards either by denying it, or by putting it in perspective, or by valorising it. A good example is given by the violent denial reactions of La Hague⁴² workers against the scientific research done by professor Viel that established an overrepresentation of child cancer in the plant's area (Grandazzi, 1998). These people depend on the factory for living and can't accept the idea that it could be a threat for their children.

For our part also, we could observe different strategies implemented for dealing with the cognitive dissonance linked to the perception of the environmental risk(s). As the burden of the hidden risk is too heavy to live with, some people keep the risk at a distance

a) by using psychological strategies that put the risk in perspective and often enclose elements of withdrawal

- they claim that they belong to a « safe » group by opposition to a more exposed one. We can define this as a « collective risk denial »(Peretti-Watel, 2000).
- they draw a frontier between them and « the others » (individual risk denial).

This social representation resorts to a scapegoat process where « the other » a different group, a different person, is considered responsible for the harm that affects society. In the case of environmental risks, people are going to refer, once again, to what their senses can perceive.

→The collective denial will focus on developing countries. After travelling in those countries, people assess that they are more polluted, dirtier, with no environmental protection hence responsible for Trans-frontier pollution. By comparison, this suggests that the French situation is not as bad as it is commonly described. People don't imagine that developed countries are more polluted than the developing world.

→ The individual denial takes immigrants, especially Arab ones, as responsible for the pollution and is another expression of the individual's racism.

b) by denying the value of information.

- they refer to the fact that the chances of seeing the occurrence of a risk are low even if the impact of the risk are threatening (example: the explosion of a nuclear power plant in France).

⁴² the French nuclear waste treatment plant

- they play on the contradictory character of some information. For example, going to the local waste collection park is a source of pollution because one has to take his/her car. Therefore one action compensates the other and it's not worthwhile doing anything.
- they can consider that the information is not serious. *Samuel: "They say that cows are a source of the green house effect. We are not going to prevent them from farting"*

Whatever their psychological reaction (with the exception of the radical commitment type), people are also behaving within a withdrawal frame. This withdrawal materialises itself in many ways.

People :

- restrict their perspective on their day to day life as was mentioned in the previous quotation of Bernadette (a)
- isolate themselves from their neighbours with whom they have limited or conflictual relationships. Many people were saying that they have never talked to their neighbours. Simone gives another example. She is cross with her neighbour who doesn't pay attention to the plastics he uses for his work. As a result, they fly over the hedge and bother her all the more so as she's got horses that get sick by swallowing them. Instead of meeting or calling the neighbour to complain and explain the situation, she throws the plastics back on his lawn without a word. Such a situation has been going on for years. By doing so, Simone puts herself in a conflictual relationship where she feels besieged instead of opening herself to neighbourhood relationships.
- don't want to interfere in public life anymore and even don't dare saying anything when confronted to pollution. This is also the sign of a lack of socialisation of both the environmental issue and sustainable action taking.

Against such a background, Spaargaren's proposal (see chapter 1) to play on people's wishes to maintain a certain degree of coherence between one's identity and one's lifestyle-by connecting the ecologisation of practices to the narrative of the self agents attach to these practices- can be understood as a way of counter-balancing the negative side of the cognitive dissonance process in the field of environmental risk. However, the conditions to implement such a process are all the more difficult that these practices and their links with the environmental risk are not socialised.

4.2 The powerless feeling is all the more important since the environmental risk and the sustainable actions that might be an answer to it are not socialised

« It is difficult to talk about the environment because the only thing you can do is an admission of failure and it's just so happen that, when you meet friends you'd rather talk about something positive for which you can do something.... What is terrible is being powerless » Serge.

Together with the conversation that was quoted at the beginning of the chapter, this sentence shows that one of the main constituents of both people's anxiety and withdrawal is the lack of socialisation of those issues at every level of the French society.

Our understanding of the word “socialisation” refers to the « classical » process of socialisation described by F. Dubet (Dubet, 1994) as an integration process which allows people to identify themselves, partially at least, to the models, norms and codes of a given society. As we saw in the previous paragraphs, people do have environmental problems and they are concerned by the environmental risks to the extent that their concerns often turn into fear. But it is not possible for them to get into a socialisation process. They can't share their concern and create a common claim about the environmental risk. It is not possible, for most of them at least, to go into an identification process that will allow them to feel that they belong to a community. Consequently, as seen on chapter 3, there are no widespread norms or models centred on the environmental risk to which people could refer. The main explanation for this situation is that, with the exception of environmental groups that have little audience (3), there is no social recognition of the environmental risk and of the value of the fear that is linked to it to the extent that there is no public power of speech(2) and that people don't dare talking about it even at a personal level (1).

- 1) At a personal level, the lack of socialisation is found not only with one's friends but also with one's neighbours and families.

Many people just say that they never speak about the environmental risk with their children or partners. Such a subject is banned because, as quoted in the introductive verbatim, the powerless perception is too big.

However, people start talking- but always in a restricted circle- when meeting an «expert», someone who knows. It is the case, for example, of people with adult children who are studying environmental issues (waste water management, food biology, etc). This assessment gives us another indication about the importance of information in the risk perception, of information needs and, again, underlines the importance of trust in the information process scheme. Right now, when talking about environmental risks, the only trustworthy persons seem to be found within the family.

But, apart from those specific cases, silence is the usual rule. However, some people still have the secret hope that something is going to change, that they will at least regain the power of speech. *Frederic: « It is the willpower of some that will lead the others to do something but it doesn't exist. »* This sentence could be interpreted as a search for a leader. Unfortunately, no leader appears as trustworthy for environmental issues. The previous generation of famous explorers and scientists as Cousteau or Tazieff that used to have a leadership and a reputation of integrity is disappearing and no one is valued as having the required calibre in the present generation. In a way, we could say that it is another sign of the decline of the scientist's leadership that is not replaced by a political one. People sometimes refer to famous TV show presenters but with no conviction. This situation might also explain why the way seems to be cleared for newcomers such as the commercial brands that we will evoke in the next paragraph.

2) At the more general level, neither the environmental risk nor adequate sustainable behaviour is socialised.

Although there are many talks about the environmental risk, they don't bring a power of speech about it. People hear about the Kyoto agreement, they can watch TV shows describing the green house effect, the loss of bio-diversity and they can listen to reports on the latest environmental catastrophe but high media coverage doesn't mean that these issues are part of a socialisation process. The main reasons for that being that the institutions /organisations/groups which would be considered as able to deal with issues such as risks and threats don't participate in socialising the risk.

First of all, there is little reaction to this information from the institutions -not only because they deny the existence of an environmental threat such as in the case of Chernobyl or focus on short term economic issues- but also because they give no reliable sign of interest in environmental issues. So called interest is the fact that people feel that dealing with environmental risk is never at the core of the political agenda. People don't say that the institutions aren't doing anything they just state that the issue is not considered seriously.

As a result of people's perception of the institutions' lack of involvement, institutions are not the focus of the hopes of the people, they don't provide any models or social norms and people - who would expect them to behave for the public good- keep quiet and keep their anxiety for themselves. One could consider that such a lack of action justified by the inaction of the institutions, is another form a cognitive dissonance: people would refer to it as a way of rationalising ex-post their own lack of interest. Of course, such a situation can occur. However, in what we could observe, the main

problem was the gap between the depth of the anxiety linked to the environmental risk perception and the type of action taken by the institutions: sectorial measures on very specific issues can't give an appropriate answer to a global ontological fear. Worse, people often have the feeling, which is sometimes confirmed by facts, that the institutions will not even listen to them if they talk about their environmental concerns. Many people mentioned that writing to the government or general institutions was hopeless. Two participants in the cognitive transfer groups have testified of their failure after having taken steps to obtain an improvement of the environmental or social situation. When a formal demand is expressed by concerned people it is not even considered.

When considering behaviour that can be taken at the household's level, we saw that there is a huge scale gap between one's action range and the size of the environmental risk. Therefore individual action is meaningful only if taken by numerous households. Unless the scale of the socialisation of these actions as an efficient answer to environmental risks bridges this gap, they will be perceived as meaningless.

This is the reason why people's perception might be reinforced by the fact that the institutions never suggest any solution at the household level. This can be seen when looking at the institution's own behaviour. The institutions themselves are not models indeed. One quotes the town hall's light that is kept on all night long, the other refers to the tolerance towards trucks that keep their engine on while delivering goods to retailers, another mentions that, in the army, vehicle's engines are kept on to use the fuel allocation so the budget can be renewed at the same level, etc.

If we look at which type of information is available, the contrast is enormous between the abundance of general information about environmental risks and the lack of precise information on the tools that a household could use as an answer to these risks. We saw that most people are unaware of both the sustainable character of some actions and their relationship with the wider environmental risk issue. Furthermore, when aware of the fact that sustainable behaviour can give an answer to environmental risk, action is difficult. For example, when considering purchasing options, people don't know what information they should look for (for example phosphate in washing powders). *Chantal* :« *It would be good to know what is important for each kind of product*». This is particularly the case for the many food quality labels- to the extent that one participant was claiming that there should be only one state guaranteed Eco-label and that's all. It is also the case for the people who are more aware of the production chain and wonder which product is the most environmental friendly.

The only global exposure to practical behavioural information as an answer to the environmental risk or threat (green house effect, bio-diversity, air pollution) was done in the autumn 2001, through a TV advertising campaign; but an advertising campaign is significant of the involvement of the ADEME - the agency in charge of sustainable behaviour- not of the whole government and can't compensate years of absence of involvement on that subject. This campaign was held after the field research and after its first results emphasising the utilitarian reasons to behave were given to the ADEME⁴³. It would have been interesting to know whether it has had an influence on the awareness of what actions can be considered as sustainable and why. We only know that the campaign had good scores from an advertising point of view⁴⁴.

We can observe anyway that, when there is no socialisation of the environmental risk, there is, sometimes, a link between some people's sensitivity to a certain type of environmental risk and the action they take at a personal level. As a matter of fact, during the first group meeting, before any cognitive transfer, it is possible to observe that Samuel is concerned by water scarcity and plans to buy a new dishwasher knowing that they consume less water than hand washing. Christiane is concerned by air pollution and takes public transports as much as she can. Suzanne and Chantal talk about future generation and try to improve the environmental awareness of their children. However, this last action might be characteristic for women: François talks about future generations as well but he is not taking any specific action. Although the range of actions that were taken is limited, the existence of such a type of sensitivity pleads for the dissemination of precise information on sustainable behaviour and the way in which they participate in solving the environmental risks even in the absence of further institutional involvement.

The lack of socialisation of the environmental risk has several consequences:

- First of all, people build their own indicators of pollution and environmental risk. For example, those who live in the countryside, observe, on the long run, the evolution of the animals that are given the statute of a physical object that mediates their fear. *Pierre L: «In summer, it was covered with cicadas, ten years after, there are none left, it's because of pesticides».* *Sandrine:*

⁴³ The first results were emphasising the importance of utilitarianism in action taking.

⁴⁴ "Alice" the advertising agency in charge of this account, gave the following figures:

Recognition: 65%- Agreement 85%- Credibility 76%- Understandable: 74%- Originality 73%- Importance of the message conveyed by the advertising 84%. Conversation with the ADEME account manager December 2001.

«We used to raise silkworms and to feed them with leaves, now we can't do it anymore, it (pollution deposit on leaves) makes them die, they don't have the strength to make their cocoon». Risk for animals is symbolic of the existence of environmental risk: those who deny the impact of pollution deny the veracity of a change in the animal lifestyle. Jean (farmer/intensive production) *« They say that there are no animals anymore, it's not true I can see them ».* Here again we find the interrelated fate between mankind and its environment. In cities, some people say that bugs look bigger but the ongoing personal mediator is the physical sensation of air pollution: the eyes itches, lungs are oppressed, etc. Such a phenomenon can be interpreted as a way of making real the unreality of the environmental risk. It emphasises again, the importance of physical objects. At the opposite, "Official" environmental risk indexes do exist but they are not used by people. Even though their existence is not well known especially in the case of water indexes (index available on a poster at the town hall), it seems that their lack of success is linked to the quality of the information source: the institution. For example, if we look at Pierre's and Isabelle's example in 4.1. 1) the institution is mistrusted hence every analysis made by it is mistrusted as well. We can argue also that, first of all, they are not of easy access, manipulation and understanding. Secondly, they don't embody people's quality concerns that are linked to physical sensations (taste of water, odour of the air) and that this lack of attention to physical sensations might, as well, be an explanation of people's lack of interest and search for something that they can handle. In other words, as long as those indexes would be built as environmental and not quality ones they will not be very successful.

- Some brands are now perceived to be more able to defend the general public interest than the State itself. The general opinion is still that industries defend their own interest first without concern for the consequences of their behaviour on pollution. This position can turn out to be in favour of the environment when profits can be made and the liberal rules respected. It is the reason given by some people to explain the success of some specific environmental policies. Isabelle: *«There are big interests at stake. This explains why the situation improves in some fields and not in others. When environmental problems can be solved thanks to specific investments, everything goes well because there is a market. When the industry has to think in terms of prevention, nothing moves. It's linked to the economic system».* Logically, industry is perceived as more likely to take some sustainable actions if they represent a competitive asset. But most impressive was the statement by some participants to the cognitive transfer groups that some famous brands could speak on behalf of public interest in environmental matters. These

brands are those (Danone, Nestlé) who have already built a "communication territory" centred on health and human well being. They are therefore considered as having a legitimacy to act for people's and the environment's sake. This trend was so obvious that it was one of the first elements that the person in charge of the group's animation noticed. Here again we find the close connection that exists between environmental and human well being. Brands appear as the ones who solve problems. Several interpretations can explain this situation. Brands,

- make people dream about happiness and health (a kind of modern fairy tale) therefore diverting the environmental issue to a reassuring perspective.
- might be the only ones to take people's ontological fear and wish to be reassured into consideration.

This perception could also be the sign of the development of another way of thinking in which the State is not expected to defend the public "interest" any more. In this case, such a conception would be more coherent with Huber's analysis of the ecologisation of the society that regards State intervention as counterproductive in the long term.

- Some people don't take any action. It is the direct consequence of the lack of socialisation of both the environmental risk and sustainable behaviour, there is no social recognition linked to adopting sustainable behaviour.

Daniel « If I do it (investing in a sustainable item), I will have spent more money to save the environment with the satisfaction of.... Nothing »

Gérard : « It is not acknowledged »

Daniel : « Yes, it is not acknowledged »

- 3) If the environmental risk is not socialised through the institutions, it could be socialised against them.

When a common enemy is designated, then a social identity can be constructed. In this case, criticisms about the liberal system being at the heart of the environmental risk issue should lead to political opposition to this system.

In France, there are few environmental concerns in the traditional political parties. The green parties could have provided an answer as they are socialising the environmental issue both in a positive (suggesting new environmental reforms and models) and in a negative (criticising the extreme consequences of ultra liberalism) way. But few people recognise themselves in these parties. It is not the aim of this study to understand why, but one remark can be made: people even hesitate to take part in a collective action in favour of the environment (a demonstration for example) as it

could make people think that they belong to a green movement. We can interpret these declarations as more proof of people's lack of trust in institutions (in this case the political system). The “green” parties are as untrustworthy as the other ones. Consequently they are unable, at least partly, to reach their objectives of socialising the environmental issue.

In contrast, the few ⁴⁵people involved in a green party find in this a way of socialising the environmental risk which directly leads to action. It is also the case of the few people who join a non-profit organisation such as WWF, Greenpeace, Nature Preservation associations etc or support them. This seems to be the case for one participant to the group who decided to join a non-profit environmental organisation.

The socialisation of the environmental risk could also be done through less formal groups that keep the political aim of influencing society. In this respect, B. Halkier (Halkier, 2001) has studied the people who were taking environmental friendly consumption practices at a personal level. He found that some environmentally friendly consumer practices can be understood as political ones because they are carried out by agents who are related to a certain type of community and are attempting to influence societal problems in a particular direction by the mean of their own practices. He claims that the « *consumer strategy to improve the environment can be seen as a reflection of a loss of community in the wake of societal individualisation* » because it is a way of avoiding being involved in more formal environmental groups. However, he states that:

- such a consuming strategy also defines a new community: an imagined one linked to unknown consumers which gives a meaning to individual action especially when it comes to pressurising producers and retailers.
- at least the most articulate consumers who integrate environmental norms in their everyday practices understand themselves as having co-responsibility in supporting particular developments in environmental solutions. To this extent, he makes a parallel with his observations and Giddens' definition of “life politics” i.e. people who live “*in a way which implies active choices about how one should live in a responsible way towards each other in global society*”. François, Elizabeth were such people. We chose to describe them as “domestic activists” by opposition to more classical forms of public involvement.

Applying these notions to what we could observe, creating an imagined community between people by making them understand the meaning of individual action as an element of a more global perspective-for example the cumulative effect on energy consumption and pollution of keeping

⁴⁵ Les Verts the main green party reckons a couple of thousands active members, 5% of votes in the 2002 presidential election polls, Environmental NPO are only 2 to 3 % of the French population (cf.part1) .

one's pilot light on- has appeared to be one of the most difficult things to do during the cognitive transference group. To this extent the imagined community defined by Halkier didn't exist within the group on a usual basis. However,

- it was created for a while after the Erika's wreckage. A couple of men did boycott the TOTAL oil company while the women - who had talked about boycotting on a general point of view- didn't take any action. I don't have elements that could tell whether such a difference could be explained by a difference in the genders' perception. However, it was more a reaction of anger than a reaction on the long run based on the permanent consciousness of an imagined community.
- together with the idea of having co-responsibility in supporting a specific issue, the idea of such a community did appear, in the Valence interviews, among people that were very aware of environmental risks and already involved in other pro-environmental groups or networks and taking pro-environmental actions on a personal level. According to those results it is difficult to assess the importance of such a specific, diluted individual way of socialising environmental issues. But, we can state that informal networks of people sharing the same views on environmental issues, professional ones for instance, (one person referred to a think tank on energy that was created in a company) can constitute a diluted community that allows the socialisation of the environmental risks and of the environmental actions that are a response to them.

4. 3 A person's relationships with the institutions draw the limits of action taking.

People's actions happen to be limited by their perception of what can be expected from the institutions. At a general level,

- if people trust the institutions and think that they are working well, they will not take sustainable action because they assume that the institutions are dealing with the problem. For example, we can refer to Gaël again. He thinks that everything is under control and doesn't do anything apart from sorting his waste because it's a matter of civism. He thinks that it is up to the government policy to deal with those issues (for example, by creating Eco taxes if necessary). The same type of reaction was observed in the interviews with Eric. It is interesting that he considers people to have a hold on society because they can vote and make consumption choices therefore can express their opinions. He does so himself according to utilitarian perceptions of what is cheap or good for him. In that case we could say that his actions are kept within the boundaries of the Techno-sphere. This type of

statement which is in contrast to the perception of powerlessness that most people were expressing, is an indication that one's perception of having a hold on events might be a determinant factor in action taking and that such a perception has close links to one's perception of his/her relationships with the institutions.

- if people don't trust the State nor the institutions, we saw that the majority is going to withdraw while some people such as Suzanne will take activist positions.

We can summarise those different positions in Table 4.1

Table 4.1 : Variation in sustainable action taking according to one's trust in the State and in the Institutions.

Trust in the institutions	Perception that individual action is possible	Consequence on sustainable action taking
yes	yes	utilitarian action
yes	no	No action
no	yes	activism
no	no	withdrawal/no action

source: CT groups/ Valence Interviews. 1999-2000

However, such analysis must be viewed in light of the type of sustainable action that is at stake and the quality of relationships with the institutions they imply.

1)The less immediate reward is given by a sustainable action, the more scrutinised are the institution's position and behaviour with egalitarianism as a constant concern.

Utilitarian reasons for taking sustainable actions have been studied in the previous chapter. However, when the economic or time pressure decreases, so does the imperative of saving energy and water or of using one's car or buying the cheapest good. If a sustainable action is taken, it is in the name of a real environmental concern. When considering this perspective, the signs sent by the institutions are scrutinised, in order to assess whether such action taking is meaningful or not. It is the case for three different actions: purchasing goods, savings and the use of public transport.

➤ Purchasing goods is the first level where one's actions interfere with one's expectations and trust towards the institutions. Although respecting the law and making good products is reckoned to be in the interest of the production companies, they are not completely reliable when communicating on the environmental qualities of their products. Only the institutions could guarantee such things. Therefore, people would accept more easily changing their purchase habits if the State was involving itself more by helping them to make a better choice. It

is expected to do so by developing its environmental guarantee function (as seen previously) but also by contributing to the promotion of existing official environmental norms not only by spreading information but also in very practical ways: for example, people would expect the environmental mentions and labels on packaging to be larger.

- Water is the case that could be observed for savings. Gaël, who has been exposed to many good reasons for saving water, decides not to do so within two sessions of the CT and explains why: *«I've received my water bill, I was struck by the fact that taxes and water treatment both represent the biggest part of it. It was a clear message to me: Gaël, no need to bother, you can consume as much tap water as you want. »* One should keep in mind that, in France, the water distribution is the responsibility of local institutions - therefore the signs given by the water bill's composition are clearly stating an absence of institutional involvement on that issue. It turns into a « good reason » for not taking action.
- In the case of the transportation mode, some people refer, of course, to the classical but very true argument according to which the supply of public transports or cycling facilities is very poor therefore taking action is impossible. But there is more than the supply issue. The public transport policy gives contradictory signs that are very well deciphered. According to the group, the public transport policy appears as:
 - incoherent: Christiane : *« They organise car-free days but they keep on building public parking in the city centre ».*
 - unstable as driven by other interests than the public one. Therefore, for example people will not buy LPG cars. They are frightened that, in case of these cars being a success, the tax reductions that are applied on both the cars and the LPG will be eliminated. The government is not considered as being able to resist a decrease in taxes' incomes for the public's sake. We are back at the criticism of the economic system and of the institutions.

With this background, making an effort seem meaningless. Furthermore, as we mentioned already, people refuse to be the only one that should take the responsibility of the sustainability issue. It is one of the reasons that justify the lack of action taking not only in transportation but also in general. Franck: *« There is the ideal of a social contract. I am ready to make an effort if everyone participates in it including other people, industries etc otherwise, I don't want to bother ».* Such a statement emphasises the need for a socialisation of the sustainable behaviour. It introduces also the importance of egalitarianism if one wants people to take action, the comparison being between socio-economic categories (it could be between neighbours as well). Pierre *« What drives me crazy is that they are all questioning the way we use our cars, never what's going on with trucks ».* Such a

comparison process also involves planes, official cars, etc. Egalitarianism which is translated often as in the last example in terms of fairness seems all the more important so as another common theme is the reference to a discrepancy in the application of the law. It seems that there is always a way out except for the average citizen. People are not giving specific examples therefore this perception could be an imaginary one, but it is the way people perceive their relationships with the institutions. However, egalitarianism also appears to be a central element as its importance is great in a highly socialised sustainable action: waste sorting. This has been described in a recent study about waste sorting in Flanders (Warlop, Vanden Abele, Smeesters, 2001). This study shows that the quality of waste sorting is influenced by both:

- the comparison that people can make between their situation (each town can implement its own waste sorting policy) and their neighbour's. This comparison is always resented as unfavourable to the people who are making the comparison.
- the absence of fines for offences such as illegal deposits in the countryside.

The situation is different in France as the policy is less coercive but people react in some similar ways: in the Valence suburbs, some people complains that things are better organised in the town of Valence itself and most people complain about illegal deposits in the countryside.

However, the importance of egalitarianism is much more developed when people are paying attention to the whole recycling process itself.

When talking about waste sorting, people are aware of being the central actors of an industrialisation process that turns their waste into new products. They are aware of their behaviour's economic importance. Therefore, they don't accept the constant rise of local taxes that are dedicated to the implementation of the waste treatment cycle any more. They resent it as both a denial of their importance in the economic system and a lack of fairness compared to the industry's position. *François: « It is a scandal to pay always more (waste treatment tax) as we should receive bonuses for good waste sorting. » Edwige : «I resent waste sorting as a penalty because the actor who is mainly responsible is the retailing industry... taxes are rising all the time, we have to refine our waste sorting more and more with no prospect of an issue»*. People state that the recycling process puts the burden of the whole device on their shoulders while the manufacturers are not making any effort to change their packaging' components and/or making them lighter. Here again, we can find the themes of the State lack of courage in front of the economic system, of institutions transferring their responsibilities to the citizen/consumer. On this specific point people spontaneously make an analysis which is close to the one developed by political scientists such as Rumpala. In an article on household's wastes (Rumpala, 1999), he

suggests that the reorganisation of the waste industry and the implementation of waste sorting in the households are, in practice, a way of legitimating some industrial plants for waste burning as they can be presented as a last resort solution. Furthermore, he presents the possibility of recycling as a process that avoids questioning the consumption system as:

- it gives an end-of-pipe solution to the environmental burden of waste production. Therefore, it contributes to the industry avoidance of its own responsibility in the choices made during the production process: impossibility to repair, limitation of the products' life, lack of standardisation of the products' packaging, etc.
- it often focuses on the packaging issue therefore avoiding more difficult questions related, for example, to the increasing production of disposable items.

Such an analysis is not far from the spontaneous understanding of some people. People's involvement in waste sorting is even the more so questioned that they can't see any obvious reduction in the global amount of waste and that they start to be aware of the poor level of recycling of some materials (such as plastics). In any case, people keep on sorting their waste because it's a matter of civic behaviour i.e. the socialisation level of this behaviour is very high and recognised at all levels of the society. Anyway, while this kind of understanding is not generalised yet, one wonders what will happen if it grows quickly. All the more so as it was made by people such as François, Daniel or Elizabeth who were those that were taking the most sustainable actions. Therefore one wonders about their exemplarity to other people and the impact that a behaviour change from their part may have.

2) Highly socialised actions give an example of what is expected from the institutions for sustainable action taking.

The example of behaviour that has been socialised for years can give us information about what is expected from the institutions. For this purpose we will study waste sorting again, as it is the only sustainable behaviour that has been implemented successfully in some French regions.

For years, waste sorting has been promoted on a wide institutional scale. Everyone from the government to the local institutions in charge of implementing waste sorting and of organising the recycling process have been involved. When observing what people say when talking about waste sorting, we can see that:

- a) people have almost forgot the reason why waste sorting is sustainable (only one participant mention that it allows a reduction of dioxin emission because less waste is burned). However, people know that it is good for the environment from a general point of view. Moreover, the

implementation of waste sorting is considered as a major factor of "green" awareness. Maybe because it is the first time that a clear sustainable quality is given to any action at the layman's level, maybe it is also because waste sorting helps people to realise the importance taken by their packaging (Eco-Emballages, 1998). Anyway, the meaning of action is clear enough to the people and is almost never questioned except when its insertion in the economic process is at stake. For example, people talk about trash trucks that dump their load in remote dumps. This impression may be given by the fact that most trucks are equipped with a double compartment system, each being used for one type of waste that is not seen from the outside unless one pays attention to the truck. Therefore people might have the impression that their waste sorting effort has been done for nothing. This example underlines again the importance of artefacts, of the way they are conceived and used in the action taking process. It also shows that the meaning of action depends not only on the kind of link that is established between the action and the environmental issue to which it is related but also on the very quality of this link. As we saw households are now conscious of being part of an industry process.

Waste sorting is a very socialised behaviour too. Therefore a strong link is made between one's behaviour and one's integration in the community: because of one's civism one has to accept participating in the sorting program for the benefit of the whole community (Charvolin, 2000). The meaning of action is not only technical, it is also moral, and many people translate this perception even though questioning the fairness of the whole process (cf. previous paragraph). They express it with words evoking a moral obligation of the « one has to do it » type. Two people go further in their analysis by explaining that even though they have to pay more for work to which they contribute, it must be done as it is an « education issue ». An invisible link appears between all the members of the same community: a "de facto" solidarity for the success of the program. This solidarity doesn't have to be expressed in a specific group but is still efficient. From this example, we could state that the success of the implementation of sustainable behaviour within the household will be assured when it will be considered as a proof of civism and not as a proof of "green" involvement anymore. It is the case, for example, for avoiding dropping papers in the street. Although the environmental impact of such behaviour is recognised by everybody with a perception that refers to the idea of cleanliness (see chapter 3) and of the aesthetics of the landscape, taking it will not be considered by many as a "pro-environmental action" but as a matter of "education and civism".

- b) People who are reluctant in taking action are also those who are the most sensitive to the coercive elements which has been implemented by some local authorities (fine, refusal of waste collection).
- c) The conversation focuses on the pro and cons of the use of the various waste sorting bins and of the way their collection is organised. Here again, artefacts play a key role in sustainable action taking as they create a link between the household and the outside world represented by the waste collection and processing system. The various bins are not only the sign of the household's integration into the waste recycling process (it seems impossible to have received a specific bin and to avoid using it), their presence has also a simplification impact: they help the layman in the difficult process of sorting the appropriate item for the appropriate bin. Even though, the waste sorting process is still difficult to handle and some people were still wondering where to put what.

However, as Anne mentions, the waste sorting behaviour is different in collective housing where the specific bins are not inside the flats but common to a couple of flats or to the whole building. In that case, the waste sorting is less systematic and sometimes not well done (cf. Ch 2). From this fact, we can state that one of the elements that might make the difference is the anonymous character of the behaviour. While one's neighbours can always check whether someone sorts his/her waste, the behaviour is less public in collective housing. The socialisation of the behaviour is therefore less important and people can adopt a type of behaviour that we can describe referring to the Mancur Olson's paradox (Olson, 1978) i.e. although people are interested in a collective good (environmental quality), if it asks for a cost (waste sorting) then they will not pay it (sort their garbage) as the collective good will exist anyway (they think that the other will not behave like them) and as they will benefit from it without suffering from social criticism. Mancur Olson describes a "rational" way of thinking in terms of costs and benefits. To keep the same line, we can say that, as the consequences of their behaviour will not be either important nor noticeable, the benefit of avoiding waste sorting is even higher. Being anonymous prevents from a personalised local social control.

This element seems to be very important at least for inducing action that doesn't provide any direct reward. It might be one of the reasons why, although being highly socialised, actions such as respecting the speed limit are not a success. If we refer to the abundant literature about road risk various explanations are given for the failure of the speed limit policy. One is important for us: the fact that the emphasis has been made on the risk perception while the most important is

the representation that people have of the action of driving and their type of practice⁴⁶. This reminds us the idea of the “provinces of everyday life”(Ch1). Taking charge of people and household at a local level seems to be part of the solution. But these kinds of things can only work within a society in which road risk is a major social issue and the respect of the speed limit a highly socially recognised and rewarding action. As for the environment, it is not the case in France yet. Driving at a moderate speed hasn't been socialised as a desirable practice. For this reason some group's members may have made a link between both situations. However, the situation has changed since the field research. In 2003, road safety has been acknowledged as a major objective of the new government with important law changes in order to make it more severe. At the same time, the motorway authorities promote speed reduction on the grounds of sustainability. But, apart from punishment, there is no other type of social control or reward such as in waste sorting. Even though the institutional involvement is very high, it is too early to check whether such policy will help the implementation of durable driving behaviour changes.

We can deduce from the waste sorting example that institutions are expected to participate, at every level, in the construction of the meaning of action which means not only giving explanations and information but also recognising the value of the household's behaviour while adopting an exemplary behaviour and a coherent policy as a result. Key elements of the socialisation process are artefacts that allow the creation of a link between the household and the outside world and the presence of a personalised and non-coercive social control. As the institutional environment during which the ground research was held can be considered as a fix frame in which no specific new relationships between the institutions and the lay people appeared (and no specific coercion policies), we will study in the next chapter the condition of the emergence of the socialisation of the link between the environmental risk and people's behaviour that can occur within this background.

Conclusion

Threat and risk are prevalent elements in the social construction of the environment to the extent that one could say that people are aware of living in a risk society. The environmental risk is perceived as an ontological one because the absorption of various pollutants by the body threatens its own survival. Therefore, the rationality at stake in the Eco-sphere is the body's one made of experiences, sensations and observations. It is made of health concerns and it has to do to with people's identity which is not the one of a consumer but the one of a living being. To this extent, it

⁴⁶ Many are quoted in Peretti-Watel. P (2000).

is not in line with the values, tools and techniques carried by the Techno-sphere all the more so as the Techno-sphere itself, through the western development scheme, is held responsible of the rise of the environmental threat.

Such an observation has several consequences:

- 1) From a theoretical point of view, it questions the value of the Theory of the Ecological Modernisation taken in its usual institutional understanding which considers Nature as a sustenance base therefore integrating it as an element of the Techno-sphere that should be protected for the resources it provides.
- 2) From a policy making perspective, it questions the efficiency of the policy tools that are implemented or, at least, it narrows their application. To a risk perceived as an ontological one, the institutions give technical answers, answers from the Techno-sphere that never take this fear into account because they don't belong to the same world. Hence the limits of these tools. Furthermore, the ontological risk is increased by the inability of the institutions to escape the techno-economical mode of problem solving. To deal with a risk perceived as a vital and global threat, the institutions give sectorial answers per type of pollution or problematic: water pollution, air pollution etc. Also people recognise the practical value of such an organisation, they miss the global answer that would respond to their global perception of environmental risk, they miss an answer that would come from elsewhere than the Techno-sphere. People's fear is ignored, hence its increase.

Those observations can be related partly to the rise of the risk society as it has been analysed by both U. Beck and A. Giddens. It is helpful to understand, in the construction process of the fear linked to the risk perception, the anxiety that is immediately linked to the environmental issue and the impact of the lack of physical perceptions of the environmental risk. Beck (Beck 1992) shows that Chernobyl has been an "anthropological shock" (in fact it was a constant reference in the field research) which made people realise that most environmental risks are invisible and can't be assessed by human's senses (hence the necessity of referring to cancers for this purpose). This has several consequences:

- risk can be anywhere without people noticing it. Therefore, every fantasy can be built about its presence or occurrence. This could be another explanation for the perception of the existence of a link between climate change and the Chernobyl cloud or for the threat that is represented by satellites.
- the risk assessment depends on the information given by science and groups of experts and on what information is widespread in the media. Therefore risks can be denied or dramatised.

- anxiety spreads among lay people who can no longer rely on anything anymore. Neither their senses nor the information they get are trustworthy. It is therefore impossible to do anything and because the risk cannot be mastered any more, society returns to a medieval conception of fate. Hence a general feeling of powerless that can also be found in the field research.

Anthony Giddens's analysis (Giddens, 1994) completes, in a way, Beck's one when he focuses on the explanation of the spread of a risk culture among lay actors (who have to deal with risk in their everyday life which turns into a multiple choice adventure) and of the importance of trust in a society where the layman is unable to assess the risk. This assessment appears clearly in the field research where the issue of the lack of trust in the institutions is largely debated and clearly related to their subjection to the Techno-sphere.

In such a background the construction of a link between environmental risk and the lay person's behaviour is all the more so difficult to achieve as the scale gap between the two levels - an economic system that generates huge environmental risks on one side, the poor action range of the layman on the other- is not mediated by the actors usually in charge of defending the public against threats: the institutions. People can't find any help in alleviating their perception of their lack of hold on the environmental risk. As mentioned before, the Nature of the environmental risk is determinant. We will see in the next chapter that low scale or local environmental risk may provoke a reaction from lay people. However, the risk perception is a global one dominated by high risk perception and fear. This is why, even though some risks are managed by the institutions, people's perception is still of this lack of hold which is not only linked to their ignorance of what to do but also to the lack of socialisation, at every level of society, of both the environmental risk issue and the sustainable behaviour that might respond to it.

- People's perception of a disengagement by French institutions from the forefront of the fight against environmental risk is resented heavily. All the more so as no other social actors (political party, NGOs etc) are replacing them for this vacant role even though a very few people might consider that some companies might play this role, as we have seen before. As a consequence, the awareness of the environmental impact of one's behaviour is poor, even poorer the awareness of sustainable behaviour while the lack of socialisation of those issues make them difficult to be taken. When attempts are made, it is often within the frontiers drawn by people's relationships with the institutions.
- At the household level, there is no social mediator that would give meaning to individual action by underlining its link with more global environmental risks while legitimating the environmental concern.

This lack of socialisation reinforces the trust crisis that affects all the institutional levels and contributes to the rise of people's anxiety and to their withdrawal into their own close circle. Sometimes, but rarely, it results in environmental activism as an optimistic reaction to the powerless feeling that is commonly widespread. This kind of activism could also be analysed as a way of expressing one's rejection of the political system while, once established as a norm, sustainable actions become ordinary and lose their political meaning. It is interesting to notice that, for a few people, several commercial brands appear as the only trustworthy entity. When looking at those brands, you can see that they have grounded their image on values such as their concern for people's health, service to people etc and not only on specific product issue. Contrary to the institutions, they have integrated some values of the Eco-sphere.

However, the example of waste sorting gives some information about the elements that would be necessary for sustainable action taking: a light form of social control, the appropriation of adequate artefacts, and, above all, the restoration of a meaning to action. These observations permit a specific focus on the role played by objects in the environmental risk/sustainable action taking context.

➤ The fact that the objectal carrier of many objects doesn't embody any aspect of the Eco-sphere, including body sensations and trust has consequences on the objectal carrier of those objects.

First of all, we could observe in chapter 3 that the efficient objects for inducing action are those that correspond to another identity of people not to their "living being" identity. Most of the time it is defined within the Techno-sphere i.e. the consumer identity, the one that allows a "economically rational" decision to take an action or not. Even in that case (for example a water bill), people are sensitive to the social balance embodied in the artefact.

Returning to artefacts that are supposed to help a sustainable action, we can see that their objectal carrier should include a strict egalitarianism of treatment between all actors, maybe because the environmental risk affects every one in an equal way. Another observation was that beyond egalitarianism, there is a moral and trust and common good embodied in the artefacts and that their proper use will vary according to people's perception of them. It also shows that strict utilitarian and technical information is not enough for sustainable action taking artefact and that any information artefact should take into account those elements. But these conclusions are made with the background of a socialised action. It is not the case for most sustainable behaviour. Consequently, people create their own environmental information artefacts. Most of them are not conceived to take action but to assess a risk that they can't handle and for which they can't trust a specific spokesman. Therefore, objects such as animals, odours are given the status of environmental objects that re-create a link between environmental risk and body

sensations. It is the translation of their need to have physical contact with, therefore the beginning of a hold on, the environmental risk.

The issue that emerges from the field research can be defined in terms of how to give back to people a hold over the environment within a risk society where there are no mediators between the environmental risk issues and the lay person? An experimental answer has been given in the cognitive transfer group by introducing the socialisation of the link between one's behaviour and the environmental issues. The study of what was at stake during this experiment gives us elements for action.

Ch 5 Empowering people is a necessary condition for the voluntary adoption of sustainable behaviour

Is there a way of returning to people a hold on their environment and, if so, to which extent empowering them is an answer to this question?

Before studying what insights were gained by the cognitive transfer experience, we must define what is understood as empowerment - as there are almost as many definitions of empowerment as authors describing it- and how the cognitive transfer inserts itself within those definitions.

The concept of "empowerment" has recently been used in several important fields, three of which are: the implementation of development policies, medicine and employment policies.

- The implementation of development policies (Faugère, 2000). One of the representations implied in such policies is that the people from developing countries are the passive victims of a traditional system, which is an obstacle to any improvement. Against this background, empowering people aims at educating them by providing them with the means of escaping their traditional system. In that case, the situation can be analysed as a conflict within the western world between the power it holds on the resources of the southern world and its objective of returning this power to those who benefit from a development program.
- Medicine. Empowerment is considered with the idea of making the patient the active manager of his medical treatment and by considering his own ideas and experiences of the treatment. « Medical staff should be there only to facilitate and promote the process of empowerment (Integra, 1999)».
- Employment policies⁴⁷. Empowerment is defined as a way of promoting access to the labour market and employability of those who find themselves excluded from it. Such a policy is made thanks to an active inclusion rather than passive participation into the empowerment process.

All of these definitions reflect a common theme: providing victims of a social or health situation with a hold on themselves and their environment thanks to education, participation and access to monitoring tools. One criticism can be made: this way of conceiving empowerment is often prescriptive as those with power empower those without it. One way to counter this criticism would be to increase the active participation of the people i.e. considering their ideas as valuable solutions and worthy of being implemented. In that case, empowering people can be related to what Nelson

⁴⁷ www.europs.be/docs/viewdoc.cfm?idPS=9&IDDocuments=6&LANG=1

& Wright call a « de-centred model of power » (Nelson & Wright, 1997). In that definition, power is not something that is possessed or used by someone or an institution, it is a system made of institutions, events, actors and words. However, it can be observed that such a model can be easily transformed into a centred one. For example, even though some western NGOs want to base development policies on the population's claimed needs, they will bring with them the western way of solving issues hence incorporating people in a system which is not theirs. Hence the need for a truly de-centred model of power.

Thus, the focus should also be directed on the methods that are used for implementing the empowerment process. Active participation not only implies being involved in the process itself but also sharing one's experience with others whoever they may be: the medical team, other « excluded » people, village people and « experts » etc, it's a matter of socialisation. Returning to our experience, and referring to previous definitions, if we consider people as « victims » of the environmental risks and pollution, then Geller's psychological definition of empowerment (see chapter 3) can be related to the finding that all participants were having feelings of "belongingness" to a group of environmental victims. However, this is not enough to explain the events within the group. Actually, if the cognitive transfer groups were a way of educating people about their ability to have "a hold on" pollution by using, as means of empowerment, both a participative method (the groups) and a kind of monitoring tool (the Energy Environment Budget), one of the main element of its positive impact was the empowerment resulting from the socialisation of the meaning of action. We will show that the construction of the meaning of action is dependent to the socialisation of a the existence of a link between personal behaviour and the environmental issue (section 1) and, particularly, to the socialisation of people's ontological concerns about the environmental risk and the answers that can be given to them (section 2). In section 3 we will focus on the mechanisms of such socialisation and on the changes it induces in people's interpretative frames.

1. Empowerment rises from the possibility of acknowledging the meaning of individual action within the collective aim of achieving sustainability.

When observing the meetings, we can see that the conversation is a continuous to-ing and fro-ing between people's observation, the social and behavioural norm that seem to be linked to them, and the meaning of both. The conversation scheme is based on a combination of all these elements and not on the development of a logical line of argument. Observations are used to assert people's opinions on what are the social norms and/or what they should be. The following example gives a good idea of such a structure:

François: « the industry must be careful today as there are strict controls...the industry is environmentally conscious and today farmers who feed people with their slurry no longer exist.»

Chantal: «It stinks when they spread it... the clouds stink too....»

Christiane: « Yes, when they spray things...»

Anne: « There is a profit criterion, they have to do so»

In this extract, François suggests an interpretation of a social norm (environmental rules in the industry and agriculture) which is contradicted by the practical observations of the two women who, in return suggests that another norm is prevalent (profit). Once again we find an assimilation of human beings and their environment- if we consider that François uses a shortcut and assimilates feeding animals to feeding humans. We can also find a reference to the dominance of the economic criteria. All of these are yet another illustration of the theme developed in the previous chapter. These remarks being put aside, it is interesting to see that the women use very basic observations involving their physical senses. However, when looking at the structure of the conversation, we can observe that the three elements (observation/norms/meaning) are not combined in the same way during the CT meetings. Before the cognitive transfer, people discuss the meaning of their observations but they never discuss the meaning of their own actions (1). Conversely, after the cognitive transfer, people's own behaviour is reintroduced in the conversation and is linked to environmental issues which was not the case in the first place (2). In our opinion, such a change is the sign of the very impact of the socialisation process: people's behaviour, which was out of place, becomes integrated in the environmental issue again. The value of this interpretation is demonstrated "a contrario" when observing what goes on when people are considering issues that are already socialised. In the case of waste separation and in the case of the 3 Suisses group (3), there is no important change before and after the CT. However, one of the immediate consequences

of the socialisation of this link is that a change in people's perception of their own responsibility can be observed (4).

1) The first meeting shows that, before the cognitive transfer, the meaning of people's observation is discussed except in the case where people's own behaviour is at stake.

The first meetings were mostly concentrated on discussions about the meaning of people's observations with no mention of their personal behaviour. Controversies occur about the meaning of those observations. Those controversies are not resolved except for a general agreement on the lack of the State's involvement in environmental affairs.

Only once is the importance of people's behaviour related to global environmental issues: when talking about nuclear energy, it appears that people's conviction that the nuclear energy is a non-pollutant one influences their electricity consumption behaviour all the more so as nuclear energy appears as an energy without any perspective of shortage. The natural resources shortage issue introduces a description of people's behaviour in terms of energy savings and then a more general discussion about savings. However:

- The link with pollution is never mentioned any more and people concentrate their discussion to the pros and cons of saving behaviour.
- Controversies appear when talking about how this behaviour interferes with norms that can be personal, attached to the household or more general social ones and when talking about the meaning of the behaviour of other social actors.

Table 5.1 describes the conversation subjects, practical observations and matters of controversies by order of appearance in the conversation before the cognitive transfer.

We can see that:

- While the observation of the outside world leads to questioning the meaning of what is seen, when people observe themselves they don't question the meaning of their behaviour.
- Adopting sustainable behaviour is equivalent to the adoption of a new behavioural norm. Therefore it interferes with people's other personal norms in terms of comfort or convenience such as the temperature of the house at night, the relaxation given by a bath, the quality of lighting that satisfies people's need and aesthetics, the convenience given by one's car etc.

Table 5.1 Description of the first meeting conversation's structure before the cognitive transfer.

The “Vs” sign indicates the points of controversy.

Theme	Observations	Norm	Meaning
	Paper waste in the street and on the road sides.		People don't care about the environment vs. a) it is not because there is no paper in the street that the environment is respected b) it is not an environmental criterion but a sign of civic behaviour.
Air pollution	the state has promoted diesel cars city centres become to be closed for the traffic black smoke from the exhaust pipes of some cars		The state position is a contradictory one, which preserves the industry's interests Vs environmental criteria are integrated in the general affairs. It is not worthwhile taking action if both the institutions and the industry don't do so.
Polluting farming practices.	slurry's odour pesticides' clouds Tap water must be boiled, and one must buy gallons of water.	Farming norms are efficient Vs they are not protecting health and the environment enough.	Financial criteria dominate the social organisation Our health is at stake
food risk	a red meat doesn't mean a good meat		
Nuclear risk	The Cogema TV ad says that there is no danger, you can bathe in the sea near La Hague		a) Nuclear energy is polluting (wastes) Vs it is safe. b) The protection of an important industry Vs health and the environment first. c) There is no shortage of nuclear energy Vs there might be shortage of gas or water
natural resources shortage (c)	ground water resources are dry watering one's garden is forbidden sometimes the price of water rises constantly Pro and cons of saving behaviours including observation and manipulation of artefacts.	a) Savings are in balance with : - Comfort and conveniences norms (relaxation in a bath, quality of lightning) - Social norms: excessive saving behaviour are a sign of stinginess. b) Manufacturing norms: things are authorised that should be forbidden by law.	
waste separation	pro and cons of the system which is implemented (visual pollution/odour/ Convenience of the bins/ frequency of collect)	Is the price paid for waste recycling a fair one? Should it be compulsory?	It prevents more dioxin emissions State of the relationships between people and the institutions.

These are very strong arguments that reflect the importance of the body perceptions in the appropriation process of a new behaviour. We will return to this point in section 3. Sustainable behaviour is also confronted with more general social norms especially in terms of savings: the idea of stinginess is never far away from the idea of saving and those who reduce their home heating temperature will increase it when inviting friends at home.

- The meaning of action is questioned more often than the meaning of norms. This is a sign that confirms our hypothesis according to which the lack of socialisation of sustainable behaviour deprives action from its meaning. Because many of the issues raised in the discussion about the meaning of action are linked to the risk issue, it also a sign that the meaning of action is linked to the way in which ontological (existential) risks are taken into account. We will discuss this important issue in section 5.2.
- Waste separation is in a specific position as both the very values of the norms and their meaning are questioned. Referring to the previous chapter, a hypothesis for explaining such a difference is that waste separation is a very socialised issue. Therefore, a hypothesis is that a sign of the socialisation of other environmental issues could be detected if both elements (norms and the meaning of norms and action) are present.

This is the case, in the first meeting, just after the cognitive transfer. People start questioning the meaning of personal behaviour against a background characterised by the lack of involvement of the other social actors on those issues. Although questioned, the link between one's behaviour and the rest of the world appears in the conversation.

2) After the cognitive transfer, people's behaviour is linked to environmental issues

During the second meeting, the creation of a link between people's behaviour and the environmental issue is confirmed: when asked what they can recall of the previous meeting, people are talking about « *savings and the environment* » « *awareness* » etc. We can observe that, in a second part of the discussion, people's observations are going to concentrate on the description of their own action following the scheme in table 5.2.

Some differences can be noticed with the first meeting discussion:

- Personal behaviour norms are less considered as obstacles to the implementation of sustainable behaviour. At the opposite experience shows that those types of behaviour can improve the quality of comfort. For example, most people agreed that reducing the home heating temperature improves the quality of their sleep.

- When an agreement is reached on a behaviour (such as reducing the home heating temperature at night) the discussion focus on the acceptability of the social norm that derives from it i.e. what should be the right temperature, the volume of water consumed etc. The validity of the norm itself is not questioned anymore.
- The meaning of behaviour is always brought up.

The themes of the discussion on the meaning of one's behaviour are the same than those observed in the first meeting: the connection of one's behaviour with environmental problem solving and the meaning of one's action within the broader frame of the other social actor behaviour. For example, according to some people, saving water or energy seem meaningless considering the amount of water or energy wastes that can be observed in some companies or public institutions houses. Moreover, both in a third part of the conversation (which is not described in Tables 5.1 and 5.2) and during the last meeting, the conversation is only focused on the meaning of action *in a broader social frame*. People talk about:

- the relative responsibility of the social actors in making the society more sustainable (manufacturers, suppliers, institutions, lay persons), their motivations (money or/and sustainability?) and within this frame, what is expected from both politics (education, tax policy, coercion) and the industry (communication, internal incentives, manufacturing practices).
- the importance of the behaviour of other countries
- the incoherence of public policies with the Erika's wreckage as the last example

The normative issue implied by those subjects appears in the last meeting and the controversy between people could be summarised as to what extent should the precautionary principle be taken into account? It is interesting to observe that people don't respect the traditional analytical frame per economic sector and consider altogether very different sources of risk, which share the common characteristic of being potential human health risks. People talk about the relative importance of: hygiene norms in different countries, Listeria, GMOs, cellular phones, mad cow disease, intensive farming and wonder:

- Whether making new norms is meaningful as many people should have been infected already.
- What should be the reaction of the institutions when confronted to new risks? For example, should they dig up GMOs rape fields?
- Whether is the information given by the press trustworthy?

Table 5.2 Description of the conversation’s structure after the Cognitive Transfer

Theme	Observations	Norm	Meaning
Environment	-Pros & cons of the products -One sleeps much better with the heater off or tuned at a lower temperature. -EDF called me to check how I could make electricity savings. -In hotels, there are incentives avoid changing bath towels everyday. Leclerc (a supermarket) gives re-usable shopping bags. Packaging is too important and a source of waste. There is a new green packaging for fruit juices and beers Is the higher price of efficient bulbs interesting Vs the savings that they allow? Unnecessary use of plastics in the production line	-What should be the heating temperature at night? 14°C? 16°C? 19°C? -Is 36 m3 a year high water consumption?	Saving energy and water improve the environment, The bill shows that savings are not a social issue Vs the less you consume the less water must be treated. What is the meaning of saving if companies and administration keep on wasting water and energy? The planet is not going to be able to endure over consumption of its natural resources. Who should inform the people? The media, the companies? The electric appliances' producers? The Institutions. Young people? -Packaging must be important to play their protective role Vs it's an over protection which is only a marketing support for the promotion of consumption. -Do companies make savings because they are green or because they want to save money? -Companies should be responsible for sustainability not the consumer who is at the end of the production scheme
Theme	Observations	Norm	Meaning
Air pollution	Black smoke from buses' exhaust pipes Some buses and post vehicles use LPG; there is no noise, no pollution. They have special exhaust pipes. The police is not able to measure a car's pollution emissions	Public transport's emissions should be controlled more often. Where does the coercive power of the institution starts and ends?	Although polluting more, buses transport more people therefore they pollute less than cars Vs Public transports are the biggest polluters.
w a s t e separation	Pro and cons of the system which is implemented	Is the price paid for waste recycling a fair one? Is it going to be compulsory? Are the norms respected?	State of the relationships between people and the institutions.

sea pollution	Erika's wreckage Children were not protected when beach cleaning while the army people had protection.	Need for sanctions Involvement of the State in pollution control.	Politicians are not trustworthy. Idem for political parties. No one takes their responsibilities. Fairness of treatment. Is it worthwhile boycotting?
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- To what extent is independent control possible?

The conversation comes full circle: in the first meeting, it started with the perception of the risk for the individual and it ends, in the third one, with a discussion on the risk issue.

This is another sign that the ontological concern is at the heart of sustainable action taking.

However there is a difference between the level of understanding of the risk issue: first verbalised as a threat on the person, it is now understood in the wider frame of international relationships, control quality etc and people are aware of their personal action range. Once again, the limits of the individual or household's action and of the empowerment are drawn by the perception of the relationships with other social actors (see chapter 4) which is logical as people react within a fixed socio-political frame.

In contrast to what happened with non-socialised behaviour, we can observe very different reactions when observing the few cases where sustainable action has been socialised.

3) When the link between the environmental issues and one's behaviour has been socialised the participants have already implemented sustainable behaviour.

We can observe that in the second and third CT meeting, the type of reactions concerning waste separation hasn't changed since the first one which was characterised by a debate about the very values of the norms and their meaning. People still talk about the pros & cons of the collecting organisation and of their perception of the local waste collecting taxes and of their insertion in the collecting system. Referring to the previous chapter, this is the sign of the socialisation of sustainable behaviour. The fact that there was no major change in the debate reinforces the assumption that waste separation is the unique example of a complete socialisation of sustainable behaviour. A socialisation that leads to a stabilisation of the social relationships for a while. However, the balance is still unstable, as ferments of destabilisation are present in the questioning of the tax system that is mentioned by several participants (cf. previous chapter). It refers to a more profound question: the social fairness in the distribution of work in the waste separation chain.

This is not the case in the 3 Suisses groups. If we consider the strong involvement of the company itself which goes far beyond organising information campaigns but is translated into multiple actions that the company applies for itself at every level (change in the packaging components, use of a windmill, heating networks etc), there is little chance that the company could be considered as unfair to its employees on this issue neither could it be considered as putting the whole burden of action on its employee's shoulders.

In fact, sustainable behaviour is socialised by the company by:

- the organisation of an information system coupled with distribution of Eco products,
- the exemplarity of the company itself including the involvement of its managers.

Such socialisation empowers people because they regain a power of speech on those issues but also because the company creates the conditions that allow individual participation in a collective aim.

As a result, the number of sustainable actions that were already implemented in their daily life by the participants to the 3 Suisses group was impressive (see chapter 3). It is striking in the observation of the first meeting of this group is that the two themes of people's behaviour's impact on the environment and of the layman's position and responsibility with the other social actors are immediately mentioned i.e. in the first sentence of the first meeting.

Daniel: «The environment is important. As Cousteau said we are not (the earth's) owners, we are tenants. For 50 years on we have polluted a lot because we didn't take the appropriate measures for accountability (economic) reasons. It is true that some processes are non-reversible but we must save what can be saved and by all means. However, I wouldn't like to be the last link in the chain i.e. the consumer to be the only one paying for all ».

A few seconds later, Pierre adds: *« We are talking about responsibility at every level... it's a matter of being aware at every level of the society including us as end-of-the-line consumers: the batteries that we don't throw away, the water and energy savings we can make, waste separation. »*

We can find here the same discussions about the meaning of action that were found in the control group. However, there are differences in the facts that:

- the importance of the individual behaviour is recognised and not questioned. People refer to the idea of a personal responsibility while the value of the individual's behaviour within the social frame is debated.
- in this first meeting, people talk about issues that are only mentioned after the cognitive transfer in the control group.
- before the CT, most people have already changed their purchasing behaviour or have taken collective action

- in the second meeting, the debate is extended to the meaning of the whole company's environmental policy within the broader frame of the environmental policies of the other French and European companies. Such an issue is only discussed in the third meeting of the control group.

This constant difference of one analytical stage between the two groups shows that the socialisation of sustainable behaviour in the 3 Suisses company had an empowerment impact at least equal to the cognitive transfer's one because of the global environmental policy of the company. Both socialisation processes have achieved linking together people's action and their social and material environment.

However, the 3 Suisses example shows that empowering people is an ongoing process because the meaning of one's behaviour is never established forever.

First of all, newcomers must be aware of the sustainability process that has been implemented by the company and they have to integrate the meaning of their own action. This is not obvious. According to the participants of the group whom all the company has employed for many years:

- There is a lack of awareness among the new employees with immediate consequences on the sustainable use of artefacts: *"Many people don't know what the different bins are for"*.
- The new employees are not able to assess the changes that have been implemented by the company within the previous years therefore what is a sign of sustainability for some is just a habit for the others. The meaning of action is forgotten. As Gérard says: *"Many things have been implemented for ten years, but we forget about them. They just turn into habits. I can still remember the coal delivery, we have forgotten all about this* (The factory uses windmills and heat networks)."

Secondly, even though they've been in the company for many years, people keep a critical eye on the meaning of both their own and the company's behaviour. As Pierre says: *"We might be an isolated case in France"*. Once again, the meaning of action is related to the behaviour of social actors and to the insertion of the company's behaviour in the wider frame of the whole French society. One particular consequence of people's empowerment because of the socialisation of the meaning of action is that it changes people's perception of their own responsibility.

4) The socialisation of the link between one's behaviour and the environmental issue has direct consequences on people's perception of their own responsibility.

There are practical consequences of the creation of a link between one's behaviour and the environmental issue. In terms of action taking, people refer to the importance of:

- Avoiding the waste of natural resources therefore of consuming less water, energy and paper,
- Avoiding water pollution (purchasing compact washing powders for example).

In this perspective, the educational aspect of the cognitive transfer is quite a success. All the more so as people discover things they had never heard of before, such as the importance of pilot lights and electric bulbs in the household's energy consumption or the impact of the washing powders on the rivers' Eco-systems or that burning gas has an impact on the air CO₂ level.

These assessments go together with people's discovery of their own personal responsibility. As Anne said, « *participating in the group enhance one's own motivation. It's a big awareness. Even if individual action is limited, taking it makes sense for the future and for our kids* ». The socialisation of sustainable behaviour, because of and in front of the group, enhances one's responsibility because it asserts the existence and importance of the environmental impact of people's behaviour. Most participants referred to the notion of responsibility in a way that makes it a consequence of the awareness of one's impact on the environment. When observing how it is verbalised, we can see that people often refer to the parent's educative role not so much in the way that they should tell their children what to do but more in an exemplary way. They use sentences such as « *giving the example, not relying on the following generations, being voluntary* » etc. Furthermore, we can observe that people referring to future generations and people referring to their responsibility in such a way are the same. It just happens that they all have or are expecting children. A feeling of guilt is another road to responsibility: Christiane who is single, divorced without kids refers to the state of the planet and to the guilt she feels for not doing anything.

However facing one's responsibility is not obvious. If Anne's evaluation of the group refers to the "awareness of the (environmental) situation" as a positive impact of the experience; she considers as negative the feeling of responsibility that goes with it because it makes life more difficult.

The whole issue turns into a matter of conscience that is spontaneously referred to, in both groups⁴⁸, by using the image of the « little drop ». Having realised both the importance of their personal impact on the environment and the fact that the more people implement sustainable behaviour, the better it will be due to a huge scale effect, people reformulate their dilemma as such: one's action is like a drop in the ocean, the more numerous the drops, the bigger the ocean. The existence of a link between the smaller and the bigger is established during the first meeting and is never questioned. However, what is at stake is the people's will of giving this "little drop" especially when the

⁴⁸ The 3 Suisses group and the control group

immediate benefits are not obvious. One of the determinants for giving this "drop" is going to be people's perception of the commitment of the other social actors. Here again we find the theme of the relationships with the institutions that has been described in the previous chapter. It is one of the keys for determining the meaning of action and it is around this idea and around the determination of who is responsible for what that the last meeting is going to focus.

Anyway, meeting after meeting the meaning of action is explored and other social actors and events are studied. The Erika's wreckage on the Brittany shores opens, in the second meeting, an exploration of the relationships between the institutions, the industry and the lay people which ends by the participant's re-assurance of their will to keep behaviour changes that they have made. For example, Christiane is shocked and a little discouraged: the scale gap between her action range and the meaning of such events in terms of collusion between the industry and the institutions is enormous. She will be silent during most of the last meeting stating that the debate should be held at the political level and that she was revolted. Despite this situation, she continues the behaviour she had implemented and stated that she was a bit reassured when seeing that other people were also concerned by the environmental issue. The socialisation made through the groups has counterbalanced, a little, the negative impact of the Erika's wreckage. For other people, it was a factor of resistance but the last example shows the fragility of this socialisation.

Despite its weaknesses, one of the group's impacts was its contribution to a change in the meaning of action, which is allowed by the reconnection that is made between people and the solution to environmental problems. It gives people the opportunity of confronting the meaning of one's behaviour with the social norms. Two kinds of situations appear. In the first one, there are signs of socialisation coming from the outside world (artefacts, institutional involvement at both a national and a local level etc) and action is taken within the limits of the perceptions of the institutional involvement. In the second one, there is no sign of socialisation from the outside world; people withdraw on to themselves and their ontological fear. Therefore, a first approach would lead us to consider that socialising the link between one's behaviour and its direct environmental impact with a consideration of fairness and equality among social actors would be enough to induce behaviour changes. Our idea is that unless the ontological fear rooted in the construction of the environmental issue is acknowledged and socialised, behaviour changes will be limited to utilitarian ones.

5.2 Empowerment rises from the meaning to action that is brought by the socialisation of the environmental risk and of one's ability to take action against it.

Our observation according to which, in the first CT group, the meaning of action is questioned more often than the meaning of norms- which suggest that ontological concerns might be the main elements at stake when talking about sustainable behaviour - is in line with the observation that the environmental risks are a major concern (Chapter 3). It is completed by the results of the face-to-face evaluation interviews held after the last meeting of the control group. They underline the importance taken by the socialisation of the environmental risk issue as a way to enhance the importance of taking action. People's analysis is that sharing a common concern gives new reason for taking action for it (1). Our assumption is that this analysis can be completed by another one which shows that action taking could also be explained by the socialisation of a possible apprehension over time and territory which are major elements of the construction of the environmental risk (2) and by the formal conditions of the socialisation process itself (3)

1) People discover that what they perceived as a personal source of anxiety i.e. the environmental risks and their consequences is a concern which is shared by the whole group. During the first meeting, people share their experience of encountering pollution and risks, their fear and their indignation. For example, Samuel, Christine and Chantal express their common fear about water pollution. Franco and Chantal mention nuclear wastes, Gaël talks about air pollution, François, Christine and Anne are shocked by paper waste etc. The consensus is not only on the diagnostic (there is an environmental risk) but also on the necessity of an answer (one should do something about it). *Samuel: « Everybody was on the same wavelength about the necessity to make efforts. People realised things. I found them concerned. We've got the feeling that things are not going well but everybody wants to do something».*

> Such a discovery changes the meaning of action because it changes its legitimacy.

People can take sustainable actions not only on their own behalf but also on behalf of all those sharing the same concern.

Elizabeth is the one who best describes the impact of this socialisation process. First of all, she acknowledges that she was re-motivated by the group as she discovered that the environmental issues were a common concern. Later, she says that she had read in the local papers that the town services were going to use compost for gardening. When meeting some town gardeners in the streets, she went to check whether this was true and was pleased to find that such was indeed the

case. She says that she would not have done so before the first group meeting. As the isolation disappears, so does the lack of interest she had for the behaviour of other social actors (with who a positive link is re-established). This reconnection with the outside world seems to lead to action as she has implemented sustainable behaviour on both a personal and collective (work place) level.

The behaviour of François seems to follow the same line. He was not interviewed after the meetings, but one can notice that, although he has been wondering for a long time why the production line he is responsible for was using polluting components, he removes them after the first meeting. Christine notices that she felt emotionally invested of something and she took action at work.

It seems that the socialisation of the common concern for the environment has set off the action taking process. To this extent, we could make the hypothesis that collective action was a direct consequence of the socialisation of the environmental debate as all of these three people have changed their behaviour at their work place. Anyway, the individual perceptions of environmental risk become a shared concern and the meetings allow the creation of a group of « concerned » people which is materialised by the creation of new social links that satisfy people's needs. All participants in the control group said that they did appreciate discovering this common concern and that they appreciated the relationships that were developed within the groups. In the 3 Suisses groups the appreciation of the social links was so good that one participant suggested to make an extra meeting around a barbecue!

2) Empowerment is linked to the opportunity of mastering time and territory

Time is embedded in the construction of the environmental risk because it is an element of the risk probability issue. However, during the field research, people didn't refer to this aspect. Maybe, as Giddens suggests, because it is too scary; maybe because some environmental catastrophes have already occurred and people are more sensitive to the meaning of their occurrence than to the probability of occurrence of other ones. Anyway, time has appeared to be present in the risk construction process on a couple of other aspects, the main one being time scale and time as a historic reference. When they perceive those elements as « controllable », people perceive that collective or individual action is worthwhile taking.

a) Time and territory both participate in the construction of the environmental risk both as factors of enlarging the gap between the individual scale and the environment.

- The time scale is a major factor of the construction of the environmental risk.
- Most of the big environmental threats are linked to a long-term perspective. In a way the risk is a certainty that is postponed in time. For example, the full impacts of the green house effect in people's life will happen over a period of many years. Therefore, it is not surprising that the people's withdrawal on their everyday life - associated, as we saw, to their fear of the environmental threat- is associated with a refusal to consider long term perspectives in one's life, *Franck*: «*I can't see myself in 20 years time* », while worrying for the sake of the future generations.
- Illnesses linked to industrial pollution or air pollution are perceived by people as happening on a shorter time period: 10 to 20 years during which the pollution's impact accumulates in nature or in the human body resulting in illnesses. It is also the kind of period, which allows people to be aware of the changes in nature that are linked to the impact of human activities therefore allowing them to make comparisons. *Claude*: «*They have canalised the Veore (the local river). But there are no fish anymore. Before, there was water seepage as far as the road and people had water in their wells. Now they can hardly wash their hands with it.*» Such a comparative process is very common and is applied to a large variety of situations. People compare fishing opportunities, sales of medicines for lung infections, trees, the aspects of the riverbank, etc. However, only the middle-aged generation is able to get into this middle term comparison process. Younger people, who have never seen anything else, tend to consider as irreversible a situation that could be reversible. *Louis Marie*: «*I have joined a youth group. They were working on air pollution. They had imagined a pollution free zone, an air bubble, like in Japan. What struck me was that they had acquired the idea that clean air was a lost battle, they needed the bubble* ». But this doesn't mean that young adults are not making comparisons but they do so in the present time. For example, even though showing a pragmatic acceptance attitude (i.e. verbatim such as: nothing can be done at our level etc.) some young people react to the environmental risk in another very pragmatic way: they leave. Young couples have mentioned the pollution of the Parisian or Lyon areas as one of the main factors in their decision to move back to the Valence area. From that example, we can state that, when it happens in the present time, the comparative

process goes on to other issue such as pollution levels. The time scale is also embedded in the environmental risk in the way that it is obvious for people that the economic time scale is in contradiction with the environmental one. Once again, the constituents of the economic society give birth to the environmental risk. *Jacques: « As in economy the short term prevails over the long term ».*

- Time is also a reference to history, which introduces the theme of modernity and technology. It appears in the way people consider what is a good solution to the environmental risk. While very few people refer to going back in time to a more traditional way of living as a good solution, the same argument is used to deny the qualities of sustainable actions. As a farmer says « *I am not going backwards by using organic cultivation methods* ». Is taking sustainable action going backwards? The idea of the ecologisation of society states the opposite and the cognitive transfer experience results show that it is possible. However, not surprisingly, this idea of going backwards was found when talking to some farmers who were directly confronted by the choice between keeping on productivist /pollution way of cultivating and behaviour change. Therefore, it is more the sign of a resistance to behavioural change. However, it is true that it reflects the idea according to which living in a sustainable way is the same as going back to the dark ages. An idea that has been recurrent many years in the questions of the French data system (see chapter 2). Ecologising society also has to take into account this type of resistance.

Time appears as a reference to our historical time when people evaluate the chances of success of an improvement of the environmental risk situation. For a lot of them, it's too late to do anything. Such a pessimistic point of view is on the same wavelength as the powerless feeling of people confronted to both the environmental threat and a lack of trust in the institutions. It can be observed in:

- A pessimistic appreciation of the present
- Sometimes of the future. *Latifa: « The very day we will start to do something (for fighting the environmental risk) it will be too late ».*
- The hope that younger people will be able to do something as the present generation is hopeless. *Pierre: « The 40 year olds are not going to change, kids yes ».* It is interesting to notice that for many people, it is the date of the first job, not the age that is considered as the frontier that determines the limit of sustainable action taking. Here again we find a reference to the economic system as responsible not only of the environmental risk but also of the difficulties of fighting for the environment.

Another important element in the social construction of the environmental risk is the link of attachment that people establish with a chosen territory therefore considering this territory theirs and as something that should be preserved for and given to the following generations. We call this link the « patrimonisation » of a territory.

- The apprehension of the environmental risk varies according to people's "patrimonisation" of their environment.

The environmental patrimony of someone varies in size. While the whole planet is the environmental patrimony of some people like Christine; for some others, it is reduced to their house or street. In that case, the environmental patrimony is:

- Closed to the idea of ownership or of belonging to a specific place. One can notice that, in such cases, administrative or legal frontiers are important objects in the definition of the patrimonisation process. For example, it is the case for a boy who considers that he is not concerned by what's going on in the stream that flows 500 m away from his house because it flows on the other village's territory.
- Linked to the withdrawal process. The more one is withdrawn, the smaller is generally his/her environmental patrimony. A good example is Claude, one of those who never talk to their neighbours. He is furious because recycling containers have been installed in front of his house on the opposite side of the street. These containers are his main environmental concern and he wants them to be removed and put a couple of meters away.

What makes people consider a territory their environmental patrimony? To answer this question, we must refer to both the interviews made in Valence and the cognitive transfer groups.

First of all, patrimonisation is linked to knowledge. It is because they've seen a report on the Great Barrier Reef or on acid rain over the eastern forests that although being geographically distant, some people felt really concerned by those issues. It might be one of the positive sides of the delocalisation process enhanced by Giddens.

Second, experience is also part of the knowledge and it induces patrimonisation as well:

- It goes with the practice of an outdoor activity. He who often fishes in a little river considers it his. Therefore the Environment is still « what goes around humans» but as the individual moves, so does the environment. To have a physical contact with Nature (or a specific area) leads to its patrimonisation.
- It goes with the experience of risk. Three people had experienced an environmental risk. They all became very concerned by global environmental issues. One, who was working in

a nuclear power plant, experienced a low scale accident. The other was working as an assistant in the laboratory in charge of water quality control in a chemical factory; she never understood why she never got any answer when asking what the pollution norms were. The last, extreme, example is the one of a man, a career soldier, who was in charge of pressing the button that will launch a nuclear bomb in the case his general would have been wounded. He resigned from the army and turned into a convinced pacifist and ecologist involved in developing climate change awareness.

Once again we find that experience is as important as formal information in the construction of one's environmental knowledge. (See Ch 3).

b) When the socialisation process changes threatening perspectives on time and territory and make them perceived as “controllable”, it bridges the scale gap and leads to action.

- Changing time perspectives reinforce the positive perception of personal control and helps to fight against the perception of powerlessness. For example, very clear statements were made about both the important share of domestic consumption in the global phosphate release and the fact that the eutrophation process is reversible within a couple of years (the recovery of the " lake Geneva" in Switzerland was given as an example). The underlying idea is that assessing the impact of one's action is possible on a human life scale, even if it takes a while. Therefore the « it's too late » attitude can't be used anymore and the various behaviour changes can be assessed using the comparison process again.

Chantal refers to this process when she talks about water savings *«I try to save more but I will see the difference in one years time as we don't consume in the same way in winter and summer. We will see whether those actions are worthwhile then, meanwhile I am doing good deeds »*. In the case of phosphate release, the women that were attending the group changed their washing powders for liquid formulae after the cognitive transfer. However, there was still some reluctance at no longer using phosphate products, especially among the male participants. This can be explained both by the fact that:

- They are not in charge of purchasing the washing powder for their family
- They remember the campaign by Unilever in the 80s against the first washing powder without phosphate. The scientific controversy is still remembered with the result that people doubt the information they receive on this subject. The issue of trust in sciences and in the institutions appears once again in this example as the only answer that I could give that

people would not question, was the fact that, at the time, the French government had commissioned a university expert to learn who was right and that his conclusion was very clear on the negative impacts of phosphates release. Unfortunately, the results of this study were less disseminated than Unilever's positions. However, the institutional guarantee is now a decisive argument, which emphasises the importance of the institutions in the trust issue.

However, showing that the assessment of one action is possible within a person's life perspective is not the only way of mastering the time element. Another one is suggested by Gérard while talking about newcomers: to create the conditions of an ever-going comparison process over time. It could also be to make people aware of the company's history with sustainability.

- Changing territorial perceptions can also lead to action. For example, NIMBY reactions happen when one discovers that he/she and the area he is belonging to are under a threat with the consequence that the « patrimonised » territory expands to this area.

Although NIMBY reactions are often criticised as being very-selfish-ones-involving-no-particular-concern-for-the-environment, they can lead to real environmental improvements due to collective action. For example, some people quoted that, together with their neighbours, they obtained a change in the air filters system of the next door factory or the burial of high voltage electric wires.

Other intermediate patrimonisation level exists though. They are materialised:

- In a region. This induces that culture links enter into the definition of an environmental patrimony and are materialised when people express their concern for the regional environmental issue while being uninterested in what happens in other parts of France/the world, etc. For example Samuel who doesn't understand the green house effect, says that he lives in a cold region and doesn't care whether the climate is going to heat up or not. Other people don't feel concerned by what's going on in the South of France etc. The CT challenged those issues.
- In a specific Wonder of Nature that is not always recognised as such by other people. Local rivers are often considered as parts of one's territory even though people don't live nearby. In the interview, people expressed concerns for the Rhone river tributaries such as the Drôme and little local rivers. They will take action to protect them when experiencing a deterioration of their quality.

From this observation we suggest that physical contacts with the areas at stake are important not only for raising awareness about the environmental risks but also in the construction of the patrimonisation.

However, if the meaning of action is made of both the socialisation of the environmental risk and the socialisation of the link between it and people's action, we can wonder what process was exactly at stake in the behaviour change itself. Our assumption is that taking sustainable action could be explained by the achievement of what Grin & Van de Graaf (Grin & Van de Graaf, 1999) call a change of interpretative frame due to the socialisation of people's ontological fear towards the environmental risks.

3. Socialising the meaning of sustainable action empowers people because it changes their interpretative frames.

Grin & Van de Graaf try to describe how meaningful actions are shaped. For doing so, they state that «*the way people formalise actions and meanings*» vary according to the situation they are in and mobilises, during action, different "orders" (levels) of interpretation -that are coherent with this situation- in a continuous exchange between the different interpretative levels.

In what they call the "first order", people mobilise their definition of problems & solutions and they assess these solutions according to their specific assessing schemes. For example, an engineer uses his/her expertise to frame a problem then suggests solutions and assesses them according to his evaluation scheme. This may lead to a reconsideration of what should be the definition of the problem. Such interpretative order is at stake most of the time.

However, Grin & Van de Graaf describe a "second order" i.e. normative and empirical theories and "ontological" normative preferences. The authors' understanding of the word "ontological" has nothing to do with what we have stated previously. While we referred to notions that question the existence, they refer to the preferences that are at the heart of the logic of action according to the various identities taken by people. We will see in the following parts that the two understandings can overlap each other in one case but, in order to avoid confusion, we will refer to the notion of "favourite state" when referring to Grin & Van de Graaf's understanding.

According to these authors, the second order guides the interpretation of all actions even though it is seldom mobilised. For example it can be involved when the engineer has to think about the theories that underlie his work and about the conceptions of the world to which they refer. Logically, interpretative frames vary according to the type of actor involved and to the type of action i.e. the interpretative frame of a consumer is different from those of engineers or businessmen although

engineers can be consumers or businessmen too. Following this model, we can try to describe the various interpretative frames that were mobilised by the participants to the CT groups and to identify the movements that have occurred between them (section 1). We will also see that formal constituents of the sessions, among which the EEB and de-routinization, contribute to creating the conditions of a change of interpretative frame (section 2).

1) Socialisation allows exchanges between the interpretative frames that are mobilised in sustainable action taking.

Grin & Van de Graaf's description of the interpretative frame of a consumer help us to understand part of the behaviour change that occurred during the CT groups. One of their interesting assumptions is that the consumers' favourite state is made of expectations of well being and comfort. Their normative or empirical theories about consumption are, for example, their beliefs about the relationships between health and food or the gender repartition of domestic tasks. Problem definition is, for example, the way people consider meals: do they represent a socialising opportunity or a health necessity?

The conditions for the success of the implementation of an artefact are established as such: « an artefact must have a meaning for the consumer and must contribute to his/her preference in terms of well being and comfort ». This was the case for the EEB when it was considered as a tool for a better consumption.

Levels of interpretation within the two "orders" draw the interpretative frame of a consumer described in Table 5.3.

Table 5.3 Interpretative frame of a consumer

First "order"	1	Assessment of solutions Evaluations of the pros & cons of the various domestic actions
	2	Definition of the problem at stake and of the meaning of the solutions (The problem definition can include the meaning of an artefact.)
Second "order"	3	Normative & empirical theories and beliefs (social order)
	4	Favourite state of well being and comfort

Source : Grin & Van de Graaf 1999

If we refer to this interpretative frame when studying the control group, we can observe that consumption behaviour was first discussed at the first order level. However, the socialisation brought by the cognitive transfer group has changed the structure of people's interpretative frame because it has introduced:

- Changes in the assessment of solutions as some behaviour have been implemented and assessed, energy and water savings for example.
- Changes in the definition of the problems & the meaning of the solutions. For example, saving energy is not only equivalent to saving money, it is also a way of protecting the air quality.
- Changes in normative and empirical theories. For example, the idea that personal action was impossible or that nobody was interested in environmental issues has changed

If we look at Tables 5.1 and 5.2, in the column describing the « meanings » that were the source of a controversy during the meeting-, which we can interpret as a potential source of change in the interpretative frame-, we can see that some issues are linked:

- to the definition of the problems and to the meaning of the solution (the environmental impacts of savings, the meaning of artefacts like a bill or a an exhaust pipe or a packaging)
- to the normative and empirical theories and beliefs as well (for example: the belief that the planet is not going to support an over-consumption of its natural resources, or normative beliefs about the relative meaning of one's action or about who should be in charge of information).

On the other hand, there was no change in people's favourite state of well being and comfort.

If there is no consumption unless it fits with people interpretative frame, then people's favourite state of well being and comfort play a main role in consumption. To this extent, their status in the interpretative frame model is decisive and is far more important than the one that was given to personal norms of comfort and convenience in the improved version of the TRA model (see chapter 3) where convenience, comfort and cleanliness are analysed as parameters of the anticipated consequences of an action. And yet, we can observe that much of the reluctance at behaviour changes was expressed with a reference to well being and comfort and that there was no change in people's preferences on these matters. In fact, as in the case of the heating temperature, behaviour changes reinforced the favourite state of well being because, for example, the new behaviour appeared to generate more comfort. However adopting savings behaviour can go against some of the consumers' favourite states of well being and comfort. They will have an impact in:

- the decision of switching off pilot lights (watching TV in bed you have to get out of it if you want to switch off the TV completely)
- the purchase of energy saving light bulbs: some people are unsatisfied by the quality of the light.

It could also be a reason for not using public transports: despite having a subway station next door, Anne seemed to prefer using her car, as she was able to smoke in it. Things are also difficult for changes in purchasing habits, as one needs to take time to read the labels (perceived idea of comfort). Slowing down when driving seems impossible as it goes against the favourite state of well being and comfort in terms of time gain and of the possibility of releasing one's tension.

The consumer's favourite state of well being and comfort that go against sustainable action can be summarised in Table 5.4.

Table 5.4 The consumer's ontological preferences involved in some sustainable actions.

ACTION	ONTOLOGICAL PREFERENCE
Reducing the heating temperature	Temperature preferences for the day and for the night
To start the dishwasher and washing machines only when they are full	Availability of clean items
Switching off the TV pilot lights	Comfort : you must get up again from you bed to switch it off
Using low consumption light bulbs	Comfort : the light is unpleasant and not bright enough
Purchasing habits	Reading labels is difficult and time consuming
Using public transports	Comfort of a private space.
Reducing speed	Getting rid of tensions

However, people are not only consumers, there are citizens too. According to Grin & Van de Graaf (Grin & Van de Graaf, 1999), this means that another interpretative frame corresponds to that other facet of people's identity. We can attempt to describe their interpretative frame by studying the example of waste separation, the wide scale socialised action considered as an expression of civism that was described in the previous section.

We can observe that even though people's sensitivity to the environment is mobilised as a "reason to behave", many people do it because they've been told so: it's a sign of their goodwill as citizens. Actually, people are expected to enter the recycling process. By doing so, they put themselves in the position of what Grin & Van de Graaf call "service providers" i.e. people who have a technical perspective (e.g. technicians, nurses or social workers) and consider artefacts as a "normative" item and a guide for action. By opposition "leaders" such as institutions, managers or households consider artefacts as both an aim and a mean. In the case of waste separation, citizens are expected to give up their interpretative frame as consumers and to consider appropriate artefacts (bins,

containers) as guide to action whatever their preferences in terms of well being. They must be technical cogs in the machine. We saw that it happens although there exchanges between both identities. Anyway, such a position allows us to refer to the interpretative frame of technicians designed by Grin & Van de Graaf and to apply it to the waste separation case for suggesting a description of the interpretative frame of the citizen.

In the technician interpretative frame, the favourite state of the technician is defined according to the meaning he/she prefers to give to an artefact (4), in our case, the waste separation bin. People are expected to consider it as a management tool for a better environment whatever the meaning of the word (referring to hygiene or to pollution). This artefact belongs to technical and scientific fields and various assessment systems (3). In our case, the assessment system is defined according to the specific conception of what should be the state of the society in terms of norms and laws but also according to social values such as fairness. When looking at the first "order", the definition of the problem and of the meaning of solutions is seen as a technical issue (2): each solution corresponds to a specific meaning. In our case, the problem is whether or not, or to what extent, using the bins and the social meaning of each sorting solution. Finally, the assessment of solutions is made in terms of cause-effect items of efficiency (1). In our case, the assessment of the efficiency of waste separation itself is made according to cause-effects criteria that were often underlined by the group's participants (odour, frequency of collection etc).

We can sum up this description as presented in Table5.5:

Table 5.5 Interpretative frame of a citizen for socialised sustainable action taking.

First order	1	Causal assessment of solutions in terms of efficiency.
	2	Definition of the problem and meaning of the solutions according to the second order. (decision on service providing)
Second order	3	Assessment system i.e. norms & social values (fairness, equity etc)
	4	Favourite meaning of the artefact

Referring to chapter 4, people's identity is also one of a living being that consider itself as part of the Eco-sphere and whose favourite state of the world is one in which there will be no ontological threat to its survival and health. To this extent the meaning of the word ontological is the same for Grin & Van den Graaf and ourselves and we will use it in that case.

We can try to describe this interpretative frame that we call the interpretative frame of “living beings” because it is based on an ontological preference, by referring to both the characteristics of the Eco-sphere defined in the previous chapter and the indications given by domestic activists in the field research. We can observe that when considering their identity as living beings, people’s favourite state of the world is one which reduces the environmental risk and enhances values of the Eco-sphere such as trust, good faith, freedom etc. Therefore, they are going to consider every action through this lens hence interpreting the signs given by their observations accordingly. Consequently, normative beliefs about the risk are that State intervention doesn’t wipe out the responsibility of the individual. The meaning of solutions (first order) are considered accordingly. Referring to the observation of Halkier in chapter 4, artefacts are used as a tool for showing one’s convictions. For example, owning a solar panel in France is not neutral but an expression of commitment to renewable energies. Pros & cons are assessed according to practical values such as price but also such as well being and comfort. This is illustrated in Table 5.6.

Table 5.6 Interpretative frame of a domestic activist for sustainable action taking.

First order	1	Assessment of solutions Evaluations of the pro & cons (can include well being and comfort)
	2	Definition of the problem and meaning of the solutions according to their environmental impact
Second order	3	Normative belief about the environmental risk management and the layperson responsibilities.
	4	Ontological preferences i.e. risk reduction, emancipation of the eco-sphere.

We can notice that the ontological preference for sustainability is going to influence the “favourite state” of the world of the other interpretative frames of domestic activists i.e. the meaning of artefacts is going to be considered differently as well as the preferences in terms of well being and comfort.

For example, such is the case with Elizabeth: confronted during the cognitive conference group with the sustainable character of energy saving bulbs, she hesitates to buying any, as she doesn’t like their lighting quality. Finally the solution she ends up with is the following: she gets rid of her halogen standard lamps - as such bulbs are the most energy consuming -and she replaces all the halogens bulbs by incandescent ones. By doing so, she changes her behaviour into a more sustainable one while maintaining her personal norms of comfort.

Therefore our assumption is that there are movements in between people's various interpretative frames (as seen above as well for waste separation) and therefore that they can influence each other. However, as Grin & Van de Graaf point out, people's interpretative frames vary according to the situation they're in. Chantal, for example, prefers to drive fast and recognises that she exceeds the speed limit because it is convenient for her. As a driver her favourite state in terms of comfort is one of speed. Nevertheless, at home, she considers savings to be very important. In her case, the reminder that driving consumes energy i.e. money (change in the problem definition) added to the possibility of bargaining a speed reduction with a shorter stay of her children under the shower (assessment) induce a beginning of behaviour change *«I pay more attention to the number of kilometres I drive, I think that I consume less.»* This change occurs after the second meeting and is confirmed during the evaluation interview *« I try to drive at a lower speed »*. Going against one's favourite state takes time and need a re-motivation but it is possible. The ideal situation would occur when driving more slowly will be part of her favourite state.

The importance of savings has made her reconsider the interpretative frame of the driving situation which suggest the hypothesis according to which a change of the favourite state linked to one consumption situation can influence the favourite state linked to another one. Anyway, we can see that the change of interpretative frame takes time to stabilise itself and that it takes several exchanges before even starting to be implemented.

Reducing one's speed is also civic behaviour, hence the suggestion that the consumer's favourite state can influence those of a citizen as in Chantal's case. The opposite situation can happen too: many of people's reluctance to changing their way of using their car or to buying a LPG one, were expressed by reference to the lack of fairness of treatment they were witnessing or expecting from the institutions (citizen's assessment system). Having said so, if we consider people as consumers, we could notice that, after the cognitive transfer, most consumers didn't consider the behaviour changes that were suggested as going against their preference of well being and comfort at least when they were talking about savings. However, when it was the case, people ended up sometimes with new solutions which allowed the integration of both ontological and convenience preferences as shown for Elizabeth in chapter 3.

If people's interpretative frames vary according to the identity to which they refer in every situation, our assumption is that the heart of the problem is that we have to look for ways of modifying the interpretative frame to which people refer for sustainable consumption if we want to increase

sustainable action taking. A way of doing so is to allow movements between the consumer's interpretative frame and the citizen's or the "living being" ones.

In that perspective, first of all, we have to consider that well being and comfort have strong links with physical perceptions. The sensations of pleasure and comfort are directly linked to body sensations while convenience is often linked to our body routines. Following this path, we can wonder whether one of the core issues for the implementation of individual sustainable behaviour is not a change of the interpretative frame that we use to understand our physical sensations. For example, referring to the understanding of the red pilot light, what was interpreted as a sign of good functioning has turned into a sign of energy waste after the cognitive transfer.

Secondly, the CT experience shows that a way for allowing movements between interpretative frames is to mobilise arguments from the second "order" and particularly, in the case of sustainable consumption, people's ontological preferences as living being; probably because such an identity is pre-eminent over all the others. This mobilisation supports the re-interpretation of sustainable consumption with the lens of ontological concerns about the environmental risk therefore allowing an empowerment process.

In what we could observe, it was done because of the socialisation of the environmental risk.

An extreme example is given when studying the changes in Gaël's perception of sustainable behaviour. At the first meeting, Gaël is very confident in his conception of the way in which the environment is handled and controlled. He says «*Economic criteria are less predominant. At least the environmental constraints are integrated into decision schemes*» and doesn't do anything. His ontological concerns about the environment are apparently weak. At the third meeting, he says: «*economical considerations are overtaking everything* » hence doubting of the control of the environmental risk. In between, he has tried to modify his purchasing habits and has looked to his water consumption. The cognitive transfer has modified his interpretative frame of the environmental situation, maybe because it reaffirms the value of individual behaviour which means, on the contrary, that the situation is not as good as it seems. Gaël left France for Italy and it was not possible to meet him for an evaluation interview. However, during the meetings he was one of those who referred to the idea of having an increased awareness of what could be done thanks to the CT. Another example is given by Samuel who is very worried by the consequences of the environmental threat to health but thinks that there are no worries to have about energy. He implements energy savings after the CT. Referring to these examples and to those that were already quoted (Elizabeth, Chantal, François etc) we can suggest that socialising the meaning of action destabilises or

questions people's preferences in the first place and, then, is the starting point of to-ings and fro-ings between the different interpretative frames that people take according to their social identity.

Gaël was also very aware of the limit to one's action. Actually, he did try to take sustainable behaviour but gave it up because he couldn't find any signs of encouragement from the institutions. In a fixed social background, the socialisation made by the cognitive transfer is not strong enough to consolidate a radical change of behaviour. The issue of the meaning of one's behaviour change in a society where the other actors are perceived as having no will to change their own is central again as it was in another context for the 3 Suisses employees. It shows the limits of a partial socialisation.

It is not surprising, therefore, to observe the fragility of the empowerment process that was achieved during the cognitive transfer groups.

First, Gaël's criticisms of the water tax system and his withdrawal from any sustainable action taking had an impact on the group's dynamic. Christiane for example comments it as such: « ... *Some people are almost ready to take sustainable action then they forget or wonder why bother... there was a sloppiness in the last meeting. A guy had tried things and then he said no, it's not worthwhile* ». Christiane stayed silent during most of the last meeting and without giving up the behaviour changes she had implemented was not very optimistic. Samuel shared the same analysis. This example shows that a socialisation based on group dynamics is all the weaker if it is not supported by other elements. In contrast, the absence of action taking from Roselyne in the 3 Suisses group had no impact on the behaviour of the other group members. This might be explained by the socialisation of sustainable behaviour on the wider level of a whole company: the impact of one's withdrawal was less important.

Secondly, we can observe that the two people that were quite reluctant to behaviour change in the first group give up action that requires an effort at the first occasion. Anne, for example, gives up the idea of convincing her daughter to use less water because of the sunny weather: «*In summer, I always feel that I consume less anyway*». In the absence of a general social concern, sustainable action taking can turn out to be sensitive to the weather forecast!

In chapter 4 we saw that the less immediate reward is given by a sustainable action, the more scrutinised are the institutions' positions. Our assumption is that most immediately rewarding sustainable action can be considered within the interpretative frame of a consumer and mobilise elements of the first order, among which utilitarian arguments. However, to help people taking other sustainable action with no immediate reward, one has to mobilise elements from the second order of

other interpretative frames that can challenge the consumer's one therefore inducing a change of frame. In other words, changing the interpretative frame is a two step process. At the first step, the socialisation process questions people's ontological concerns, in a second one it implement various exchanges between people's various interpretative frames each of them being coherent with one aspect of their identity.

2) Formal constituents of the socialisation process contribute to creating the conditions of a change of interpretative frame.

The CT experience shows that changes in the interpretative frames are enhanced by the use of a proper artefact (1) and by the conditions of the socialisation process. (2)

a) Artefacts support the change of interpretative frame

There are some artefacts such as low energy consumption bulbs or washing machines programs which are essential for action taking because action is embodied in them: it is impossible to save electricity this way without them. Other artefacts are conceived as informative ones: they must deliver correct information that will hopefully lead to behaviour change. To this extent, the EEB induces action taking as:

- It gives practical information. People appreciated the fact that they could implement some actions immediately without further information or reasoning. They often refer to the word "practical." It is like a « *collection of tricks* » says Samuel.
- Its personalisation allows a comparison process: *«I've told myself that the household's habits should be changed because it was above the average»*. The EEB was conceived not only as a way to bridge the gap between the household and the outside world but also as a way of improving the personal control and self-effectiveness components of the empowerment. To this extent, one's ability to measure is important.
- It can be manipulated as people can recalculate their consumption and impact at home and take the action they find best adapted. For example, François decides that the type of contract he has with the electricity provider is not adequate anymore and changes it. However, the ability of manipulating one's EEB should be reinforced: some people wished

they could have spend more time working on their own case, calculating all their consumption themselves.

These last two elements underline:

- the importance of the reflexive quality of informative artefacts aimed at inducing action that is described in Geller's Actively Caring Model (cf. chapter3). It can be observed in real life when looking at the interest people pay, on their water bills, to the schemes which summarise their past water consumption. Reflexivity reinforces the perception of one's control over action. It has been well understood in The Netherlands where the Global Action Plan always gives feedback on people's action both on a personal and collective level. The feedback of one's action on a collective level is also appreciated and reinforces people's involvement in the few occasions in which it occurs in France. For example, Franco says that he did appreciate very much the fact that the local waste reception centre has sent him an assessment of its activity. Such an example is very rare though and leads us back again to the question of the other social actor's involvement.
- the importance of a physical appropriation process of the artefact thanks to the reflexivity of information and manipulation of the artefact itself.

However, may be the most important quality of the EEB is that it conveys elements belonging to two kinds of interpretative frames therefore allowing people to link one with the other. On the one hand, the EEB mobilises elements of the consumer interpretative frame: it delivers utilitarian information about potential savings; it is coherent with people's favourite state in terms of well being and comfort. On the other hand those elements are immediately connected to others that belong to the "living being" interpretative frame: information on risks issues linked to the impact of one's behaviour. Therefore the EEB is a means of having an impact on the world. The intrusion of those elements forces a shift of perspective that is enhanced by the socialisation process. As a result, the EEB is coherent with the consumer's interpretative frame while allowing its modification due to the embodiment of elements that mobilise another frame. The EEB's efficiency is made of this capacity to mobilise and modify various interpretative frames.

b) Formal constituents of the sessions, among which de-routinisation, contribute to create the conditions of a change of interpretative frame

- First of all, the place where the sessions were held was important. Being outside the household in a « neutral » place is considered by people as a positive element. A place with immediate reference to the household's environmental impact could be a positive element

too. Suzanne refers to Aut MOT test garages where a discussion could be made while the tests go on. Most people consider as well, that a company is a relevant place but to the condition that it has shown interest in the environmental issue beforehand.

- A second element appears in Anne's assessment of the group. It is the fact that there were no power relationships within the group with one side animated by « moral » purposes wanting to change the behaviour of the other side. This element might be quite important as, in the 3 Suisses group, Pierre was obviously disappointed by the fact that the company's training was only an informative one with the company holding information on one side and the lay people (its employees) on the other. This refers again to notion such as reflexivity, participation (by contrast to receiving information in a passive way) and fairness of treatment between social actors.
- However, a most important element is constitutive of the groups themselves: it is their "de-routinisation" character.

When looking at the way people were considering their daily actions during the field research, it appears that most sustainable behaviour changes are changes of habits. Most saving behaviour are habits that we don't pay attention to in our daily lives. Other actions such as the route we take inside a supermarket and the products we buy, the transportation mode and the way we are using them are routines too. To change one's habit reflexivity on one's behaviour may be necessary. We have to consider that the whole family can be concerned by a new behaviour norm, which might lead to its reinterpretation. We have to reconsider whether we think that our daily routine is coherent with our changing appreciation of the word, with norms that comes from the outside i.e. with our changing interpretative frame. Most analyses assume that an actor will act in a « rational » way and will assess the various perspectives offered by the different type of behaviour to which he is confronted. When the automatic pilot is turned off, one is able to examine our routine behaviour from a different perspective and eventually we can modify it. This process is called "de-routinization". It is followed by a "re-routinization" one: the old habit is changed into a new one (not into a new conscious action) until the following de-routinization will call it into question.

However, our assumption is that "de-routinisation"

- favours a change of interpretative frame.
- is very different from including new criteria in a list of elements mobilised rationally before taking action: it is a way of favouring reflection on the meaning of action.

Which events are able to make you think about your habits? Spaargaren (Spaargaren, 1997) speaks about external events such as the interruption of a guaranteed supply of water and energy, a strike or

a home improvement project i.e. all elements that question the relationships that people have established with society's structuration systems. Referring to the cognitive transfer group we can add that environmental catastrophes can play this role too as the Erika's wreckage on the French coasts has led some participants to reconsider the choice of their usual oil supplier. From a broader perspective, we wonder whether the perception of an environmental risk can lead to a change in daily habits. The field research shows that this can happen. For example, a pharmacist has decided to reduce the frequency of the family daily car trips after noticing an increase in bronco-infections. De-routinization can also come from the simple fact of having to justify one's position therefore one becomes aware of the reasons why he/she is taking action and this awareness can drive him/her to change his/her behaviour. This is at stake during the cognitive transference group, even during the interviews. Many participants said: *"We became aware"*, *"It made me make good resolutions"*. Therefore, one can say that de-routinization is not enough to induce action as it should be preceded or accompany by information that establishes the existence of these new norms and give a meaning to them which is not always the formalised one. Taking the example of the heating temperature reduction again, it was presented in the 70's as a way of fighting the oil crisis, although it was, as well, a source of savings and- according to the group's members- a source of comfort.

Is a de-routinisation process compulsory for empowering people for sustainable action taking? A formal one might not be necessary.

If we refer to the last example, it is possible to imagine that somebody who spends the night at a friend's place may notice that he sleeps better with a lower temperature. This "noticing" may not be conscious at first and perhaps its repetition will be necessary before a change of behaviour will take place. In any case, the behaviour change will not be induced by a de-routinisation process but by the repetition of a physical sensation.

Following that line, Kauffmann (Kauffmann, 1997) emphasises the importance of the vision in the integration of new behaviour norms. He shows that vision records many more details than our consciousness and is determinant in action taking. Our vision «automatically» establishes the difference between our norms and other peoples one's. To this extent, we could say that the family, friends and neighbours are determining factors in establishing common social norms but that TV shows and movies could play the same role. As a matter of fact, the family extended to close friends is quoted in all the interviews as the place for discussing sustainable behaviour that belong to the private sphere.

This analysis draws the attention on the importance of physical sensations in behaviour change.

➤ The body sensations can act for or against empowerment

We saw that physical sensations play a major part in the assessment of pollution, and the embodiment of action; that the rationality at stake in the Eco- sphere is the body's one made of observations, experiences and sensations; that our body sensations participate in the reflexivity process and that a change of interpretative frame allows a change in the way we perceive our physical sensations. To this must be added the importance of physical sensations in people's information system.

We can observe that, next to the « official » information that was, for example, given during the cognitive transfer, another source of information appears which is just as important: it is what people observe in their life, their experience. Embodied in people's life, such kind of information is powerful. It is the reason why, people's accounts of their own practices have important convincing power: the demonstration that action taking is possible and worthwhile is held within the information itself. A demonstration of such convincing power is given, in the 3 Suisses group, by Pierre's behaviour change. During the second meeting, Gérard says that he has given up burning fallen leaves as it was polluting and a cause of asthma for his neighbour's son. In the last meeting Pierre refers to Gérard's account and says that he had paid attention to this information and has stopped burning leaves. A good demonstration of the hierarchy of information that induce sustainable action taking is also given by Pierre: in the second meeting he says that he doubts the information about pilot lights' energy consumption that was given to him during the company's information session. On the other hand, Daniel says that, after the first session, he had the idea of checking the pilot light's consumption of his electrical appliances and that they go from 2 to 15 Wh. Such information is considered as « *non negligible* » by Pierre who seems far more convinced by Daniel than by the information session he's been attending. Actually, he tries to switch off his pilot lights between the two sessions. However, Pierre's video player can't be switched off otherwise it loses all the information that is registered in it. Confronted by this characteristic, Pierre gives up the idea of switching off the video player's pilot light, which is another demonstration of the embodiment of action within an artefact. Confronted by a "reluctant" artefact, good information combined with a will to change are of no use.

Physical sensations are also elements of resistance to behaviour change. First of all because our ontological preferences as consumers are grounded in them, but also because, according to Kauffmann, habits are embodied in ourselves so deeply that the body routine is a "heaviness" that we must fight in order to be able to embody a new habit. Body "heaviness":

- Materialises itself in a conflict between the mind (that wants to change i.e. to embody a new behaviour norm) and the body (which resists to it).
- Is painful: people will refer to it as such (they use words as unpleasant, boring etc.)

Therefore people will tend to reduce its painfulness as much as they can.

The more the distance between the Self and the norm/behaviour is important, the more time it takes to reach a behaviour change and the more unpleasant the body heaviness is. But this gap must exist though as, in the opposite situation, the coherence between the two makes impossible the creation of the distance that will create the condition for the “injunction” of action taking. A sign of this perfect coherence is given when there is no representation of lost time. At the opposite, verbatim such as *“it takes time”* were often heard when talking about actions that would ask for a big body routine change, sorting batteries for example.

The fighting process itself is what Kauffmann describes as “the little” movie. According to him, the behaviour changes process starts with an irritation that is the consequence of the existence of the gap that was previously described. Then, the individual is going to enter into the “little movie” i.e. a kind of day dreaming and thinking process during which the present action, the present body behaviour scheme and what is felt as the ideal situation (the new behaviour norm) are going to be confronted for a while until the irritation that results from this process will give birth to a brutal behaviour change. The ground research gives an example of such a process when François states: *“Every day I was asking myself why are we using this? why don’t we use something else? ...Now it’s over, out, we’ve changed it”*.

The little movie process takes time as it takes a while for the mind to convince the body to change its routines. Chantal reflects it well when she says: *“once you’re aware, action follows slowly, but once you’ve done the first step then it (action) comes more easily”*. If we describe which elements are confronting each other during it we can see that the new norm is weighted with body sensations:

- The body rhythm is at stake when routines succeed one to the other. For example, to change one’s routine in the supermarket in order to look at the labels or to find a specific product. Here again the “it takes time” item reappears as a sign of the gap between the actual and the expected behaviour. People look for a compromise in order to reduce this gap at the least cost. They ask for a clearer identification of the products’ quality on the packaging or for the design of specific department for sustainable products within the supermarket. Two women rely on the visual aspect of washing liquids (a bottle) to justify that they didn’t take the time to read the labels. It might be because of the smaller visual effort.

- The sensation of cleanliness interferes with the decision to change one's washing products. Cleanliness is perceived as an odour that refers to the usual type of washing powder that is used. Changing a washing powder is not only linked to a change of rhythm but also to the acceptance of a change of odour.
- Hearing interferes too. It is often linked to the use of water: listening to the sound of the running tap water, washing one's hair with rainwater or taking a long bath are all sensations that can interfere with or against a water saving norm.

It should be noticed that both the vision and artefacts are important factors in "the little movie" process. Kauffmann shows that they can stand as disturbance factors that will take an active part in the injunction of taking action. For example, he quotes a woman that feels that she has to start ironing only when the pile of clothes reaches a certain level. These kinds of visual signs were found in the cognitive transference groups when people mentioned that because of the cognitive transfer, seeing a "red" pilot light was the signal that it should be switched off.

More generally speaking, Kauffmann insists on the importance of the eyes in the perception of social norms. Many of our daily routines have been embodied during our childhood by the simple fact that we have watched our parents and family doing so. If we go back to the field research results, the family appears as the first place of socialisation of saving behaviour, sometimes since the early childhood. People refer to what their parents were doing, what they were taught and try to raise their kids with the same norms. The fact that they meet the opposition of their teenagers is more proof that such behaviour belong to the family/parent's norms as they are rejected as such during adolescence. It is the case for Chantal who is always fighting her son's long stays under the shower. Actually, water or energy consumption becomes an endless subject of conflict. The conflict linked to the socialisation of behaviour norms within the household is not restricted to the parents/children relationships. It can also arise within a couple. The best example was given by the endless dispute between Franco and his wife: as soon as one has reduced the heating temperature, the other raised it. This was so prevalent that we can guess that, perhaps, the thermostat issue was symbolic of a deeper conflict. Without going to this extreme, other people try to convince their partner to change their behaviour. For doing this, they use an artefact as a way to encourage the behaviour (a box for battery recycling is put on the kitchen table) or they show the example themselves (especially for waste separation) referring, once again, to the importance of the visual example.

All of this is very different from assuming the « rationality » of the actors like both the Attitude/Behaviour model and the Actively caring model, that were described in chapter 1, do-

consequences that it seems possible to make a straight division between motives and behaviour. However, it seems that the assumption of a «rational» attitude is correct in only one situation: the purchase of important goods for the household such as white products or cars. In that case, people do prepare their purchase; they gather information, discuss about the choice they have etc. Accordingly, the problem of making them purchase a sustainable item can be formalised in how introducing sustainable concerns in their list of purchase criteria turning those concerns into what marketing people call «a top of mind » criteria. Franco and Chantal describe this well. Chantal bought a new washing machine and says that Eco-efficiency was her main purchasing criterion. Franco decided to replace his toilet's system by a double flush one as he learned that such a system was more efficient. In their mind the rationality of saving money goes together with the sustainability criteria, the price of the item itself is not mentioned.

Daniel from the 3 Suisses group gives more information on the assessment of price. He is the example of the introduction of time as a rational and mastered element for the assessment of a purchase. He has bought a new fridge and, a couple of years ago, a new heater. He says that he chose to pay a higher price for both of these artefacts because they were more efficient while being friendly for the environment. He considers this purchase as a win-win choice as the savings he makes pay back the price difference. We are here in a very rational and conscious decision making process in which the environmental criteria are an element of choice such as the product's price itself. The difference with other purchase situations lies in the way time is taken into account and related to the price characteristics of the products. This doesn't occur very often: the ADEME and consumer magazines such as "65 millions de consommateurs" both campaign with little success to make people aware of the price of a car in the long run. However, the socialisation of the time issue that was observed in the 3 Suisses groups, could have been a consequence of the socialisation of environmental issues that was made within the company.

Conclusion:

Empowering people appears as a matter of giving back a meaning to action in a society where people don't classify the environmental risks per category but have a global perception in which every risk is added to the other- hence contributing to the construction of a risk society. The meaning of sustainable action appears to be built on two elements:

- the socialisation of the environmental concern to which the action is related,
- the socialisation of the action itself and on the way in which it is related to the environmental issue. The acknowledgement of people's ontological fear towards the

environmental risk and the socialisation of approaches that allow reducing the scale gap between the importance of the environmental risk and the impact of individual action are a main constituent of the whole socialisation process. Particularly those that allow the re-introduction of a mid-term perspective in people's perception. (The time perspective to be mobilised shouldn't exceed the length of a man's life; too long-term perspectives have less impact because people are not directly concerned: observing the consequences of one's action should be possible⁴⁹.)

Both socialisation processes are made of information through the bias of conventional systems but also through shared experience and discussion. They are made of de-routinization and comparison. They are made of artefacts. They are made of the involvement of all the actors that may contribute in taking such or such sustainable action hence re-assessing the collective aim of achieving sustainability.

Within this frame, empowering people for sustainable action taking seldom takes a "rational" path, and can be generally analysed as a process allowing a change in the interpretative frames that are mobilised by people according to the various aspects of their identity. In this respect, we can identify:

- action that belongs to the interpretative frame of a consumer. They are all belonging to the Techno-sphere and can be influenced by enhancing their utilitarist consequences.
- action such as waste separation that belongs to the interpretative frame of a citizen
- action that belongs to the interpretative frame of living being. They are aimed at contributing to the reduction of the environmental risks.

Moreover, the interpretative frame of one action varies according to the situation one is in. This is another sign of the value of the analytical frame of "the provinces of every day life" suggested by Otnes (Ch 1).

The problem is that most sustainable behaviour is interpreted within the frame of consumption while their meaning belongs to a "living being" frame because they can participate in answering the environmental risks that are an ontological concern for many people. Therefore the challenge is to induce a change of the interpretative frame of the individual hence changing the meaning of action. A way of doing so is to socialise the meaning of sustainable action according to ways described before. The socialisation process is going to destabilise people's preferences within each interpretative frame and to allow continuous exchanges between them, hence resulting in a re-

⁴⁹ This corresponds to what the economist call "discounting".

composition of the interpretative frame that is used for an action. Changing one's interpretative frame as a consumer for a "living being" one contributes to empowering people because it shows them that they've got a personal capacity of action.

An artefact like the EEB helps the change of interpretative frame because it can belong to all of those that are mobilised in sustainable action taking. Therefore it supports the creation of paths between them. More generally speaking, artefacts are interpreted differently according to the interpretative frame in which they are used. Guides for citizen's action, they must be coherent with their preferences as consumers in terms of well being and comfort while transforming themselves into policy tools for the domestic activist. When used as a socialisation vector, the artefact efficiency will depend on the capacity of its objectal carrier to embody various interpretative frames and to allow a connection between them. Using an informative artefact, manipulating and personalising it introduces a reflexivity that is a main condition for the appropriation of the artefact itself. Hence it reintroduces as well the importance of the body sensations in the empowerment process. They have first appeared as a factor of risk perception and assessment, then as a factor favouring behaviour change or resisting it. Generally speaking, we could state that because physical sensations (or their absence) are the basis of environmental risk perception, changing people's interpretative frames in order to implement sustainable action is in fact changing people's interpretation of their body sensations. It could be also reintroducing them when they have disappeared. To this extent, information artefacts such as the EEB can play an important role, because they allow the measurement of things (like pollution levels) that would be impossible to apprehend otherwise therefore allowing people to take action and to assess it.

However, as we saw in chapter 4, the size of the environmental risks to which most sustainable consumption responds (for example the green house effect) is so big that action seems meaningless unless inserted in a collective aim. This is the second field in which the socialisation process is efficient: it helps understanding that one's action will not be isolated.

But the scale of socialisation defines its limits and this is the point where the lack of institutional involvement analysed in the previous chapter comes to the fore.

In the rare cases of sustainable actions that are already socialised, we can observe that their meaning and pertinence is always questioned within the broader frame of the involvement and fairness of the other social actors. Some people consider stopping waste separation because of their suspicion of the institution's will to make people carry the burden of waste recycling. On a smaller scale, it is because the environmental policy of the 3 Suisses doesn't appear to be shared by many other companies that the pertinence of taking action is questioned. Finally, when dealing with sustainable

actions that are socialised in the CT groups only, the lack of institutional involvement limits the range of action taking to the sustainable behaviour that offer both a reward for the consumer and improved sustainability. Domestic activists are an exception: the socialisation of sustainable behaviour mobilises their living being interpretative frame, which is going to encompass all the others. Otherwise, the lack of institutional involvement goes against action taking.

This analysis leads us to wonder which notion of empowerment is coherent with our results.

The theory of the ecological modernisation of production and consumption suggests that empowerment is an increase of capacity, of personal ability which can grow due to work and appropriate help (information, education etc.) without any impacts on the other's life. According to such a definition- that is in line with Geller's definition of empowerment as "*the conviction that one's action can make a difference*"- empowerment exists within a given social situation i.e. within a given structure of a power relationship. It was in fact the way the cognitive transfer has been conceived: not as a way of redefining the relationships of lay people with other social actors but as a way of redefining the relationships of the lay people with the environment. However, household empowerment has appeared to be limited by the perception of one's relationships with the institutions and with other element of the environmental risk construction such as time and territory. This shows the limits of the models that analyse action taking within the fixed frame of established social relationships.

Following this path, if we refer to:

- the constant criticisms of the Techno-economic system,
- people's expectation for political signs coming from the institutions on the issue of the environment
- and to the importance, in the behaviour change process, of the quality of the involvement of all social actors that have appeared during the field work,

empowering people to take sustainable action would mean taking their criticisms into account hence redefining what a participant called «the social contract» between all actors of society: institutions, industry, trade and lay people. To this extent implementing sustainable action within the household enhance the necessity of both redefining the policy-making system, according to the de-centred model of power mentioned in the introduction, and referring to other ways of considering the ecological modernisation of household consumption.

Ch 6. General conclusion

This work shows that a capacity for adopting behaviour changes might exist in France, elsewhere than among convinced ecologists. Against a background which is characterised by the very weak socialisation of most sustainable action, one of our main results is that providing an adequate information tool could induce some behaviour change to the condition of achieving a minimum level of socialisation of the meaning of action. To this extent hypotheses that were raised at the beginning of this work were found to be correct: raising awareness of the link between individual action and its benefit for the environment and of practical action, support sustainable action taking. This holds as well for information embodied in an artefact. However a simple generalisation of this experience on a wider scale cannot be considered without questioning the State position towards sustainability. The research suggests that sustainable consumption depends highly on people's relationships with the State and will not be taken on a large scale unless higher involvement of the State through the socialisation of the meaning of action. Furthermore, the kind of expectations that people build towards the State and the variety of identities that the individual mobilises when taking sustainable action suggest that the frame of the ecological modernisation of consumption might be too small for good understanding of the process of sustainable action taking.

Our hypothesis according to which the lack of action is linked to a lack of representation of existing solutions happened to be correct but should not be understood as a simple information constraint. The field research has shown that the situation could be better described as one in which people perception's is one of a lack of hold over environmental threats, which makes taking sustainable action meaningless. Such perception is mainly linked to the scale gap that exists between the size and impact of environmental issues and people's personal action range. What is missing for bridging the gap is as much giving back a meaning to action as the knowledge of actions that can be taken on personal grounds or as a proper tool for supporting it.

In most cases, environmental issues have turned out to be perceived in terms of environmental risks. People have appeared very concerned by them, particularly by those that are perceived as representing a threat for the survival of mankind (air pollution, green house effect etc) all the more so as they are perceived as those on which individual action has the least impact. Therefore information about the impact of individual behaviour on the global environmental issues is

relevant. However, even though some might consider it obvious, other elements of the environmental risk construction should be noticed:

- There is a hierarchy in the environmental risk perception, which is linked to the degree of the perceived hold on them that can be elaborated. Such a perception is strongly linked to people's ability of comprehending and mastering the risk within the limits of their physical perceptions. To this extent, people are more likely to address pollution affecting the neighbourhood than regional and in turn global environmental issues. This hierarchy will affect people's perceptions and action, especially when confronted with the decision of participating in collective actions.
- However, even if people's perception of the hold they can have over the environmental risks vary, people's construction of the environmental risk is not a sectorial one: each perceived risk is added to the other, therefore getting rid of one risk is not enough for changing the perception of a global environmental risk.

The consequences of such a construction of the environment as a risk is that the perceived lack of hold over many risks generates fear and prevents action taking.

Against this background, the cognitive transfer's effectiveness is linked to the socialisation of both this fear and the link between risk prevention and personal action because it gives back a meaning to action.

The idea of socialising the risk and the fear seems quite paradoxical because there is widespread media information about environmental risks. However, we could observe that:

- At a macro level. People's fear is often ignored. Talking about one's fear, and/or suggesting action is not socially rewarding (most people feel that they will be considered as troublemakers) and when some participants dared so, they were ignored by the institutions. Moreover, there is no exemplary behaviour from public actors on all the specific issues related to sustainable behaviour that answer global risks (no internal promotion of energy savings or no promotion of alternative transportation system for example). Belonging to an environmental organisation where these issues can be debated is generally not considered to be socially rewarding either.
- At a micro level. People don't talk about the environmental risk even with their closest relatives. When they dare doing so, it is not socially rewarding all the more so as, if someone evokes the issue, he/she is often not aware of the existence of the individual's or household's capacity of action. Therefore he/she can't bring positive inputs to the debate.

Consequently, people preferred to stay silent and don't do anything. This is the reason why, socialising the meaning of action must go together with socialising the action means and recognising people's fear.

This doesn't mean that policy makers should play on people's fear but rather that they should acknowledge its existence and consider it as something relevant-on which it is worthwhile founding a policy- not as the irrational attitude of lay people.

When acknowledging people's fear with a socialisation mode such as the cognitive transfer, the process at stake can be described referring to Grin & Van den Graaf model of interpretative frames where actions are part of a specific interpretative scheme that varies according to people's various social identities. We suggest that the interpretative frame that is introduced by the cognitive transfer mobilises people's ontological preferences as "living beings" i.e. their favourite state of the world in terms of safety and conservation. When mobilised for interpreting daily actions, these preferences are so strong that they are able to destabilise the interpretative frames that are normally involved in the understanding of these actions (interpretative frame of a consumer). By doing so, they help people to reintegrate sustainable considerations hence reformulating their interpretative frames. As a consequence, consumption is given a new meaning. This passage through the "living being" interpretative frame is all the more essential that:

- sustainable actions can't be considered as a whole: one doesn't switch off the light for the same reason he/she will by a solar panel. This is coherent with Otnes' idea of the existence of various « provinces of everyday life » i.e. situations and identities that influences the way in which we interpret our daily action.
- no direct relation of cause and effect can be isolated for each action. Although a major determinant often exists, the meaning of each specific action can vary according to the interpretative frame in which the action is included. For example, driving one's car can be the quickest way to go to work but it can be done also because it is perceived as a safety guarantee for the kids. Hence the difference in the informative elements that turn out to be important. Hence a contradiction with the idea, commonly widespread, that mobilising specific policy tools is enough for implementing each sustainable action. The research shows that it happens to be the case only when immediate rewards can be expected (utilitarianism).

It is therefore important to be able to mobilise an interpretative frame that can challenge all the other ones. In that perspective, referring to people's ontological preferences as living beings has

turned out to be quite efficient for the cognitive transfer experience as it has led most of its participants to make behaviour change.

However, the change of interpretative frame is also the achievement of a group process. Against a background where, as described before, sustainable actions are poorly socialised, a specific focus can be made on the role of intermediate socialisation levels such as the one artificially created by the cognitive transference groups and on their capacity in implementing behaviour change. Positive results such as those achieved by the Cognitive Transfer can be found in other experiences involving intermediate socialisation levels such as in:

- A company: In the 3 Suisses company where sustainable actions have been socialised for a long time, many of them were already implemented before the CT experience.
- Local /neighbourhood groups: Also much more founded on feedback and reward thanks to the institutional involvement, the GAP experience held in The Netherlands led to behaviour changes.
- Close neighbours: we have identified the presence of neighbours as the efficiency element that help people to sort their waste.

On the contrary, research conducted on English GAP groups concludes that most people didn't change their behaviour except on minor, cost less issues (Hobson. K 2002). In explaining her results, the author refers to elements, which are, for some of them, similar to our results. She quotes the powerlessness perception of the participants, the lack of fairness embedded in a process where behaviour changes of other social actors are not considered. However, she states that the program misses *«the emergent and arguably most important process taking place when the information is read »* and assesses that people are questioning social and personal rights and wrongs. She doesn't link this finding to the fact that the GAP group methodology was adapted in England *« aiming not so much for group cohesion but for widespread participation »*. The Action at Home program, GAP's English version, is described as sending information on a monthly basis with step-by-step suggestions of behaviour change, the relationship with the household being on a provider-recipient type with no other socialisation system. We suggest that part of the poor results that are assessed are linked to the absence of the group dynamic and that, even though GAP experiences have a limited audience because the group organisation is time consuming, they can't be as efficient without this socialisation level. This last result shows that implementing sustainable consumption among the French household's can't be reduced to influencing the terms of dual relationships between the household and its environment.

Returning to the socialisation process, we observed that its achievements were always limited by people's perception of the wider social dimension i.e. the institutions' global involvement and the group's links with the outside world. For example, the 3 Suisses participants were questioning the value of the sustainable actions that they and their company took when considering that most companies are not involved in sustainable policies. Further analysis has driven us to state that people's relationships with the Institutions are a (the) major determinant of sustainable action taking. Hence the necessity of re-introducing politics in the analysis of individual action.

In contrast to approaches that consider the consumer/citizen as sovereign with the consequence that the ecologisation of consumption relies:

- on the assumption that the actor's rationality is a moral one that will make him/her choose all solutions that will benefit his/her environment- if given the information means to do so hence adopting a "utilitarian" perspective.
- on the actor's free will of choosing more sustainable products

we state that the relationships at stake in the ecologisation process is a multi-faceted one in which people's relationships with the State play a key role. The reason for that being that the State interferes in people's life in two main ways:

- First of all, as we have already stated, people have appeared very concerned by the environmental risks, particularly by those that are perceived as representing a threat for the survival of mankind. Hence their expectation that the State will take its traditional responsibility for defending the public good and, before anything else, health.
- Secondly, the State, through its multiple service providing companies, shapes people's life. It is involved in people's daily routines because of the multiple Socio- Material-Collective Systems (SMCS) they have access to. People are often conscious of the existence of some of those systems and of the dependence that they introduce.

Both of those characteristics of one's relationships with the State are under people's constant scrutinisation. It explains why it is not possible to avoid politics when considering sustainable action taking all the more so as, in both cases, awareness of the scale gap between the impact of individual behaviour and the size of the environmental issues as well as and of the dependence on SMCS, participates in the construction of people's lack of hold on their environment; hence making individual behaviour change meaningless unless supported and endorsed by the State.

This result could be first interpreted by referring to Spaargaren's (Spaargaren. G, 1997) conclusion on the ecological modernisation of consumption, where he emphasises the role of the State as of

« vital importance where the adjustment of existing consumption patterns in the direction of sustainable development is at stake ». Spaargaren develops this importance by considering the essential role of the State in the provision of goods and services in the Socio-Material Collective Systems from which people depend. Actually, the more the State will develop opportunities for renewable energy consumption and sustainable form of transport, the better the chances of behaviour change. Such an understanding suggests that the issue at stake for policy makers can be analysed as providing the means of a behaviour change (public transports, control on water and energy consumption etc).

➤ My statement is different than the previous understanding and suggests that the main issue at stake is the trust in the Institutions' will to deal with the environmental risk issue.

We have already stated that the environment and particularly high level environmental risks are some of the core issues that catalyse an increasing uneasiness of people's relationships with the institutions (cf. Ch 4). Most people are convinced that the Institutions don't consider seriously the issue, that they are involved in an unsustainable path because they are perceived as more interested in supporting the economical interests promoted by various lobbies than in the population's health and well being. Interestingly enough, a recent thesis has shown that, actually, environmental issues tend to be systematically translated in economical terms by the French institutions and handled in this framework (Rumpala, 2003). In that case, the results of this study suggest that people perceive that trend. Anyway, as long as the government will be perceived as preferring to follow the lobby's guidelines instead of taking difficult measures for people's sake, people will tend to withdraw onto themselves (as Giddens and Beck described) and to focus on privatised modes of consumption. To this extent we suggest that people's withdrawal is the sign of the inability of our industrial and technical society to produce social links. By focusing on the market and avoiding the environmental risk issue and the fear that it generates, the institutions deprive people of the recognition of a global meaning of their action

The main consequence of the present situation is people's lack of trust in the institutions (which is coherent with Beck's analysis). It is not generalised but often found and results in the lack of action taking. Sustainable actions are, then, only considered for their utilitarian values, mobilising people's identity as consumers, not for their "sustainable" character.

In contrast, when people trust the institutions, they consider that the State takes care of the public good and that, therefore, taking sustainable action is not worthwhile unless promoted by the institutions themselves. In that case, people just take actions that have been socialised at a global level with high institutional involvement: it's a matter of civism. They pay attention to the

cleanliness of public areas and sort their waste but to the condition of the existence of an intermediate level of social control that is often represented by the neighbours.

Consequently, it was possible to identify three types of situations:

- Both trust and mistrust don't result in sustainable action taking. Even citizenship is hard to mobilise when the lack of trust in the institutions and the powerless perception are very strong.
- For most people, taking sustainable action because of their civic responsibility is meaningless unless action is compulsory.
- However, few people will react and adopt a kind of environmental activism when convinced by limited specific intermediate socialisation processes that individual action is meaningful.

Actually, intermediate socialisation vectors such as the Cognitive Transfer groups induce or increase individual or collective sustainable action taking and can even destabilise people's trust in the institutions therefore leading them to question the State's will to handle environmental issues. Anyway, in all cases, sustainable action taking will be done within the limits of people's perceptions of the institutions' behaviour. For example, it will affect the domestic activist consumption of goods such as for car purchase (no trust in the permanence of LPG tax rebates etc); state guaranteed products⁵⁰, etc. Generally speaking, it is as if the more one goes outside his/her personal sphere, the more he/she needs the support of the State's involvement.

Against this background, we can understand the influence of utilitarianism in the sustainable action taking process. First of all utilitarianism is an element that exist whatever the trust in the institutions. It is often materialised in terms of financial or timing considerations. At the opposite, when the grounds for utilitarianism, especially economic ones, are weak, then the meaning of sustainable action is defined only in terms of personal inputs for the prevention of risk (and fear). Hence the importance of its socialisation and of the signs issued by the institutions otherwise there is no action (unless personal utilitarian reward can be foreseen). In many cases the action at stake embodies the two aspects and people will mobilise them both in the sustainable action taking process.

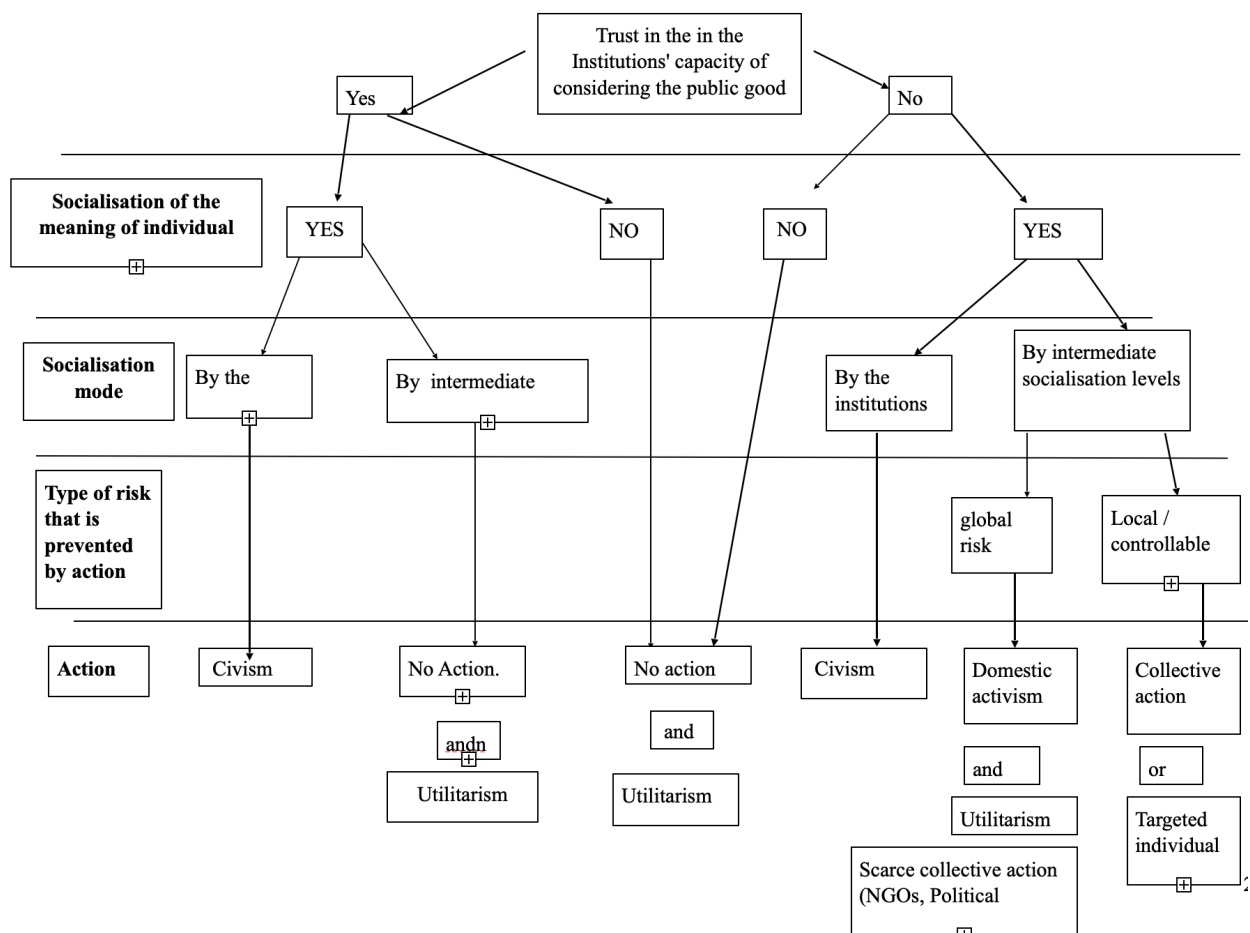
Another issue has been outlined by the research i.e. the very importance of taking into account people's physical perceptions. They are key elements in the sustainable action taking process not

⁵⁰ perception of contradictory information provided about food products or green ones, unclear labelling of many products and gap in the poor quality of some public transports (access, price, safety)

only because they interfere in our daily routines but also because they participate in the construction of the perception of our potential hold on the environmental risk. The more it is comprehended within the limits of our physical perceptions thanks to its limited territorial or time impact the more easily it is mastered. Therefore, when describing the various conditions of sustainable action taking, it allows us to draw a second distinction-besides trust in the institutions and the level of socialisation of the meaning of action-: the potential physical control of the environmental risk. When the risk is limited to a specific area or when it is controllable over time, like in the case of phosphate release, then socialising the issue leads to sustainable action taking and overcomes the apathy that distrust in the institutions often generates. The perception of this physical control often corresponds to the existence of an intermediate socialisation level (often a local collective one) that will lead action taking (petition, local association). At the opposite when there is no perception of physical control, movement from lay people will be limited to those from environmental activists.

Having said so, it is possible, then, to detail the previous description as follows in Fig. 5:

Fig 5 Paths of sustainable action taking



From this analysis we can suggest that, if French people's involvement on sustainable action taking is a function of the way in which the institutions are going to deal with their ontological fear, then serious sectorial environment policies are not enough for regaining people's trust and lead to behaviour change. It can only be done with a general socialisation process with the following conditions:

- 1) Demonstrating the involvement of the institutions themselves as a whole. To fulfil this aim, the French institutions have to convince people that they are not bound by economical objectives and that notions such as « the public good » are still significant. For doing so, they would have to start managing a change of their relationships with the citizens and issue signs of this transformation.

A first symbolic sign could be sent by allowing people to be more autonomous from some of the SMCSs that are State controlled and, in particular, the energy network⁵¹. We have seen that awareness of depending from those SMCs is one of the reasons that create a powerless perception among lay people who, on the other side, are very aware of air pollution and climate change. Promoting, for example, the use of solar energy panels on a wide scale could be a sign of the State's acceptance of lower economic incomes to the benefit of both an increased autonomy of the citizen and a reduction of high level risks such as the glass house effect.

The importance taken by people's ontological fear and its lack of socialisation suggests that recognising the existence and value of this fear instead of deploring people's lack of rationality could be a second step in that direction. In practical terms, adopting such a paradigm would imply that the State gives up referring to the rationality of the « experts » as the only source of understanding of a problem therefore introducing new forms of democratic procedures in the decision taking process. However, referring to the citizen rather than to the consumer is a commonly widespread idea that has been underlined by many authors. It leads to the conception of new forms of empowerment that are commonly debated and can be described as attempts to create ways of including the excluded in the decision process (see chapter 5). However, there is a big gap between an idea and its fulfilment and this research shows that the need for change is not only the fruit of policy theoreticians but corresponds to people's demand.

⁵¹In France, the liberalisation of the electricity and gas market is going to be applied for the industry and trade consumption, not for the domestic one.

2) Socialising the meaning of action. For this purpose, the focus should be made not only on the socialisation of environmental risks but also on actions that contribute to prevent them. Both of them belong to a socialisation process that creates a way out of the withdrawal logic

When talking about socialising the meaning of action, the first policies that are suggested or rise from the research field are a higher involvement of the institutions due to:

- a) Stronger leadership taking shape in exemplary behaviour. This last issue is all the more important that the results emphasise the role of observation as a learning means.

In fact, inducing behaviour changes is often considered by policy makers as a learning path that implies that an isolated piece of information is passed on to an audience. Such an approach- that was ours as well at the beginning of this work- forgets that another way of learning has always existed i.e. confrontation, then imitation of the behaviour of others. Hence the importance of the exemplarity of the public institutions' behaviour not as a way of showing what is right vs. what is wrong but as a way of showing that the behaviour is possible on a day-to-day basis and that achieving sustainable behaviour is a shared concern. It has the advantage of letting people find their own way of mastering an action and therefore embodying it much more efficiently. A counter example would be to focus on one-shot actions that would be understood at best as prototypes or at worst as a showcase of the institutions' environmental policy.

- b) The respect of fairness and equity among the various social actors in the distribution of the tasks meant to achieve sustainability.

This issue is a constant demand in all the cases of socialisation of a sustainable behaviour that could be observed. It confirms results of studies achieved in England and in Belgium. According to Jolivet analysis (Jolivet, 2001), such an expectation can be explained by Mauss' theory of donation, « *the recognition of a co-dependence is expressed from an instrumental but also moral i.e. responsible point of view. The behaviour aim (waste separation in that case) is to get a feedback hence re-integrating individual life in the life of the social group* ». Since I work outside this theoretical frame, I didn't refer to it but I agree on the idea that what is at stake is the link that waste separation allows to build with the other social actors. However, fairness and equity are not only expected from the social network involved in a specific sustainable action but more widely, in the perceived social balance between all social actors. We are back again at the issue of the perceived unbalanced relationships between the State and the Techno-sphere.

Anyway, we suggest that fairness and equity belong to the social values that are mobilised in the type of interpretative frame involved when socialised sustainable actions are stake: the

interpretative frame of a citizen. Therefore the State has a key responsibility in maintaining this balance, as it is necessary:

- if one wants people to keep on doing sustainable actions that are already socialised at a general level
 - if one wants to prepare a confidence ground for the implementation of other sustainable behaviour. All the more so as one considers that the final aim of the ecologisation of behaviour is to make it as commonplace as possible, hence achieving its full socialisation.
 - if one wants to encourage activists to go beyond the frontiers that distrust in the State have created.
- c) The introduction of various incentives for sustainable action taking among which information tools. Our first assumption, at the beginning of this project, was that information tools could embody action. To this extent, the results confirm our hypothesis while emphasising the importance of physical sensations and of the appropriation process that allows people to situate their household by reference to an average and assess their margin of action. In other words, encouraging the manipulation of information artefacts can be a way of developing behaviour changes thanks to both the embodiment of the artefact that result from manipulation and the reflexivity that it induces.
- The first application that comes to mind is developing artefacts that will allow a better control of consumption and pollution emissions. They should be able to measure the household's situations but also to allow simulation. The experience of the Energy Environment Budget is one of them, we can also think of the Eco-teams calculation tables or of the programs that are to be set on the Internet by the GAP organisation. However those artefacts could be simpler. Referring to the suggestions made during the groups, ready-to-use meters could be conceived for being installed on the household's equipment. Pollution testers such as those existing already for nitrates' concentration in water could also be developed; they could involve the sense of smell.
 - A second application could be another way of considering the implementation of policy instruments. The importance of body sensations and manipulation suggests that studying actual practices and incorporating the successful ones and the suggestions made by practitioners into the body of policy instruments is relevant.

Furthermore, the fact that information was sometimes enough to lead some people to adopt sustainable behaviour reflects that it can induce a minimum level of socialisation.

The research underlines two ways taken by information to contribute to the socialisation of sustainable behaviour.

- ◆ First of all, information is one of the elements that contributes to the re-creation of the meaning of action because it can provide knowledge about the link that can be drawn between one's behaviour and the environment. To this extent, with the word "information" we are not only referring to written or media information but also to the information made through physical observations and experiences:
- Experiences made by people themselves are often the starting point of their recognition of an environmental problem and will make them more sensitive to the complementary information they can receive on such or such specific issue.
- Experiences communicated by other people can be a demonstration that behaviour changes can be adopted.

People need facts and very down-to-earth information that they can make theirs, not general information. Hence the importance of:

- precise information, for example the amount of kWh consumed by a pilot light.
- use of familiar benchmarks for example *"according to environmental NGOs, if all the French people would switch off their pilot lights it will save in one year, the amount of electricity provided by a middle-sized nuclear plant during the same period"*.

The type of information that has appeared to be salient during the field research can be summed up in the Table c.1:

Table c.1 Key information in the behaviour changes process.

Action	Key information
Switch off pilot lights	Pilot lights energy consumption on a one-year basis, comparison with other electrical appliances' consumption in the household. Lighting comfort.
Reducing the heater's temperature	Testimony of comfort & pleasure.
Reducing the hot water boiler's temperature	Awareness of the feasibility of this action.
Use of low energy consumption bulbs	Share of the electrical bulb consumption in the global electric consumption of the household. Return on investment for low consumption bulbs.
Purchase of energy and water saving appliances.	Return on extra-cost investment. Testimony of feasibility.
Purchase of recycled items	Readability of the information. Society's involvement.
Purchase of green products (chlorine free, phosphate free etc)	Impact on the environment of the chemical element at stake. Expected progress within a certain time range. Society's involvement.
Purchase of organic or "reasoned" food products.	Exact meaning of the labels at stake.
Voluntary waste separation	Positive environmental impact. Availability and convenience of disposal items. Feedback. Testimony.
Change in the transportation mode	Involvement of the social actors. Availability of facilities. Mid-term range cost estimation of car use.

Another issue is the reliability of information. People are confronted both with scientific controversy and the State and its institution's indecisiveness with the result that some of them tend to question the "honesty" of Science. It often results in no action. Moreover, when information is based on experience, it is embodied in artefacts or has trustworthy origins within people's close circle; it is more likely to lead to action. The status of the information provider (a person, the fact of the very existence of the artefact, a conversation) reflects the beginning of a socialisation process that makes the behaviour change tangible.

- ◆ Secondly, information contributes to the behaviour normalisation process as it contributes to:
 - A raise in the general awareness of action. People get used to the idea that, for example, it is possible to get a solar panel on one's roof.

- Enhancing the perception of one's own responsibility in achieving environmental goals; for example, the information according to which household are the main contributors to phosphate pollution.
- The construction of some people's perception or beliefs. For example, an ideal type sentence underlining this fact is the often met "*I've been told that*", "*I've heard that*" etc. People's memorisation of the information is the basis of an awareness that might lead, later on, to behaviour change.
- The questioning of people's own behavioural norms because it confronts them with alternatives.

Against this background, we may wonder whether the success of the Energy Environment Budget could be explained because it has played the role of an « intermediary artefact » (Vinck, 1999) i.e. an artefact that links people, a mediator that influences the way people link themselves with others. Not only was it the subject of a socialisation process and of an exchange but it was also linking the different Spheres into which people live, their various identities. On the contrary, the failure of official environmental indexes in implementing behaviour change would be explained by their statute of ordinary objects with no « intermediary » qualities. The main reason for that being that they are perceived as coming from untrustworthy Techno-sphere with little concern for people expectations as citizens or human beings.

d) The consideration of experiences that mobilise intermediate socialisation levels.

We are not referring only to those levels that are already dedicated to environmental issues (we saw in the first part that their audience is limited), but also to those that can result from the organisation of new links between existing groups such as the experience of the PCRD (Plans Communaux de Réduction des Déchets) held in Belgium. However, we must keep in mind that, although essential for the socialisation process of sustainable actions, intermediate bodies can't do all the work by themselves. The research has shown that the meaning of taking sustainable action is constantly evaluated by referring to the behaviour of the other social actors. Even the 3 Suisses employees were questioning the meaning of their company's involvement (and their own) in a society where they couldn't find many other companies with the same environmental goals. Therefore the idea of delegating sustainability issues to specialised agencies or social bodies or even a specific ministry hasn't got much chance of being efficient if not relayed at a higher level, the level that is confronted to the "big" environmental risks and the high level economic decisions in which the Techno-sphere

and the Eco-sphere confront each other i.e. the whole government. In other words d) can't be fully efficient without what was developed in a).

To sum up, taking sustainable action is linked to the perception of a hold on the environment that can be created with:

- High level State exemplarity that would help restoring trust in the institutions.
- The existence of a meaning of individual action within the wider frame of collective objectives. It results from the socialisation of the meaning of the environmental risk, the fear it generates and the individual and collective actions that contribute to its reduction.
- The existence of intermediate levels of socialisation (groups, territory, time schedule) and the existence of objects (that can be artefacts)
- The reference to and use of physical sensations.

Our analysis is in line with Spaargaren's acknowledgement of the importance of the household's interpretation of the changing relationships between the private and the public sector in the ecological modernisation of consumption. It details the aspects that these relationships can take within the French background.

On another side, the importance taken in the sustainable action taking process by the construction of the environmental risk and by the notion of trust in the institutions are in line with Beck's and Giddens' analysis of the risk society. However, the Theory of the Ecological Modernisation of Production and Consumption (TEM) is often considered as irreconcilable with the risk society theories. This contradiction is defined by Spaargaren & Mol as such: *"Whereas the ecological modernisation approach emphasises the important contribution of modern technology in bringing about an ecological switchover, Beck takes a very sceptical and even negative stand regarding the possible contribution of science and technology to mastering ecological problems"....*" Expressed in the language of reflexive modernity (and risk society) theories, ecological modernisation makes unproblematic use of science and technology in controlling environmental problems. Ecological modernisation is also different because it does not so much emphasise the relation between the global and the individual but rather concentrates on strategies of environmental reform on the meso-level of national governments, environmental movements, enterprises and labour organisations. Giddens, pays far more attention to (awareness of) the loss of control by individuals confronted with ecological high consequence risk resulting from processes of globalisation than to

elaborating on the possibilities of “controlling” other sectors of environmental problems at the meso-level using, among others, science and technology...” (Spaargaren & Mol 1997)

From this analysis, they develop a two step conclusion according to which:

- there is no contradiction between the two theories when meso-level environmental risk is at stake. Making use of modern institutions such as science, technology and State intervention can control those environmental risks.
- by their very nature high consequence risks raise the *“problems of technical control, awareness of existential anxiety and so on which can’t be dealt with within the framework of the ecologisation theory”*

In other words, both theories can live together if (high consequences) risk theories are as a “supplement” to the ecological modernisation theory when it comes to:

- introducing lay actors and lay perceptions into a theory of the environment and modernity and linking them to developments in the risk profile of modernity.
- pointing to the different aspects of the relationship between environment and society and stressing the inadequacy of ecological modernisation theory in dealing with those risks.

The results of this work fits into their analysis if we consider that what they call “meso-level” corresponds to the area (or the timing) that is apprehensible by physical senses; hence inducing that we are talking about local and/or controllable environmental risks whatever the size of the area they correspond to. Thanks to science, technology and above all, state intervention, lay people can take ad hoc individual or collective behaviour that will help handling those risks.

However, the research nuances Spaargaren & Mol ’s statements by showing that the socialisation process led by State intervention with the help of the means described previously, is as important as science and technology.

It is even the most important item when the behaviour at stake is not the adoption of a specific technology but a change in the way it is used. The ecological modernisation can't be conceived only in terms of efficient science and technology.

Also, it questions the dichotomy drawn between high consequence risks - that can’t be dealt with by the TEM theory- and meso-level risks, by showing that high risk perceptions are not isolated by lay people but are constitutive of their global risk perception and, therefore, of their reactions to meso-level environmental policies aimed at introducing sustainable behaviour in their lives. To this extent:

- High consequence risks have to be integrated into meso-level policy making.
- The State's behaviour in front of high consequence environmental risks is a constitutive part of the relationships between the global and the individual. Therefore, even though it is not able to control those risks with the tools of the TEM, if the State is able to resist the pressures that come from the Techno-sphere (economic pressures and science reductionist habits) it will create a step in restoring trust with the citizens and will help them to get out of their withdrawal hence reducing the negative effects of the risk society.

These inputs have the advantage of showing that the solution for succeeding in the implementation of an ecological modernisation of society- which is mainly defined according to economical standards such as those of production and consumption- lies outside the economical world. For this reason my results suggest that the frame of the TEM theory, in its institutional learning understanding, is too narrow to describe what is at stake in the process of taking sustainable action. Actually, the understanding of the TEM as institutional learning, is grounded in the Techno-sphere:

- it considers Nature as a sustenance base
- it considers that the economy should be ecologised and the ecology economised which makes it part of the Techno-sphere.
- it considers that, because the individual "naturally" cares about the environment, it will be translated into preferences that are expressed through acts of consumption. Therefore information systems are based on the idea of a rational actor that will choose sustainable consumption either as a consequence of its utility for him or as a consequence of the information that enhance his/her personal responsibility.

It is in this framework that the Energy Environment Budgets were conceived.

These elements from the institutional understanding of the TEM are challenged by this research. In addition to people's expectations from the State to consider their living being's ontological fear:

- Many people are questioning the Techno-sphere and make it responsible -together with the institution's inability to escape from it- for the environmental threat.
- Time, patrimonisation, physical contacts are constitutive elements of the construction of the environment and plead for the existence in the Eco-sphere of a perception of a Nature-to-be-enjoyed (but not consumed) which is closer to the Arcadian perception that gives to Nature an intrinsic value (Van Koppen, 2000).

- Specific values such as responsibility and public good were directly involved in the construction of daily sustainable practices. It is coherent with one of the prospective path of the Ecological modernisation suggested by Cohen i.e. the development of a « social capital » thanks to the increase of the degree of associativeness and trust between its members. It is within this frame that we understand K. Hobson's suggestion that the ecologisation of consumption needs the State" to reconsider its relationships with those campaign groups that are wrongly labelled as subversive" (all the more so we should add because they represent intermediate socialisation levels).
- Opposite to the learning process based on a voluntary, rational and valued exchange of knowledge enhanced by the TEM and by many official programs such as the UN's, an efficient way of learning is made of what Dupuis calls an "autonomous" process based on experience and observation (Dupuis, 2002)

All those elements describe the frame of an Eco-sphere that is far from Huber's description and is centred on the reintegration of the human dimension into decision making. In a background where there are strong attempts for an increased rationalisation of private life, they show the persistence of the logic of social links. Also, they show that, although expressed within the frame of the Techno-sphere, people's expectations are often oriented towards a resistance to the Techno-sphere from the inside that only needs the right circumstance (a socialisation process, for example) to express itself. This is an indication that public criticism of the Techno-sphere might be more widespread than expected and, therefore, that the basis for a public acceptance of policy changes towards increased sustainability could be much larger than what is commonly understood in the political spheres and only waiting for increased institutional commitment. Whether these critics have already given birth to the adoption of sustainable practices as ways of expressing "ordinary resistance" -such as Dobré states in her last book (Dobré, 2003)- was only confirmed through the example of what we have called "domestic activists". In the other cases, economic circumstances and utilitarianism were the major forces that had led to sustainable action taking and socialising the meaning of action was the only way of helping people to take sustainable action within or outside the frontiers of their household.

Another way of expressing these results is to realise that results of a field research that was grounded in the institutional understanding of the TEM can't be explained within that frame. The simple introduction of both time (the length of observation) and an artefact such as the EEB into the relationships between the Eco-sphere and the Techno-sphere with the aim of contributing to the

ecologisation of the latter, shows that other elements interfere in the process. To be able to precise those elements we have to go to the individual level where we can find that sustainable action taking mobilises the dynamic between people's identity as citizens, « human beings » and consumers. By referring to the ontological preferences linked with what I have identified as the « human being » identity, behaviour change for an increased sustainability can be implemented.

This relation between people's various identities can be depicted, as in Fig.6, with the various spheres in between which sustainable action taking takes place in the TEM i.e. the Eco, Techno and Socio spheres and to the various understanding of Nature defined in chapter 1.

- The Eco-sphere would include people's identity as "human beings" and a construction of Nature as having an intrinsic value, an "Arcadian" one.
- The Techno-sphere would include people's identity as "consumers" and a construction of Nature as a sustenance base.
- The Socio-sphere would include people's identity as citizens and a construction of Nature that has to be defined by society.

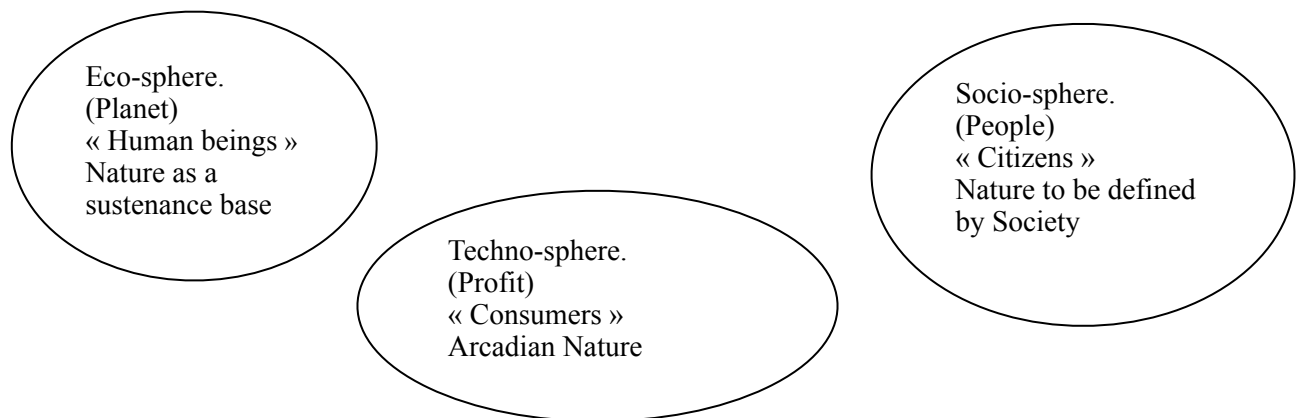


Fig 6 The three spheres of the TEM

Such an analytical frame is coherent with the criticisms of the "institutional learning" understanding of the TEM developed in chapter 1. Those criticisms, which promote an understanding of the TEM as a "technocratic" project and as "cultural politics", emphasise the role that should be given to the Socio-sphere in the implementation of the Ecological Modernisation.

However the question of qualifying the links that exist between the various spheres is open. If the links between the Eco and the Techno spheres are well defined by the theory i.e. the ecologisation of the Techno-sphere and the economisation of the Eco-sphere, the reintroduction of a tripartite system forces us to wonder how we could qualify the links that exist between the other spheres.

The results of this work give an insight when showing that, when environmental matters are at stake, the State, which should be perceived as belonging to the Socio-sphere because it represents people, is perceived by many people as belonging to the Techno-sphere. It is so because its action has been "economised". The conditions for restoring the balance are fairness from the State, equity as well as trust.

These elements appear when the institutions expect people to contribute to sustainability. They are what people expect from the institutions and what they are giving back. As a consequence, we can wonder whether those elements that we have described as belonging to the Eco-sphere are not, in fact, constitutive of the Ecological modernisation of the Socio-sphere. We can also notice that reintroducing this type of governance in the dynamics that exist between the Socio-sphere and the Techno-sphere allows the reintroduction of the social considerations that are present in the definition of sustainability and which are not taken into account by the institutional understanding of the TEM. It is a way for the Socio-sphere to "emancipate " itself from the Techno-sphere following Huber's advice.

How should we then consider the links between the Eco-sphere and the Socio-sphere? What "ecologising" the Socio-sphere means? And how can we qualify, on the contrary, the link between the Socio-sphere and the Eco-sphere?

- ◆ On one side, a result of this work shows that the issue of the environmental risk is a concern for the French society and that socialising the risk is a way of allowing people to have a hold on it. To this extent, as mentioned at the beginning of this conclusion, policies that usually recommend avoiding acknowledging the existence of the environmental risk are misleading. Does this means that we should implement an "enlightened catastrophism" i.e. recognising that risk and catastrophes might occur and therefore *"getting an image of the future that will be catastrophic enough to be repulsive and credible enough to induce actions that will prevent its occurrence except for one accident"*⁵² (Dupuis. JP 2002) ? At least, it means that,

⁵² this last words are aimed at making the occurrence of a catastrophe credible, otherwise precautionary policies don't last : their success induce their lack of credibility.

in contrast with policies that define the "acceptable" risk with economic standards (Decrop.G & al, 2001), the issue of who should or should not be at risk is a matter of democratic debate.

- ◆ On the other side, we can go further when observing that people's identity as "human beings" is mobilised when the environmental risk is at stake. A risk that is constructed as threatening as much Nature as human beings because the latter perceive themselves as belonging to Nature. To this extent the difference between an Arcadian Nature that would exist per se and human beings vanishes. As a result, this means that humans and non-humans acquire the same statute, that the hierarchy that is usually made between them disappears. It also means that the Socio-sphere should be in charge of both and therefore should adopt a position that is not totally anthropocentric. A position in which non-humans, like their fellow humans, are ends and not means. But how can the Socio-sphere deal with this? Who's going to speak on behalf of Nature? Latour provides an insight when he shows that Nature has its speakers and that the separation between Nature and Society is, generally, artificial. He suggests that what is at stake is a real "ecologisation" process in which ecologising is not defined, as in the Techno-sphere, by the choice of appropriate means for greening the economy but by "*creating procedures which allow a constant follow-up of a range of quasi objects - that have uncertain subordination links- and which generate a new type of political activity that is adapted to this follow up.*" (Latour. B, 1995). We are not in the world of ready-to-apply solutions but in the world of trial and error, of learning, of constant policy reconfiguration because considering both human and non-human as ends generates a constant uncertainty. This definition of "ecologisation" could be applied for qualifying the links between the Socio and the Eco spheres. But, to my opinion, it suggests a dynamic relationship between the three spheres because economic considerations can be part of the process as well.

The relationships described in this work appears, then, as in Fig 7:

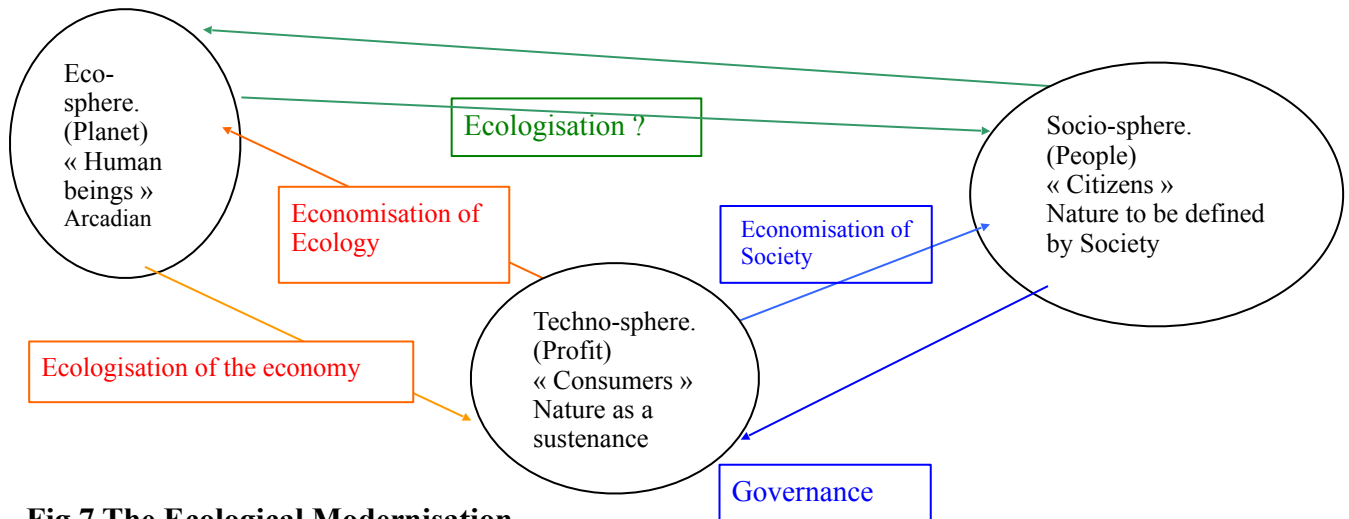


Fig 7 The Ecological Modernisation

Anyway, the links between the Socio and the Eco spheres are not well defined yet and so are the dynamic relationships that exist between all the links. Referring to the interpretative frame theory has helped me to make a first step in that direction. Both issues should be explored further.

In our daily lives, it is rare to find the consideration of humans and non-humans as ends. Most of the time the ecologisation process is understood in its first definition of the link that exist between the Eco and the Techno Spheres. Society is just starting to explore and to implement the governance and equity policies that links the Techno and the Socio-sphere as if it was a prerequisite before coping with the issue of the link between the Eco and the Socio-spheres.

According to Cohen -who was looking at ways of reconciling the TEM with the analysis of the risk society- at one time in their development, societies reach a stage where the environment's status changes from an expandable resource to a valuable amenity (Cohen, 1997). At this moment, societies have the opportunity of taking an ecological modernisation path: they can overcome the risk situation to the condition of recognising "the preponderance of humanity over economic determinism and the creation of accountable administrative structures for making technological decisions with collective ramifications". Acknowledging that such a recognition asks for deep changes in institutional structures and policy tools, Cohen states that this path might not be taken. Society, then keeps on the route of a risk society characterised by *"an erratic development and increasing lay insecurity arising from a preponderance of inadequately managed hazardous*

technology". Cohen states that France's centralisation is an opportunity to implement a switch towards the ecological modernisation to the condition of sufficient environmental resolve. His article was written in 1997. Unfortunately, the environmental resolve has since turned out to be poor even though people's expectations can now be described as high.

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**UNIVERSITE DE LIEGE.
Faculté des Sciences.**

FONDATION UNIVERSITAIRE LUXEMBOURGEOISE.

**Can an informative artefact induce sustainable behaviour in the
French households? The answer of a cognitive transfer experience.**

APPENDIX

PhD thesis in Environmental Sciences presented by Isabelle Scherer

Appendix to the chapter 2.

This appendix develops the work done for the construction of Energy Environments Budgets with a bottom-up approach.

Appendix 1. The impossibility of a top down approach for the calculation of the average household heating energy consumption. Page 3

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- «The Eco-citizen Guide» displayed on The French Minister of Environment's web site.
- « Housing: Control the energy» a supplement to the consumer magazine " 60 millions de consommateurs » dated 1997.
- An extract of a document of the French Minister of the Environment about phosphorus and nitrates that stress people should reduce their phosphate consumption (Agences de l'eau 1997).

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Appendix to the Chapter 2.

Appendix 1. The impossibility of a top down approach for the calculation of the average household heating energy consumption :

A first attempt to calculate household's heating consumption can be made by using a top down method i.e. to start from global consumption levels and go down to the level of household's heating systems. Calculations should focus on energy consumption per type of housing and per type of heating system in order to be able to cross results.

1) Top down calculation per type of housing

In that case, we know the data of :

- the breakdown of energy consumption/energy sources for heating purposes (1).
- the number of houses/type of house (Collective buildings CB or individual houses IH)/ source of energy (2).
- the average surface area per household/source of energy (3)
- They allow the construction of Table 2.1.

Table.2.1 : Number of housing per type of heating energy source (in thousands). France. 1995.

TYPE OF FUEL	IH	CB	TOTAL HOUSING
Gas	2 800 000	4 230 000	7 030 000
Oil	3 387 000	1 858 000	5 245 000
Electricity	5 365 000	3 398 000	8 763 000
Coal	<i>568 000</i>	<i>168 000</i>	736 000
Heat network		<i>1 031 000</i>	1 031 000
Wood	<i>1 705 000</i>	<i>104 000</i>	1 809 000
LPG	<i>444 000</i>	<i>73 000</i>	517 000
Total	14 269 000	10 862 000	25 131 000

Source : Economie & Statistiques 1995 (italics) , INESTENE 1995

(2)

It should be possible then to calculate the breakdown of sq meters per type of housing and per energy and to deduce from it the energy consumption per type of housing. But data about the average surface are 1988 ones that don't correspond to 1996 figures (Ceren, 1988) as shown in Table 2.2.

Table 2. 2: Comparison of the average housing surface.

	IH	CB
Average m2 1996	105	66
Average m2 1988	90	74
Gas 1988	102	70
Oil 1988	117	81
Electricity 1988	103	62
Coal 1988	95	75
Heat network 1988	0	70
Wood 1988	110	88
LPG 1988	105	68

Source : Ceren/ La Documentation Française

Therefore it is necessary to reconstitute the average m² breakdown per type of energy.

For this purpose, the following assumptions will be made:

- New housings are bigger and equipped with electricity, gas or oil heaters.
- The average surface increases when heaters use these energy sources.
- There is a trend to change old heaters for new ones at least in collective buildings (CB)
- The average surface of coal, wood and LPG heaters decreases in CB and stays the same in individual houses (IH).

Knowing the 1999 energy consumption/type of energy, the 1995 number of households, the 1988 situation, it is possible, then, to make variations per energy of the average

(m² * number of households) figure until the figure of energy consumption is reached (Table 2.3).

Table 2.3 : Reconstitution of the breakdown of average housing surface in m²/ type of energy and type of housing.

1996	IH	CB
Average m2	105	66
Gas	140	70
Oil	150	80
Electricity	133	62
Coal	95	62
Heat network	0	70
Wood	110	69
LPG	105	54
Total	105	67

It is then possible to calculate a new figure of m² per type of housing and energy (Table 2.4) which allows then the calculation of the energy consumption per type of housing (Table 2.6).

Table.2.4 : Calculation of the number of square meters per housing and heating energy source.

Type of fuel	IH	CB	TOTAL
Gas	392 000 000	298 215 000	690 215 000
Oil	508 050 000	148 175 500	656 225 500
Electricity	713 545 000	210 676 000	924 221 000
Coal	53 960 000	10 416 000	64 376 000
Heat network	-	72 170 000	72 170 000
Wood	187 550 000	7 176 000	194 726 000
LPG	46 620 000	3 942 000	50 562 000
TOTAL	1 901 725 000	750 770 500	2 652 495 500

These results can be converted in percentages as in Table 2.5.

Table 2.5 : Number of m² in %.

Type of fuel	IH	CB	TOTAL
Gas	0,57	0,43	1
Oil	0,77	0,23	1
Electricity	0,77	0,23	1
Coal	0,84	0,16	1
Heat network	0,00	1,00	1
Wood	0,96	0,04	1
LPG	0,92	0,08	1

Table 2.6 : Results :Energy consumption per type of housing

Type of fuel	IH	CB	TOTAL Mtep
Gas	4,43	3,37	7,8
Oil	6,35	1,85	8,2
Electricity	7,64	2,25	9,9
Coal	1,34	0,26	1,6
Heat network	0,00	3,00	3,0
Wood	5,20	0,20	5,4
LPG	0,46	0,04	0,5
Total	25,42	11,00	36,4

b) The average heating energy consumption per m² is then calculated as in Table 2.7 :

Table 2.7 : Average energy consumption/ m².

	TEP
Gas	0,011
Oil	0,012
Electricity	0,011
coal	0,025
Heat network	0,042
wood	0,028
LPG	0,010

2) Calculation of Energy consumption per type of heating systems

It is possible to calculate a breakdown per type of heating systems CCC (Collective central heating) or CCI (Individual central heating) in CB by crossing the figures of central heating equipment and the figures of energy sources per type of housing (Haehnel, I 1995) as in Table 2.8 and 2.9.

Table 2. 8 : Energy consumption per type of heating systems in individual house. 1995.

IH	C O N S I N MTEP	EQUIP MENT %		CON/ EQUI P M E NT	
Type of fuel	IH	CCI	other	CCI	other
Gas	4,43	0,97	0,03	4,29	0,13
Oil	6,35	0,88	0,12	5,58	0,76
Electricity	7,64	0,83	0,17	6,34	1,23
Coal+LPG	1,80	0,35	0,65	0,63	1,17
H e a t network	0	0	0,00	0,00	0,00
Wood	5,20	0,25	0,75	1,30	3,90
Total	25,42			18,16	7,26

Source : Economie et Statistiques n° 288-289 1995

Table 2. 9 Energy consumption per type of heating systems in Collective Buildings

CB	cons in Mtep	equipment %			consumption/equipment in Mtep		
Type of fuel		CCI	C C C	other	CCI	CCC	other
Gas	3,37	0,5	0,50	0,00	1,68	1,68	0,00
Oil	1,85	0,0	0,80	0,19	0,00	1,50	0,35
Electricity	2,26	0,7	0,04	0,24	1,60	0,10	0,54
coal, wood	0,46	0,9	0,00	0,13	0,40	0,00	0,06
Heat networ	3,00	0,0	1,00	0,00	0,00	3,00	0,00
L P G	0,04	0,0	0,00	1,00	0,00	0,00	0,04
Tota l	11,00				3,68	6,29	0,99

Source : Economie et Statistiques n° 288-289 1995

At this stage, this kind of result can't be of great help for the research as it was not possible to go further down and find a breakdown taking into account some important items such as the heaters' efficiency etc (It was not possible to find suitable data and a suitable common denominator).

Furthermore, other factors influence energy consumption for heating purposes : the size of the housing, its location etc. Therefore, the results are too general for the purpose of the sociological study which has to be able to tell people : this is what you have, this is how much energy you consume and this is how you can behave in a more sustainable way.

Appendix 2 The poor scientific reliability of general figures of water consumption in France.

Actors of the water world in France.

The French world of water resources is rather complicated, actors are organised according to the 1964 water act which has taken river basins as a basis of organisation.

There are six great river basins in France : Seine, Loire, Rhône, Garonne, Rhin-Meuse, Artois (Escault).

In each one a « basin committee » which represents users (towns, industries, farmers, local representatives, ONG, consumers, administration) defines the water policy. Its action are based on the « who pollutes pays » principle and its flip side : « who depollutes is helped ».

In each one, a water agency gives technical and financial help to users in order to solve pollution and water supply problems.

Until recently, their financial aid was raised thanks to a tax which is calculated on water pollution levels and the figures of local population. This tax used to be allocated to the water agencies but it is now reallocated to the general budget. Water agencies' budgets is now allocated by political decision of the government.

This decision makes the whole system more obscure but it is too early to evaluate its impact on the agencies' every day functioning.

As the depollution work to be done before and after water distribution is more and more sophisticated, water distribution is more and more often delegated by public institutions ie local town authorities- to private ones. In France two big companies : Lyonnaise des Eaux and Compagnie Générale des Eaux (Vivendi) are the market's leaders.

1.2 Figures for domestic water consumption

According to INSEE and water agencies⁵³, the average annual water consumption per inhabitant called « domestic consumption » is 60m³ or 165 l/day.

⁵³ Conversation with Monsieur Pardieu. Agence de l'eau Adour Garonne. October 1998.

This figure seems to be one of the highest in Europe if we refer to the following table. But as we will see, different parameters interfere in such a calculation and a strict comparison is not possible. To start with dates of the data are different. Therefore the table only gives an idea of proportions.

Table 2.10 Domestic Water Consumption in various countries

	l/pers/day
France (1995)	165
Germany (west) (1990)	143
Portugal (1990)	100
Netherlands (1992)	135
USA (1990)	577

Source : LATTS/ENPC Insee.1996

Indeed, the French figure is an approximation as data :

- are based not only on households consumption but also on all consumption below to 6000 m3 per year i.e. lots of shops, offices, schools etc...(The various private water companies consolidate their figures at this level and not at a household level).
- are calculated by dividing this figure by the amount of consumers whatever its nature is.

This incomplete knowledge of household's demand can be explained as :

- measures are made by water companies which, until recently, were only interested in the volumes sold and by the growth of these volumes. Their accounts isolate only industrial clients (>6000m3/year).
- taxes calculated by water agencies are based on population figures, therefore the amount to recover is stable whatever the consumption figures are. These figures are those given by water distributors. As a consequence, water agencies are not very interested in launching qualitative researches about household behaviour.

And though general ideas such as, for example, « cities' households consumption are superior to rural ones », are often misleading as the difference could be explained by the concentration of businesses and because the figures don't integrate the use of wells and private water sources that are often found in the countryside.

The scientific value of water consumption figures is now so poor that an agency such as the Agence de l'eau Rhône Méditerranée Corse has decided to stop publishing water consumption

figures in 1999⁵⁴. From this date, it will only publish the figures of water debits(from rivers and underground water).

This situation could change: volumes sold by water companies for « domestic » consumption have decreased (if 1991 is a 100 basis, consumption in 1993 were on a scale of 93 to 98) (Cambon, 1996) and, as a result, water companies have started to wonder why.

Furthermore, the investment costs of water depollution before its distribution are growing to such an extent that local authorities will be interested, sooner or later in the reduction of the volumes to be treated by private companies; therefore in a better understanding of households' behaviour.

In this situation, the Compagnie Générale des Eaux have financed research on households consumption (Maresca.B, 1994), in order to establish links between climate, population (age, type of house) and water consumption (levels of incomes were not known). Its main conclusion is that the ageing of the population is the main explanation of the consumption decrease as it induces :

- a decrease of the amount of people/households,
- a decrease of consumption per capita - more than 80% of people > to 50 years old try to save water,
- a lower level of equipment in dish washers or washing machines.

As far as the climate is concerned, an over consumption can only be correlated at temperatures > 25°. This study was based on figures given for a few neighbourhoods and not on all the company's figures.

The validity of these results on the global scale and for the future could be questioned as :

- old people tend to keep their consumption habits : old people in 1994 are still influenced by habits from the war period, old people in 2010 could have a very different behaviour.
- old people represents a growing part of the population : people over 65 were 14% of the French population in 1990, they will represent 17% in 2005 (INSEE, 1999)
- even if old people consume less water, they tend to stay at home longer therefore consuming more.
- other factors such as washing habits could be an explanation. We will see in the following pages that they differ according to geographical areas and social positions.

⁵⁴ Conversation with Monsieur Debaisieux. Agence Rhône Méditerranée Corse. Novembre 1998.

- cultural habits especially those of various ethnic groups could also make a difference also no results are available in France to prove this hypothesis.

The Lyonnaise des Eaux has financed specific research to explore the future of domestic water consumption.(Cambon, 1996). This work emphasises the fact that on a European level, only one study on the characteristics of the water demand has been held in Portugal (Alegre. MC 1992). It also stresses the need for a better characterisation of the French demand particularly the influence of the type of housing, the existence of gardens, the standard of living, the localisation of the house (city/suburb/country).

We could add that detailed studies of the household's water demand have also been done in the Netherlands by the Netherlands Institute for Public Opinion (NIPO).

Appendix 3 Calculation of the environmental impact of some household behaviour according to a bottom up method.

A Water

A.1 Water consumption

French people living in individual houses are always provided with a water bill that details - at least twice a year - their cold water consumption. When living in a collective building, the global water consumption used to be split up between people on the basis of the flat's surface, this situation is changing quickly as more and more apartments are equipped with individual meters for cold water (and sometimes for hot water as well).

- In the case of water consumption, the basic formula to reconstitute the demand is :
Consumption = $\sum c$ where c is for each equipment in the household:

$$c = [\text{Equipment level} * \text{volume of water used} * \text{number of usage per day} * \text{efficiency factors}]$$

- We will detail in the following paragraphs how each of the components of the equation was calculated.

Efficiency factor:

- Calculations are based on the average efficiency of household's equipment defined in 1994 in the "Revue Technique du Bâtiment" (Garnier, 1994). Efficiency gaps will be considered later on.
- Volume: Water consumption of equipment is defined on a base of 170 l per day/pers and is quoted by The Revue Technique du Bâtiment. On this document the water flow of showers is 6 l/min (the Ministry of Environment quotes 9l/mn) These are recommended levels that imply the use of water saving equipment. But most of real life water flow is higher because of the water pressure. This is why we will take the flow corresponding to the commonly found pressure of 3 bars: 16 l/min.

Equipment level

- The average efficiency of household's water equipment is defined in 1994 in the Revue Technique du Bâtiment (Garnier, 1994). Efficiency gaps will be considered later on.

- Levels of household's equipment are defined thanks to INSEE data (Eneau, Moutardier, 1995). The high level of equipment for the whole of French society can be seen with equipment levels superior to 90% for bathroom, toilets, kitchen, and washing machines.

The main difference lies with the possession of a dishwasher.

- The level of equipment for showers doesn't reflect the fact that households are equipped with a shower cabin but shows the possibility of taking a shower (shower in a bath tub for example).
- Detailed data on washbasin equipment are not available. As we concentrate on usage, we can consider that the usage of a washbasin doesn't depend on the number of washbasins available in the house but on one's needs and habits. Therefore what is important is to know whether there is a washbasin in the house or not. The same can be said for toilet equipment.

Number of usage per households.

All usage per person will be multiplied by the average number of persons per households.

- Usage of bath and showers are defined with the help of figures given by various Hygiene data (Nirascou, 1998). This data doesn't make any difference between having a shower or a bath- the question is based on the idea of washing oneself entirely. The average French person washes herself 5,2 times a week I make the hypothesis that the figure given includes one bath per week (0,14 a day) and that showers are used all the other times. We know that farmers, retired people, workers, employees, people living in little towns wash themselves less than average and that there is no major difference between other social groups. But as employees are included in the « low middle class » group, levels of shower usage have been weighted to take this fact into account. In that case shower figures are as described in Table 2.11:

Table 2.11 Average usage of shower per person per day

	Cities	Peri-urban	Country
Workers	0,50	0,48	
Farmers			0,35
Retired	0,60	0,57	0,57
Middle class			
upper	0,75	0,70	0,70
lower	0,75	0,64	0,64

Source : Nirascou 1998

- Bathing figures are weighted for families with kids as small kids often wash together or with a smaller quantity of water.
- For washbasin usage we know that :
- 85% of French people wash their hands before a meal,
- 59% wash their hands after going to the toilets,
- 67% wash their teeth twice a day, 25% once. This behaviour is common throughout French society. We have widened this last figure a little bit in order to take into account usage of washbasins for face washing and shaving- which are not included in data (washbasin usage for teeth brushing is considered to be twice a day instead of 1,7 times).
- Diners are supposed to be taken at home while lunches are taken outside. This hypothesis is different for the detailed study per SPC ⁵⁵ as we know (Grignon & Grignon, 1996) that 92 % of farmers take their lunch at home, this figure is 60% for workers, 42% for lower middle class and 40% in upper middle class. We made the hypothesis that retired people are more likely to take the two major meals at home. The same thing couldn't be done for housewives (which are a minority in 1996 (Insee, 1996), 80% of women aged 25 to 45 were working)
- The calculations are made on the basis of four toilets' usage/person/day.

For example, on an average French household, the minimum level of washbasin usage for hand washing will be calculated as such:

$$[0,6 * 4 + 0,8 * 1] * 2,4 = 7,9$$

with 60% = percentage of people washing their hands after being to the toilets

4 = number of toilet's usage per day per person

85% = percentage of people washing their hands before a meal

1 = number of meal taken at home

2,46 = average number of persons in the household.

The same type of calculation is made for other washbasin usage and showers.

- Usage of dishwashers and washing machines are based on the average figures given by the AISD⁵⁶ for 1998 (4,5 usage/week for washing machines ; 4,3 for dishwashers) It must be noticed that the Revue Technique du Bâtiment quotes a figure of 2,38 times per week while the CREDOC quotes 3 usage/week (Maresca & Poquet, 1997). The choice of the AISD figure is motivated by the fact that we know that the total duration of washing machine

⁵⁵ SPC : Socio-Professional Categories

⁵⁶ Association des Industries des Savons et Détergents

usage is 295 hours/year i.e. 5,56 hours a week (Inestene, 1996). A 4,5 usage/week correspond to an average cycle duration of 1,24 hour equal to 5,58 hours a week. This figure is more plausible then that the Revue Technique du Bâtiment number of 2, 38 usage /week which corresponds to a too long duration of 2,33 hours per cycle.

- The National average water consumption for gardening is estimated in 1995 to be 3l/day/pers on the basis (Garnier, 1994) of a garden of an average size of 1000m² (Insee, 1996 & 1998). As we don't have a breakdown per garden size per type of household (we only know that in 1992, 49% of flats had a balcony or a loggia (Insee, 1992)). We have decided to use the 3 l figure as an average and to increase it for big gardens and for the Mediterranean area in which the need for water is greater.
- Water leaks in households are 20% (Retlowsky, 1986) of the water consumed i.e. around 30l/pers/day. This figure is enormous and shows the impact of what is called « hidden leaks » such as leaks on taps (up to 44 m³ /year) (INC 1995), leaks in the toilet system (up to 220 m³/year) : a survey has shown that 25% of toilet's systems are in poor conditions (UFCS, 1994). Dispatching leaks' water consumption over the whole population, Garnier makes the hypothesis of an average consumption of 7l/pers/day and we will keep it (Garnier, 1994). We make the hypothesis that leaks are better controlled in houses than in apartments where water consumption is rarely individualised (as mentioned above most people pay water according to the area occupied by their flat).
- Another hypothesis is that gardens are wider in the country than in suburban areas therefore the amount of water used for gardening is more important too at least for
 - farmers and the upper middle class. The size of gardens for lower middle class should be more or less the same in suburban and rural areas. There is no evidence that a garden's size is linked with the size of the family.
- Car washing is done at home by 20% of car owners (1997). This percentage has been applied to the car equipment figures quoted by INSEE.
- In the countryside, only 94% of housing is individual. Therefore we have focused on this case.

Knowing these figures it is then possible to calculate the average daily consumption of a the French household as in Table 2.12.

A.2 Main results

Table 2.12 Calculation of the daily water consumption of the average French Household.1995

	EQUIPMENT/HOUSEHOLD		FLOW (MN)	Duration of use (mn)	VOLUME	Usage/day/household	Consumption / day household (l)
Bathroom	Bidet	0,30	10	3		0,08	0,72
	Bathtub	0,82			150	0,35	43,05
	Shower	0,96	16	5	80	1,47	112,90
	Washbasin	1,00	10	2	20	4,92	98,40
	hand wash		10	0,3	3	7,99	23,97
Toilets	WC	0,98			10	9,84	96,43
Kitchen	Sink	0,95	10	4	40	2,00	76,00
garden watering		0,25					7,38
car wash		0,15	25	8	200	0,02	0,48
Elec appliances	Washing machine	0,88			80	0,64	45,06
	Dishwasher	0,36			30	0,61	6,59
Leaks							17,22
						Total/day	528,19
Day/year	365						
Nber of persons/	2,46					l/person/day	215
Global consumption/	192790					l/person/year	78 370
Global consumption	4465						
Number of	23,16						

Source : INSEE 1995 Revue Technique du Bâtiment 1994 (in bold)

- The average consumption per person is 215 l a day much more than the official 165 l, but close to the Parisian area consumption of 200 l. This can be explained by the fact, already mentioned, that evaluations are based on the volumes sold to people. In cities where it is difficult to use private water resources, the official figure might reflect correctly the consumption while this is not the case for the country.
- Detailed calculation of water consumption per socio-types and areas are to be seen in the appendix .

A.2 Households' phosphate emission from washing machine activities

Because we have a basic knowledge of the average amount of machine wash within a household, we can use this element to calculate the average phosphate emissions linked to this usage.

b.1 General overview

In 1994, the average level of phosphate's emissions in domestic waters was supposed to be 1g/pers/day.⁵⁷ The pollution has a cost. Altogether, the cost of domestic, agricultural and industry MP pollution was evaluated to be FF 2 billions in 1988 (Euro 300 millions) (Agences de l'eau, 1997).

Phosphates are present in washing powders while most liquid formulas and concentrated powders don't include any. Therefore, trends in the market shares between liquid and powders have great importance.

It just so happened that concentrated formulas are not successful in France and that liquid formulas market shares are stable as shown in Table 2.13.

Table 2.13: Market shares of washing formulas

« CLASSICAL »	1989	1993	1996	1997
Powders	79	61	66	67
Liquid	20	16	15	16
Total	99	77	81	83
« CONCENTRATED »				
Powders	1	17	13	11
Liquid		6	6	6
Total	1	23	19	17
Total	100	100	100	100

Source : AISE 1998

The phosphate level is also influenced by the proportion of washing powder that is used. Concentrated formulas and, since 1998, washing tablets were supposed to be a help. But, not only is their marketing not a success (it is too early to evaluate the market penetration of tablets), but also their usage is not appropriate. The recommended doses for concentrated

⁵⁷ Conversation with Mr Miot. Association des Industries des Savons et Détergents (AISD). Oct 1998.

powders are not respected for both concentrated and classical formulas. In the last case, this is positive (see table 2.14). However, an increase in doses of more or less 3% since 1993 (AISD, 1998) has been documented.

Table 2.14 : Skip products doses per wash

	RECOMMENDED DOSE	AVERAGE USAGE
Classical		
Powders	259	153
Liquid	220	145
Concentrated		
Powders	97	110
Liquid	127	119
Liquid /Tablets	80	80

SOURCE : LEVER 1998

Referring to an average TPP (tri polyphosphates) level of 12,6% in 1996, the usage of a 153g/ dose of washing powder releases 19,28 g of phosphates which produces a minimum of 95 m2 of green soup and the growth of a minimum of 19kg of plankton (Carbiener, 1991).

To evaluate the minimum quantity of TPP rejected by households, we can use the data according to which, in 1997, 66% of clothes washes were made with a conventional powder (AISD, 1998). For the same year, Lever quotes 57,2% (Table 2.15). The first figure comes from distributor's panels, the second from the manufacturer's data and I will use this one as it is likely to underestimate therefore giving the minimum levels.

Table 2.15: Penetration of washing powders (%)

France	0,57
1pers	0,43
2 pers	0,56
3 pers	0,65
4 pers	0,67
5+ pers	0,74
Farmers	0,79
LMC	0,53
UMC	0,57
workers	0,68
retired	0,56

Source : Lever 1998

Combining these figures and water consumption that have been calculated previously, P emissions per households can be calculated as in Table 2.16.

If we go back to the household level, as the following chart shows, the dispersion of results makes it difficult to isolate a general trend. The only obvious thing is the higher level of emissions of the lower class's household which are frequent users of powders formulae and frequent users of washing machines. However, differences in dates between the studies used as references could explain at least part of the difference.

Table 2.16 Calculation of the average emission of Phosphates/ Socio-Economic Categories

grams	per week	per year
Average	50	2620
Workers	75	4000
LMC	48	2500
UMC	45	2400
Farmers	94	4900
Retired	34	1800
Location :		
Country	53	2800
Peri- urban	51	2700
Urban	47	2500
Family size:		
1	15	800
2	39	2000
3	68	3600
4	94	5000
5+	130	6890
Geographical area :		
Paris & suburbs	49	2500
Parisian basin	68	3600
North	53	2780
East	51	2700
West	49	2500
South west	48	2500
Centre east	49	2600
Mediterranean area	46	2400

b.2 Perspective :

It is already possible to calculate the impact of a more sustainable water consumption in the household (see Tables 2.17, 2.18, 2.19.)

- By using a specific behaviour : showers only, systematic search for leaks, saving water while teeth brushing, saving water while using the sink, using the machine's full capacity, one can reach 175 l/person/day, and improve the TPP level by 20%.
- By using the most efficient equipment available, water consumption can go to 130l/pers/day .
- By using both efficient equipment and applying water saving behaviour, water consumption can go to 86l/pers/day.

The main question remains that of the awareness of the potential of saving behaviour and of the importance of the equipment's efficiency.

Table 2.17 Calculation of household 's water consumption with the most efficient behaviour in 1998.

		equipment/ household	Flow(l/mn)	duration of usage (min/ day/pers)	Volume in litres	usage / day / household	Cons/day/household
Bathroom	bidet	1	4	3		0,08	1
	bathtub	1			150	0,35	53
	shower	1	7	5	35	1,47	51
	washbasin	1	4	2	8	4,60	37
	hand wash		4	0,3	1,2	7,99	10
Toilets	WC	1			6	7,38	44
					3	2,46	7
Kitchen	Sink	1	5	4	40	2,00	40
Garden		1					7
car wash		1	25	8	200	0,02	3
E l e c t r i c appliances	w a s h i n g machine	1			60	0,64	22
	dishwasher	1			20	0,61	18
leaks							17
						Total/day	431
p e r s / household	2,46					l/pers/day	175
Total cons./ year	157 260					l/pers/year	63 927
T o t a l consumption i n Mm3	3 642						
N u m b e r o f households	23,16						
P / W e e k i n grams	21.6						

Table 2.18 Calculation of the water consumption of a household using both the most efficient behaviour and the most efficient equipment in 1998.

		equipment/ house.	Flow (l/ mn)	duration of usage (min/day/ pers)	Volume in l	usage/day/ house.	Cons./day/ house.
bathroom	bidet	1	10	3		0,08	2
	bathtub	1				0	0
	Shower	1	7	5	35	1,82	64
	Washbasin	1	4	1	4	4,92	20
	hand wash		4	0,3	1,2	7,99	10
Toilets		1			6	7,38	44
					3	2,46	7
Kitchen	Sink	1	4	3	3	2	24
G a r d e n watering		1			40		7
Car wash		1	25	8	200	0,016	3
Elect.appliance s	W a s h i n g machine	1			60	0,51	31
	Dishwasher	1			20	0,61	12
Leaks							0
						Total/day	224
pers/household	2,46					l/pers/day	91
Total cons./year	81 909					l/pers/year	33 296
total cons.in Mm3	1 897						
N u m b e r o f households	23,16						
P / W e e k i n grams	39,37						

Table 2.19 Calculation of the water consumption of a household with the most efficient equipment in 1998.

		equipment / house.	Flow (l/ min)	duration of usage (min/day/ pers)	Volume in l	usage/day/ house.	Cons./day/ house.
bathroom	bidet	1	10	3		0,08	2
	bathtub	1				0	0
	Shower	1	7	5	35	1,82	64
	Washbasin	1	4	1	4	4,92	20
	hand wash		4	0,3	1,2	7,99	10
Toilets		1			6	7,38	44
					3	2,46	7
Kitchen	Sink	1	4	3	3	2	24
G a r d e n watering		1			40		7
Car wash		1	25	8	200	0,016	3
Elect.appliance s	W a s h i n g machine	1			60	0,28	17
	Dishwasher	1			20	0,61	12
Leaks							0
						Total/day	211
pers/household	2,46					l/pers/day	86
Total cons./year	76 872					l/pers/year	31 249
Total cons.in Mm3	1 780						
N u m b e r o f households	23,16						
P / W e e k i n grams	21,62						

B Energy

Households consume energy to satisfy seven types of needs: house maintenance, entertainment and information, lightning, cooking, hot water, heating, transports. The energy consumption will vary according to the technical characteristics of the system that equip the house and to the type of energy source. Electrical appliances answer the first three needs, this is why they will be studied together. Specific parts will focus on each of the other needs and will be followed by a calculation of CO2 emissions while transport will be studied in a specific section.

B 1 Energy consumption of electric appliances in the French household

B 1.1 Calculation of the energy consumption of electrical appliances

The energy consumption of an electrical appliance can be calculated according to the following formula :

$$C = W * h * \text{equip}$$

where C is the energy consumption in Joules or in kWh.

W is the energy in W

h is the duration of usage

Equip is the equipment level.

Some specific calculations have to be made for

- electric bulbs as their type can be different (Incandescent, halogen, low consumption, fluorescent) and their distribution in the house too.
- stand-by consumption as pilot lights equip more and more appliances and are often kept switched on.

As the number of little electric appliances in a house can be quite large (alarm clocks, toasters, coffee machines etc) and can vary a lot, I will take into account the most common ones i.e. vacuum cleaners and irons.

Air conditioning systems are not taken into account as the equipment level of French households is negligible : less than 1,5% for air conditioning (among which reversible systems (heating or cooling) are less than 1%) (Inestene, 2000). Ventilation systems are more numerous but 70% of the French household are still not equipped with them (ADEME, 1999). This situation will change in the near future as electric ventilation systems are now compulsory in new buildings.

Units : kWh is the most commonly understood energy consumption unit in France, all consumption figures are given in kWh. As this work aims to establish Energy Environment Budgets that could be understood by everybody, this unit will be kept but the main results will be converted in MJoule as they are the international unit.

1kWh= 9,3 M Joule

1kWh= 3,6 M Joule

The value of the electric kWh is higher than the value of a kWh produced by another energy source because of the losses linked to the production of electric energy.

1tep= 41 855 M Joule or 41.8 G Joule = 4500 kWh= 11626 kWh.

(Chevalier, JM &Al. 1986)

Origin of the figures used for the calculation.

Equipment levels

They are quoted in « Le budget des ménages » INSEE 1995.

Figures of second equipment levels are taken from « L'équipement des ménages » INSEE 1991

Duration of use

All figures are from « Analyse des usages électriques du secteur résidentiel » Inestene 1996 except for:

- computers : the CEMEDA study (Anglade & Al 1998) found an average use of 2.8 hours a day. We will suppose that there is almost no stand by consumption (14%) as it seems that in France, people don't use their energy saving programs and prefer to stop their computers.⁵⁸ Screen energy savers consumption is considered to be negligible.
- second equipment levels : the duration figures are deduced from consumption levels quoted in the Ciel-ADEME-EDF research. They have been checked by the O.Sidler cabinet which found that our assumptions were coherent.
- washing appliances : the consumption is evaluated by taking into account the number of utilisation per week already calculated for water consumption.

Appliances' power

- All figures come from the Inestene study quoted above with the exception of second equipment, hi-fi, video, computers and standby's consumption figures which are quoted in « Synthèse des campagnes de mesure sur les usages éleectriques spécifiques du secteur résidentiel » Save Program/Ademe- Cabinet O. Sidler 1997.
- Lighting consumption per type of bulbs are quoted in « Analyse des usages électriques du secteur résidentiel » Inestene 1996 and in « lightning in French households » EDF/2nd conference on Energy Efficient Lightning. Arnheim. The Netherlands 1993.

⁵⁸ Conversation with Mr Anglade ADEME Nov 98

B.1.2 Specific calculations

Before being able to calculate the average consumption of a household electric appliances, we have to make specific calculation for light bulbs, pilot lights and we have to be able to evaluate the average duration of a wash cycle in the French households. This requires the specific calculations described in Table 2.20..

Stand By energy consumption.

Table 2. 20 Calculation of average stand-by energy consumption of leisure and cleaning equipment

	Equipment	Power W	Duration of use/ week (hour)	A n n u a l consumption (kWh)	Total annual consumption equipment (kWh)
TV	on	0,95	110	27	158,5
	pilot light	0,95	11	46	27
2nd TV	on	0,20	110	9	52,5
	pilot light	0,20	11	15	9
hi fi	on	0,60	55	12	35
	pilot light	0,58	12,5	156	103
video recorder	on	0,57	25	1,5	1,99
	pilot light	0,57	14	166	123,5
computer	on	0,13	120	20	124
	pilot light	0,13	30	2,7	4,36

Source : INESTENE 1996, O. Sidler 1997, CEMEDA 1998

- Video recorder pilot lights consumes more energy each year than vacuum cleaners or irons and as much energy as video recorders themselves
- Hi-fi pilot lights are more energy consuming than hi-fi systems themselves

Light bulbs.

The use of electric light bulbs is different from one room to an other, therefore

Consumption = Σ (Equipment level* equipment power *duration of use) in each room for each type of equipment. Therefore, the average electricity consumption of light bulbs can be calculated as in Table 2.21.

Table 2. 21 : Calculation of the average light bulbs' energy consumption in household

Equipment level per type of room	Bathroom/bedroom	Kitchen/dining room	Lounge	Corridors	
incandescent	7,52	2,32	1,41	0,77	
halogen	0,00	0,00	0,33	0,00	
fluorescent	0,32	0,12	0,00	0,00	
low consumption	0,00	0,00	0,04	0,00	
power w	bathroom/bedrooms	kitchen dining room	lounge	corridors	
incandescent	75	120	80	100	
halogen	200	500	350	200	
fluorescent	40	40	40	40	
low consumption	20	20	20	20	
duration of usage/ year in hours	Bathroom/bedrooms	kitchen dining room	lounge	corridors	
incandescent	186.24	740	782	900	
halogen	0,00	0	183,50	0	
fluorescent	7,76	39	0	0	
low consumption	0,00	0	25	0	global consumption per year in kWh
consumption per year	bathroom/bedrooms	kitchen dining room	lounge	corridors	
incandescent	10 5040	20 5765	87 970	69 300	468,00
halogen	0	0	21 130	0	21,00
fluorescent	100	187	0	0	0,30
low consumption	0	0	22	0	0,02

TOTAL

489,5 i.e. 4.5 GJoule

Source : INSEE 1996 INESTENE 1996

Other electrical appliances.

Before calculating the average energy consumption of electrical appliances, we have to calculate dishwashers and washing machines energy consumption according to the duration of usage and the number of usage (Table 2.22)

The *average* number of use per week = number of use/day/household*7

Average duration of each use = duration of usage per week/ number of use per week (given in the last section)

Table 2.22 Calculation of the correspondence between number of usages per week and duration of usage.

UNIT	hours	w	kWh/week	kWh/year	week	
	duration of usage/ week	average power/ item	appliance's cons		average use	average duration of use
dishwasher	4,17	1651	6,9	364,9	4,27	0,98
2 n d	4,17	1651	6,9	364,9		
w a s h i n g machine	5,56	874	4,9	257,6	4,50	1,24
2nd washing	5,56	874	4,9	257,6		

Source : INESTENE 1996. INSEE 1999

It is possible, then, to calculate the average energy consumption of the electric appliances of an average French housing (Table 2.23).

The average energy consumption of a household electrical appliances per year is 2295 kWh i.e. 21325 MJoule i.e. 0.51 tep.

The heaviest electric consumption of appliances in the average French household is from the « cold » products (42%) followed by light bulbs (21%) and washing equipment (16%).

Generally speaking, leisure equipment is consuming 50% of the cold appliances' energy consumption. The increase of households' equipment in entertaining appliances can have a non-negligible consequences on energy consumption.

Pilot lights are almost as energy consuming as leisure equipment with which they coexist.

Table 2.23 : Calculation of electrical appliances average energy consumption per year Source : Inestene 1996, INSEE 1991 and 1996

Consumption		hours / week duration of usage	average power/item W	kWh/ week	consumption kWh/year	equipment level	Average Consumption kWh	Average consumption MJoule/year
cold	fridge	168	49	8.2	435.4	0.57	248.18	2306.0
	2 nd fridge	168	49	8.2	435.4	0.12	51.81	481.0
	freezer	168	68	11.5	609.0	0.51	308.17	2863.0
	2 nd freezer	168	68	11.5	609.0	0.02	10.96	102.0
	combi	168	62	10.4	552.4	0.59	330.66	3072.0
washing	dishwasher	4.17	1651	6.9	364.9	0.35	129.06	1199.0
	2 nd dishwasher	4.17	1651	6.9	364.9	0.02	5.47	50.0
	Washing	5.5	874	4.8	254.8	0.88	225.45	2094.0
	2 nd washing	5.5	874	4.8	254.8	0.05	13.25	123.0
drying	dryer	2.32	2754	6.4	338.6	0.21	69.28	643.0
lightning	incandescent			8.8	468.0		468.08	4349.0
	halogen			0.4	21.13		21.13	196.0
	fluorescent			0.01	0.29		0.29	2.7
	low				0.02		0.02	0.2
Entertain & info	TV	27.19	110	3.0	158.5	0.95	150.58	1399.0
	2 nd TV	9	110	1.0	52.5	0.19	10.39	23.8
	video	1.5	25	0.04	2.0	0.57	1.14	10.6
	computer	19.6	120	2.4	124.7	0.13	16.82	156.0
	hi fi	12	55	0.7	35.0	0.58	20.40	189.5
maintena	vacuum	1.86	211	0.4	20.8	0.88	18.42	171.0
	iron	1.69	405	0.7	36.3	0.99	36.17	336.0
pilot	TV	46.4	11	0.5	27.0	0.95	25.70	239.0
	2 nd TV	15.3	11	0.2	8.9	0.19	1.77	16.4
	Hi fi	156	12.5	2.0	103.4	0.58	60.28	560.0
	video	166.5	14	2.3	123.5	0.57	70.95	659.0
	computer	2.74	30	0.082	4.4	0.13	0.59	5.5
TOTAL							2295.00	21325.0

B.2 Energy consumption of cooking activities

As the energy sources of cooking activities vary, we had to reconstitute the average consumption from various data sources.

Origin of the figures used for the calculation.

Electrical appliances average power and duration of usage was found in the Inestene study (Inestene, 1996) on electrical appliances. As I couldn't find any data on gas equipment, a store check was done in April 1999 to list the power of the main appliances (Table 2.24).

Table 2. 24 : Energy use of the main cooking appliances (W) . 1999.

W	Oven	Hot Plates			
		ultra quick	quick	semi quick	auxiliary
	3 300	2 400	2 000	2 000	1 500
	3 520	3 300	1 650	1 500	1 000
	3 300	3 500	2 400	2 000	1 500
	3 400	2 000	2 000	2 000	1 000
		3 200	1 550	1 550	1 050
	2 650	3 200	2 500	1 920	1 450
	3 000	3 000	2 400	1 500	1 000
	3 250	3 200	2 950	1 850	900
	3 600			1 920	870
	2 950				1 100
	2 380				
	3 500				
Average	3 168	2 975	2 181	1 804	1 137
Average hotplates					2 024

Source : store check DARTY. Valence April 1999

It appeared that :

- gas hot plates have different power depending on the speed of the heating (very quick, quick, semi, auxiliary).
- when using the pyrolise function, ovens (gas or electric ones) can need up to 5 300 W. As no information could be found about the equipment's level and the frequency of usage, this information is not taken into account i.e. the results are the minimum average in energy consumption.

There is no possibility of identifying LPG appliances from gas ones : they are the same, the burner is the only item to change and this is done at the selling point.

As gas appliances heat up quicker, their duration of usage is considered to be slightly inferior to electrical appliances’.

The INSEE data shows that 94,5% of French households have a kitchen , the equipment levels take this figure into account. One can suppose that these kitchen are equipped ad minima with a cooking device, a fridge and a sink. We also know the breakdown of energy consumption used for cooking per type of energy (Table 2.25).

Table 2.25 : Breakdown of cooking energy consumption per type of energy (a)

		Mtep	GJoule
LPG Mt	1		
Gas billions kWh	7.8	671	28 000
Elec billions kWh	5.9	1311	54 800
Total		1982	82 800

Source : Les chiffres clés de l’énergie. 1993

Calculation of cooking appliances’ energy consumption.

Knowing the energy use, the duration of usage per week, the equipment level; it is possible to calculate the average energy consumption of cooking appliances (Table 2.26).

Table 2.26 : Calculation of the average energy consumption of cooking appliances

	hours	w	kWh/year		kWh/week	kWh/year
	duration of usage/week	average energy use /	appliance's cons	equipment level	average House's cons.	average house's cons.
electric oven	2,92	717	111	0,66	1,38	73
hotplates elec.	5,43	1451	417	0,25	1,97	104
hotplates gas	5.00	2024	536	0,72	7,29	386
gas oven	2,50	3168	420	0,32	2,53	134
micro waves	1,13	991	59	0,43	0,48	26
total						724

Source : INESTENE 1995 (in bold)

Electric equipment are much more efficient than gas ones, electric ovens have the largest market share.

B.3 Energy consumption of household's heating systems

The global energy consumption of household's heating systems is given per energy source by the Table 2.27 :

Table 2.27 : Energy consumption of household's heating systems (1)

	M tep	GJoule
heating oil	8.2	343 211
LPG	0.5	20 927
gas	7.8	326 469
CEI	9.9	414 364
other electric equipment		
coal	1.6	66 968
coal without central heating		
heat network	3.0	125 565
wood	5.4	226 017
Total	36.4	1 523 521

Source : Enerdata 1997.

CEI is a type of electric heating system, which respects specific EDF technical standards.

Gas, heating oil and electricity are the main energy sources of households' heating systems in France. Wood consumption is very difficult to evaluate as a lot of the volume used is not marketed, but we know that wood is used as the main heating energy source in 7% of French households (Ceren, 1995). Logically wood is mostly used as main energy source in houses, in small towns and in the country : 20% of households located in towns < 20 000 inhabitants are heated with wood (Haehnel, 1995).

As said previously, evaluating household's unitary heating consumption- the only way to be precise when talking about energy savings potential- is very difficult as this figure depends on many items such as type of insulation, efficiency of the heating system, climate, amount of windows, size of the building, date of construction etc...the very behaviour of the inhabitants itself is important too (heating temperature, presence at home during the day). At the time of the study (1999) the households' equipment level in cooling systems was so small that it didn't appear in the data. Therefore, such a kind of equipment was not taken into account. The situation

should be different in 2004 as the heat of the last two summers has made people equip themselves with air conditioning .

Therefore, we will simplify the equation. Energy consumption C is calculated taking into account the three following components (Chérel & al 1997)

$C = (\text{climatic conditions}) \times (\text{housing's characteristics}) \times (\text{equipment's characteristics})$
--

Calculation of the climatic condition factor

The climate can be represented a Basis x Day Degrees (BDD) which is the average value of the difference between the outside and the inside x temperature, on a specific day.

When calculating the equipment needed for a housing, an engineer will use a variable basis.

For our purpose, we will use a Unitary Day Degree (DJU) that consider $x = 18^{\circ}$. This temperature is recommended by the French authorities.

The French territory has been divided in three big climatic areas :

- H1 is the coolest and corresponds to the Northern, Central and Eastern part of France.
- H2 is the oceanic front area west and Southwest part of France.
- H 3 is the Mediterranean area.

Calculation of average DJU per climatic areas (Table 2.28)

The average figure is calculated by using the various DJUs per towns quoted by the AFME and based on 15 years of observation (AFME, 1987) The towns were grouped together per INSEE areas and then by climatic regions (which are a little different than the INSEE division) by using the following equivalence

H1 = North, East, Centre east, Paris area, Parisian basin INSEE areas

H2= West, South west

H3 = Mediterranean area

Table 2.28 : Calculation of the average Unitary Day Degree (DJU)

	DJU	AVERAGE			DJU	AVERAGE
Paris only	2682			millau	2497	
P a r i s montsouris	2463			Le puy	3199	
P a r i s L e bourget	2675			saint etienne	2884	
Paris		2607		clermont ferrand	2380	
				vichy	2781	
chartres	2822			grenoble	2983	
beauvais	2904			bourg st maurice	3609	
bourges	2640			dijon	2827	
nevers	2817			macon	2744	
tours	2574			lyon	2625	
orleans	2766			center east		2853
parisian basin		2754				
				carcassonne	1985	
dunkerque	2656			perpignan	1536	
boulogne	2731			montpellier	1830	
abberville	2857			nimes	1787	
lille	2938			marignane	35	
st quentin	2965			montélimar	2211	
north		2829		toulon	1339	
				nice	1462	
reims	2910			mediteranean area		1736
romilly	2859					
langres	3303			bordeaux	2154	
metz	3402			cazaux	2078	
nancy	3106			agen	2216	
strasbourg	3012			mont de marsan	2152	
mulhouse	3031			biarriz	1823	
east		3089		pau	2184	
				toulouse	2176	
dinard	2516			south west		2112
brest	2415					
rennes	2470					
le mans	2604					
angers	2474					
nantes	2342					
poitiers	2531					
west		2479				

Source : AFME 1985

The results are : DJU H1 = 2826- DJU H2 = 2295- DJU H3 = 173

Calculation of housing's characteristics.

Housing's characteristics can be expressed by a « heating need » defined as such:

$$BC = V * G - AGV.$$

where

V= Volume of the housing

G = energy loss for a 1°C difference between the inside and the outside temperature
(W/m³* °C)

AG = energy positive inputs linked with sun exposure, people's presence etc.

It gives a “ volume to be heated” (m³) figure.

Volumes: the average height referred to is 2.8 m for old houses, 2.6 meters for flats and new houses.

The examples that will be studied are

- houses of 70, 110, 150, 210 square meters (The national average is 106).
- flats of 40, 70, 110, 150 square meters (the national average is 66).

Energy losses. The average values of G are given by the Ademe for house's surfaces of 70, 110 and 150 m² (Chérel & al, 1997). It depends on the insulation level. As the characteristics of the houses have changed after World War II and as there were incentives for insulation after the first oil shock then followed by 3 thermic regulations, (1974, 1982, 1989), five periods will be studied :

before 1955 we will consider that people had the choice between no insulation and insulation from draught and attic, walls and windows insulation. 1955- 1974, 1974 – 1982, 1982 – 1988, since 1989. As the outside average temperature has an influence on G, its values will be given for the three climatic areas.

For flats, it will be considered that the value of G is 1.8 time smaller than for houses.⁵⁹

⁵⁹ Conversation with Mr B Sesolis/ Tribu Consultant company.March 1999.

As it was not possible to find official average values for 40m² flats and 210m² houses, the values of G are hypotheses based on the other figures and appear in italics.

Energy inputs : the AG coefficient depends on the house's orientation, the surface of windows, the number of inhabitants. As it is not possible to know these items on a large scale, a 10% diminution of the BC will be applied.⁶⁰

Equipment's characteristics.

The influence of the heater itself depends on its efficiency, the frequency of its usage (on and off) often referred to as the « intermittence » factor . We will call it E.

The following values of E are described in Table 2.29.

Table 2.29 : Average efficiency values of heating equipments.

	CI gas or heating oil	CC gas or heating oil	CI gas without PL	Electricity
Individual house IH	*1.7		0.71	1.04
Collective Building CB	0.51	0.53	0.55	1.04

Source : Tribu 1999 * this figure is a multiplicative efficiency coefficient

The heating energy consumption of a household can be formulated now as :

$C = [(24 * G * V) / 1000 * DJU] - AG / E$
--

For practical reasons, we will first calculate the household's energy needs (Tables 2.30 a, b, c, d, e) before calculating the household's energy consumption (Table 2.31)

⁶⁰ Conversation with Mr Chérel, Ademe. March 99.

TABLES 2.30 : CALCULATION OF HEATING ENERGY NEEDS

- Figures in bold are given by the ADEME in « Produits et technique de la MDE en zone rurale ». Paris. 1997
- Cal = draught proof

Table 2.30 a: Calculation of energy needs in houses built before 55

BEFORE 55	SURFACE	VOL	G PER AREA			ENERGY NEED- KWH/YEAR		
without insulation	m2	m3	H1	H2	H3	H1	H2	H3
House	70	196	2,50	2,80	3,00	29 910	27 205	22 049
	110	308	2,50	2,80	3,00	47 002	42 751	34 648
	150	420	2,30	2,50	3,00	58 966	52 051	47 247
	210	588	2,15	2,30	3,10	77 169	67 041	68 351
Flat	40	112	1,37	1,50	1,60	9 366	8 328	6 720
	70	196	1,39	1,56	1,70	16 617	15 114	12 249
	110	308	1,39	1,56	1,70	26 112	23 750	19 249
	150	420	1,28	1,39	1,70	32 759	28 917	26 248
insulation								
attic+cal House	70	196	2,00	2,20	2,60	23 928	21 375	19 109
	110	308	2,00	2,20	2,60	37 602	33 590	30 028
	150	420	1,80	2,00	2,20	46 147	41 640	34 648
	210	588	1,75	1,80	2,00	62 812	52 467	44 097
Flat	40	112	1,12	1,23	1,45	7 657	6 829	6 090
	70	196	1,11	1,22	1,44	13 294	11 875	10 616
	110	308	1,11	1,22	1,44	20 890	18 661	16 682
	150	420	1,00	1,11	1,22	25 637	23 134	19 249
attic+ cal+ walls House	70	196	1,65	1,80	2,20	19 741	17 489	16 169
	110	308	1,65	1,80	2,20	31 021	27 483	25 408
	150	420	1,50	1,65	2,00	38 456	34 353	31 498
	210	588	1,45	1,50	1,65	52 044	43 723	36 380
Flat	40	112	0,95	1,03	1,24	6 495	5 719	5 208
	70	196	0,92	1,00	1,22	10 967	9 716	8 983
	110	308	0,92	1,00	1,22	17 234	15 268	14 116
	150	420	0,83	0,92	1,11	21 365	19 085	17 499
Attic+cal+walls+windows								
	70	196	1,45	1,60	1,90	17 348	15 546	13 964
House	110	308	1,45	1,60	1,90	27 261	24 429	21 944
	150	420	1,30	1,45	1,75	33 329	30 189	27 561
	210	588	1,25	1,30	1,45	44 866	37 893	31 970
	450	1260	1,20			92 295		
Flat	40	112	0,82	0,90	1,08	5 606	4 997	4 536
	70	196	0,81	0,89	1,06	9 638	8 637	7 758

	110	308	0,81	0,89	1,06	15 145	13 572	12 191
	150	420	0,72	0,81	0,97	18 516	16 772	15 312

Table 2.30 b Calculation of energy needs in houses built in 1955- 1974

	SURFACE	VOL	G PER AREA			ENERGY NEED- KWH/YEAR		
1955-1974			H1	H2	H3	H1	H2	H3
Attic+cal								
House	70	196	2,50	2,80	3,00	29 910	27 205	22 049
	110	308	2,50	2,80	3,00	47 002	42 751	34 648
	150	420	2,30	2,50	3,00	58 966	52 051	47 247
	210	588	2,20	2,40	2,90	78 963	69 956	63 941
Flat	40	112	1,41	1,58	1,68	9 640	8 772	7 056
	70	196	1,39	1,56	1,67	16 617	15 114	12 249
	110	308	1,39	1,56	1,67	26 112	23 750	19 249
	150	420	1,28	1,39	1,67	32 759	28 917	26 248
Attic+cal+walls								
House	70	196	2,00	2,20	2,60	23 928	21 375	19 109
	110	308	2,00	2,20	2,60	37 602	33 590	30 028
	150	420	1,80	2,00	2,40	46 147	41 640	37 798
	210	588	1,50	1,80	2,20	53 839	52 467	48 507
flat	40	112	1,13	1,24	1,46	7 725	6 885	6 132
	70	196	1,11	1,22	1,44	13 294	11 875	10 616
	110	308	1,11	1,22	1,44	20 890	18 661	16 682
	150	420	1,00	1,11	1,33	25 637	23 134	20 999
Attic+walls+cal+windows								
House	70	196	1,45	1,60	1,90	17 348	15 546	13 964
	110	308	1,45	1,60	1,90	27 261	24 429	21 944
	150	420	1,30	1,45	1,75	33 329	30 189	27 561
	210	588	1,25	1,35	1,70	44 866	39 350	37 483
Flat	40	112	0,83	0,91	1,08	5 674	5 052	4 536
	70	196	0,81	0,89	1,06	9 638	8 637	7 758
	110	308	0,81	0,89	1,06	15 145	13 572	12 191
	150	420	0,72	0,81	0,97	18 516	16 772	15 312

Table 2.30 c Calculation of energy needs in houses built in 1974-1982 First thermic regulations.

Non electric heater	SURFAC E	V O L	G PER AREA			ENERGY NEED- KWH/YEAR		
	m2	m3	H1	H2	H3	H1	H2	H3
House	70	196	1,45	1,60	1,90	17 348	15 546	13 964
	110	308	1,45	1,60	1,90	27 261	24 429	21 944
	150	420	1,30	1,45	1,75	33 329	30 189	27 561
	210	588	1,15	1,30	1,60	41 276	37 893	35 278
Flat	40	104	0,84	0,93	1,09	5 333	4 795	4 251
	70	182	0,81	0,89	1,06	8 949	8 020	7 204
	110	286	0,81	0,89	1,06	14 063	12 602	11 320
	150	390	0,72	0,81	0,97	17 193	15 574	14 218
Electric heater.	70	196	1,20	1,25	1,35	14 357	12 145	9 922
House	110	308	1,20	1,25	1,35	22 561	19 085	15 592
	150	420	1,10	1,15	1,25	28 201	23 943	19 686
	210	588	1,00	1,05	1,15	35 892	30 606	25 356
flat	40	104	0,69	0,72	0,78	4 380	3 712	3 042
	70	182	0,67	0,69	0,75	7 406	6 265	5 118
	110	286	0,67	0,69	0,75	11 639	9 846	8 043
	150	390	0,61	0,64	0,69	14 548	12 352	10 156

Table 2.30 d Calculation of energy needs in houses built between 1982 and 1988 (2nd thermic regulation).

	SURFAC E	V O L	G PER AREA			ENERGY NEED- KWH/YEAR		
Non electric			H1	H2	H3	H1	H2	H3
House	70	182	1,00	1,05	1,20	11 110	9 473	8 189
	110	286	0,95	1,00	1,10	16 585	14 178	11 797
	150	390	0,90	0,95	1,05	21 426	18 366	15 355
	210	546	0,80	0,85	0,95	26 663	23 006	19 450
Flat	40	104	0,58	0,61	0,70	3 682	3 145	2 730
	70	182	0,56	0,58	0,67	6 172	5 263	4 550
	110	286	0,53	0,56	0,61	9 214	7 876	6 554
	150	390	0,50	0,53	0,58	11 903	10 204	8 531
Electric Heater.								
House	70	182	0,90	1,00	1,10	9 999	9 022	7 507
	110	286	0,90	0,95	1,00	15 712	13 469	10 724
	150	390	0,85	0,90	0,95	20 235	17 400	13 893
	210	546	0,80	0,85	0,90	26 663	23 006	18 426
Flat	40	104	0,53	0,59	0,66	3 365	3 042	2 574
	70	182	0,50	0,56	0,61	5 555	5 012	4 171
	110	286	0,50	0,53	0,56	8 729	7 483	5 958
	150	390	0,47	0,50	0,53	11 242	9 667	7 718

Table 2.30 e Calculation of energy needs in houses built since 1988 3rd regulation

	SURFACE	VOL	G PER AREA			ENERGY NEED- kWh/YEAR		
			H1	H2	H3	H1	H2	H3
House	70	182	0,75	0,80	0,95	8 332	7 218	6 483
	110	286	0,75	0,80	0,95	13 093	11 342	10 188
	150	390	0,65	0,75	0,9	15 474	14 500	13 162
	210	546	0,55	0,70	0,85	18 331	18 946	17 403
Flat	40	104	0,44	0,48	0,56	2 793	2 475	2 184
	70	182	0,42	0,44	0,53	4 629	4 010	3 602
	110	286	0,42	0,44	0,53	7 274	6 301	5 660
	150	390	0,36	0,42	0,50	8 597	8 055	7 312

- The influence of the G factor is enormous and stresses the importance of insulation.

When speaking about insulation, most people think about attic and windows, but wall's insulation can provide up to 17% of savings in energy needs and draught proof measures, combined with attic insulation, can provide up to 12%.

- The G factor is the same for housing built in between 1955 and 1974 with a minimum level of insulation than for housings built before 1955 without insulation. This is explained by the material used : concrete after 1955, cement before as they don't have the same reaction to heat.
- The G factors is still the same from 1974 to 1982 in housings heated with gas or oil as the first regulation did concentrate mainly on electric heating.

Results : Table 2.31 : Average energy consumption of heating systems

Legend

CCI : individual central heating

CCC : collective central heating

see following page

before 55	Sur	v o	G			c c i			c c i			c c c			electri		
without	m2	m	H1	H2	H3	H1	H2	H3	H1	H2	H3	H1	H2	H3	H1	H2	H3
House	70	1 9	2,5	2,8	3,0					38							21
	110	3 0	2,5	2,8	3,0					60							33
	150	4 2	2,3	2,5	3,0					73							45
	210	5 8	2,1	2,3	3,1					94							65
Flat	40	1 1	1,3	1,5	1,6					15			15	12			6
	70	1 9	1,3	1,5	1,7					27				23			11
	110	3 0	1,3	1,5	1,7					43				36			18
	150	4 2	1,2	1,3	1,7					52				49			25
insulation attic+cal	70	1 9	2,0	2,2	2,6					30							18
	110	3 0	2,0	2,2	2,6					47							28
	150	4 2	1,8	2,0	2,2					58							33
	210	5 8	1,7	1,8	2,0					73							42
Flat	40	1 1	1,1	1,2	1,5					12				11			5
	70	1 9	1,1	1,2	1,4					21				20			10
	110	3 0	1,1	1,2	1,4					33				31			16
	150	4 2	1,0	1,1	1,2					42				36			18
attic+ cal+ walls house	70	1 9	1,6	1,8	2,2					24							15
	110	3 0	1,6	1,8	2,2					38							24
	150	4 2	1,5	1,6	2,0					48							30
	210	5 8	1,4	1,5	1,7					61							34
Flat	40	1 1	0,9	1,0	1,2					10							5
	70	1 9	0,9	1,0	1,2					17				16			8
	110	3 0	0,9	1,0	1,2					27				26			13
	150	4 2	0,8	0,9	1,1					34				33			
attic+cal+ walls+win dows House	70	1 9	1,4	1,6	1,9					21							
	110	3 0	1,4	1,6	1,9					34							
	150	4 2	1,3	1,4	1,7					42							
	210	5 8	1,2	1,3	1,5					53							
Flat	450	1 2	1,2														
	40	1 1	0,8	0,9	1,1					9							
	70	1 9	0,8	0,8	1,0					15				14			
	110	3 0	0,8	0,8	1,0					24				23			
	150	4 2	0,7	0,8	0,9					30				28			

	Surface	Vol	cci gas or heating oil with PL			cci Gas or Heating oil without PL			ccgas or heating oil			electricity		
1955-1974			H1	H2	H3	H1	H2	H3	H1	H2	H3	H1	H2	H3
Attic+cal House														
	70	196	50 848	46 249	37 483	42 127	38317	31 054				28 760	2 6 1 5 9	21 201
	110	308	79 903	72 677	58 901	66 200	6 0 213	48 800				45 194	4 1 1 0 7	33 315
	150	420	1 0 0 243	88 486	80 320	83 051	7 3 311	66 545				56 698	5 0 0 4 9	45 430
	210	588	1 3 4 238	1 1 8 925	108 700	111216	98530	90 058				75 926	6 7 2 6 5	61 482
Flat	40	112	18 901	17 201	13 834	17 527	15950	12 828	18188	16551	13 312	9 269	8 4 3 5	6 784
	70	196	32 582	29 635	24 018	30 213	27480	22 271	31353	28517	23 112	15 978	1 4 5 3 3	11 778
	110	308	51 200	46 570	37 743	47 477	43183	34 998	49268	44812	36 318	25 108	2 2 8 3 7	18 508
	150	420	64 233	56 700	51 467	59 562	52576	47 724	61809	54560	49 525	31 499	27 8 0 5	25 239
Attic+cal+ walls House														
	70	196	40 678	36 338	32 485	33 702	30106	26 914				23 008	2 0 5 5 3	18 374
	110	308	63 923	57 103	51 048	52 960	47310	42 293				36 155	3 2 2 9 8	28 873
	150	420	78 451	70 789	64 256	64 996	58649	53 236				44 373	4 0 0 3 9	36 344
	210	588	91 526	89 194	82 462	75 829	73897	68 320				51 768	5 0 4 4 9	46 641
flat	40	112	15 148	13 499	12 023	14 046	12517	11 148	14576	12990	11 569	7 428	6 6 20	5 896
	70	196	26 066	23 285	20 816	24 170	21591	19 302	25082	22406	20 030	12 782	1 1 4 1 9	10 208

	110	308	40 960	36 590	32 710	37 981	33929	30 331	39415	35210	31 476	20 086	1 7 9 4 3	16 041
	150	420	50 270	45 360	41 174	46 614	42061	38 179	48373	43648	39 620	24 651	2 2 2 4 4	20 191
Attic+walls +cal+wind ows House	70	196	29 492	26 428	23 739	24 434	21895	19 668				16 681	1 4 9 4 8	13 427
	110	308	46 344	41 529	37 304	38 396	34407	30 906				26 213	23 4 9 0	21 100
	150	420	56 659	51 322	46 853	46 942	42520	38 818				32 047	2 9 0 2 8	26 501
	210	588	76 271	66 895	63 720	63 191	55423	52 792				43 140	37 8 3 7	36 041
Flat	40	112	11 126	9 907	8 894	10 317	9 186	8 247	10706	9 533	8 558	5 456	4 8 5 8	4 361
	70	196	18 898	16 934	15 211	17 523	15703	14 105	18185	16295	14 637	9 267	8 3 0 4	7 459
	110	308	29 696	26 611	23 904	27 537	24676	22 165	28576	25607	23 002	14 563	1 3 0 5 0	11 722
	150	420	36 306	32 886	30 023	33 665	30494	27 839	34936	31645	28 890	17 804	1 6 1 2 7	14 723

1st regulation Non elec.	Surf ace	Vol	cci gas or heating oil with PL			cci gas or heating oil without PL			ccc gas or heating oil			electricity		
	m2	m3	H1	H2	H3	H1	H2	H3	H1	H2	H3	H1	H2	H3
House	70	196	29 492	26 428	23 739	24 434	21 895	19 668						
	110	308	46 344	41 529	37 304	38 396	34 407	30 906						
	150	420	56 659	51 322	46 853	46 942	42 520	38 818						
	210	588	70 170	64 418	59 972	58 136	53 370	49 687						
Flat	40	104	10 456	9 401	8 335	9 696	8 717	7 729	10 061	9 046	8 020			
	70	182	17 548	15 725	14 125	16 272	14 581	13 098	16 886	15 131	13 592			
	110	286	27 575	24 710	22 196	25 570	22 913	20 582	26 535	23 778	21 359			
	150	390	33 713	30 537	27 878	31 261	28 316	25 851	32 440	29 385	26 826			
1st regulation elec. heater. House	70	196										13 805	1 1 6 7 8 0	9 5 4 0
	110	308										21 693	18 3 5 1 2	1 4 9 9 2
	150	420										27 117	2 3 0 2 2 9	1 8 9 2 9
	210	588										34 512	2 9 4 2 9 1	2 4 3 8 1
flat	40	104										4 212	3 5 6 9 5	2 9 2 5
	70	182										7 122	6 0 2 4 2	4 9 2 2
	110	286										11 191	9 4 6 7 4	7 7 3 4
	150	390										13 989	1 1 8 7 7 5	9 7 6 5
1982-1988 2nd regulation			H1	H2	H3	H1	H2	H3	H1	H2	H3	H1	H2	H3
	Surf ace	Vol												
non electric House	70	182	18 886	16 104	13 922	15 647	13 343	11 534						
	110	286	28 195	24 102	20 054	23 359	19 968	16 615						
	150	390	36 424	31 223	26 104	30 177	25 868	21 627						
	210	546	45 327	39 111	33 065	37 553	32 403	27 394						
			-											
Flat	40	104	7 220	6 166	5 353	6 695	5 718	4 963	6 947	5 934	5 151			

	70	182	12 102	10 319	8 921	11 222	9 569	8 272	11 645	9 930	8 584			
	110	286	18 066	15 444	12 850	16 753	14 321	11 916	17 385	14 861	12 366			
	150	390	23 339	20 007	16 727	21 642	18 552	15 510	22 459	19 252	16 096			
ElectricHeater. House	70	182										9 614	8 6 7 5 8	7 2 1 8
	110	286										15 108	1 2 9 5 1 2	10 3 1 2
	150	390										19 457	16 7 3 1 9	1 3 3 5 9
	210	546										25 637	2 2 1 2 2 8	17 7 1 8
												-		
Flat	40	104										3 235	2 9 2 5 5	2 4 7 5
	70	182										5 341	4 8 2 0 0	4 0 1 0
	110	286										8 393	7 1 9 5 9	5 7 2 9
	150	390										10 809	9 2 9 5 1	7 4 2 1
Since 1988 3rd regulation														
House	Surf ace	Vol												
	70	182		12 14 165	11 270	11 735	10 166	9 131				8 012	6 9 4 0 4	6 2 3 4
	110	286		19 22 259	17 282	18 441	15 975	14 349				12 590	1 0 9 0 6 6	9 7 9 6
	150	390		24 26 306	22 650	21 794	20 422	18 538				14 879	1 3 9 4 2 5	1 2 6 5 5
	210	546		32 31 162	29 209	25 818	26 685	24 511				17 626	1 8 2 1 8 3	16 7 3 3
Flat	40	104		5 477	4 852	4 282	5 079	4 499	3 971	5 270	4 669	4 120	2 686 3 7 9 0	2 1 0 0

70	182	9 076	7 862	7 062	8 416	291	6 549	8 734	7 566	6 796	4 451	3	3
												8 5	4 6
												6	3
110	286	14 263	12 355	11 098	13 226	11 457	10 291	13 725	11 889	10 679	6 994	6	5
												0 5	4 4
												9	2
150	390	16 856	15 795	14 337	15 630	15 199	13 295	16 220	15 199	13 796	8 266	7	7
												7 4	0 3
												6	1

- For the same surface, there is a 78% difference between the energy consumption of a non insulated house built before 1955 and a house built after 1988. The gains in efficiency obtained since 1975 should compensate the rise of energy consumption linked with the increase of electric equipment.
- The pilot light of gas cci represents about 8% of its global consumption.
- Gas or oil CC are more efficient than CCI with PL and as efficient as systems without PL.
- A comparison made between energy consumption per sq. meters shows that energy consumption decreases when the housing's size increases : the bigger the housing, the lesser the housing's rooms occupation (therefore the heating).

- Due to strict regulations for insulation, electric heating is the lowest energy consuming system.
- The detailed factors influencing the energy consumption gap between housing equipped with an electric system and other housings have been studied by the Ceren (Haehnel, 1995)
 - Housing characteristics explain 13% of the gap for houses and 9% for flats.
 - A frequent use of wood as a complementary heating source explains 13% of the gap for houses but 0% for flats.
 - The price of energy explains 25% of the gap for houses and 20% for flats.
- For example, people with annual incomes from 90 to 110 KF (Euros 13 000 to 16 500) consume an average of 60kWh/m² and spend 42F/m² while the same category using a gas heating system consume 142kWh/m² but spend 32 F/m² (note 23)
- What is left is called the « technical factor » and can be associated with a better efficiency of electric heaters and an ease of utilisation (programming, temperature control, etc.). It represents an important part, which is still difficult to explain, and could be linked as well with behaviour.
- The results are coherent with an IER study which quotes an average annual heating energy consumption of 33 000 kWh for gas heating in an old house and 15 000 kWh in new houses(Haug, Gebhardt & al 1998).

C Calculation of hot water heating energy consumption

Hot water energy consumption is linked mainly with the volume therefore with the behaviour and the number of inhabitants in the household (length of showering time, number of bath etc). For a family of three, the daily hot water consumption is estimated to be 100l /day with 43 l used in washbasins, 26 litres in showers or bath, 29 l in the sink.

More generally, the average hot water (60 °C) consumption figures quoted per person/day go from 30 to 40 l (DDE Hauts de Seine, year unknown).

However, in the same way that we have used for heating energy calculations, we have to identify the energy needed for hot water and to establish the correspondent energy consumption according to the heating system and energy used.

First of all, a link can be established between the amount of needs in hot water in l/day and the number of room/housing (Table 2.32). It is interesting to notice that the evaluation of hot water needs has changed since 1988 while the general water consumption has been stable since this date (Cambon, 1996).

Table 2.32 Hot water needs/number of room

Number of rooms	1	2	3	4	5
Hot water needs (l/day) at 60° C					
1990.	50	70	95	120	160
1997	70	95	125	175	240

Source : Ademe/Sygma 1993/Cheriel 1997

However, according to Cheriel, the energy needs for hot water production can be calculated without taking into account the number of rooms as such:

$$E = 1,163. V. (T \text{ hot water} - T \text{ cold water})$$

V is the volume of water (m³)

T hot water is the storage temperature (°C)

T cold water is the water temperature at the pipe.(°C)

E is in kWh

In the calculation, T hot water is 60°C, T cold water is 10°C

Therefore energy needs values are calculated as in Table 2.33:

Table 2.33 Calculation of energy needs (E) for the hot water production

HOT WATER NEEDS (LITRES)	N U M B E R O F R O O M S	E (KWH)
70	1	1355
95	2	1840
125	3	2420
175	4	3389
240	5	4647

Source : ADEME/EDF 1997

Energy consumption will depend on the efficiency of the water heating systems. I will calculate the energy consumption of an electric boiler, various examples of the energy consumption of some oil or gas systems and end with the use of a more general formulae.

C.1 Energy consumption of an electric boiler.

We first have to consider energy losses as they will interfere in the global energy consumption of a boiler. Energy losses can be calculated as follows :

$$P = V * Cr * (T \text{ hot water} - T \text{ room temperature})$$

V is the boiler water capacity (m3)

Cr is the cooling constant

T hot water is the storage temperature (°C)

T room temperature is the average temperature of the space where the boiler is situated.

(We will consider T room temperature = 18°C)

The values of Cr are given by Table 2.34 :

Table 2.34: Values of Cr

VALUES OF CR	TYPE OF HOT WATER HEATER			AVERAGE
boiler capacity l	A	B	horizontal	
100	0,35	0,32	0,39	0,350
150	0,26	0,23	0,33	0,270
200-300	0,24	0,22	0,30	0,253
>300	0,22	0,22	0,30	0,247

Source : CSTB 1993

Therefore the energy consumption for water heating can be defined as :

$$C = E + P * \text{duration of usage (in days)}$$

The duration of usage that we will consider is 333 days (32 days holidays).

To avoid energetic over consumption, it is important that boiler's capacity fits with hot water needs. As the capacity exceeds the needs, the average energy consumption is

$$C = (C \text{ capacity} + C \text{ needs})/2.$$

It is possible to calculate the Hot water needs taking into account the boiler's capacity (Table 2.35)

Table 2.35: Calculation of Hot water needs/boiler's capacity

B O I L E R CAPACITY	E in kWh	CR	P in kWh	C in kWh
75	1452	0,35	367	1819
100	1936	0,35	490	2426
150	2905	0,27	566	3471
200	3873	0,253	708	4580
300	5809	0,247	1036	6846
Hot water needs	E	Cr	P	C in kWh
70	1355	0,35	343	1698
95	1840	0,35	465	2305
125	2420	0,27	472	2893
175	3389	0,253	619	4008
240	4647	0,247	829	5476

Source : ADEME/Sygma 1993

C.2 Calculation of the energy consumption of gas water heaters.

We know the average consumption of gas water heaters (Table 2.36)

Table 2.36 Energy consumption of gas water heaters.

CAPACITY	HOT WATER NEEDS	AVERAGE C in kWh
75	70	1759
100	95	2365
150	125	3182
200	175	4294
300	240	6161

Source : Ademe/Sygma 1993

Gas water heaters can be with or without pilot lights (PL). They can produce hot water instantly or have storage capacities. They can be integrated in central heating systems or be independent. The following examples have been calculated on the basis of technical information given in an Ademe research (Ademe, 1993) according to the following formulae:

$$C = \text{Energy needs} / \text{heater efficiency} + \text{energy losses.}$$

- Gas water heater with an option for an in-house 200l storage capacity.

Energy consumption of PL : 1000 kWh before 1988, 1100 kWh after this date.

Efficiency 0.77 before 1988 ; 0.79 after.

As the energy losses linked with storage are not given, the losses figures of electric boilers will be used.

$$C = (E/\text{efficiency} + C \text{ pilot light}) + (C \text{ Storage consumption}) / 2$$

It is then possible to calculate the energy consumption of different types of gas water heaters. (Tables 2.37, 2.38, 2.39)

Table 2.36 : Calculation of the energy consumption of a gas water heater with PL

			1983-1988		AFTER 88	
Hot water needs	number of rooms	E	C	C when Storage	C	C when storage
70	1	1355	2760	3670	2816	3698
95	2	1840	3389	3985	3429	4004
125	3	2420	4143	4362	4164	4372
175	4	3389	5401		5389	
240	5	4647	7036		6983	

Source : ADEME/SYGMA (1993)

Table 2.37 Calculation of the energy consumption of a gas water heater. Instant production. Double usage. No pilot light.

BEFORE 1988				AFTER 1988
average efficiency 0,83				
Hot water needs	number of rooms	E	C	efficiency: 0,85
70	1	1355	1633	1595
95	2	1840	2216	2164
125	3	2420	2916	2848
175	4	3389	4083	3987

240	5	4647	5599	5467
-----	---	------	------	------

Source : ADEME/SYGMA (1993)

Table 2.38 Energy consumption of a collective gas central heating.

Double usage; 200l storage with an energy loss of 730kWh/year.

Loss in pipes : 1 138kWh.

Efficiency : 0,75 before 1988 and 0,80 after this date.

HOT WATER NEEDS	N U M B E R R O O M S	O F E	C 83-88	C A F T E R 88
70	1	1355	3675	3562
95	2	1840	4321	4167
125	3	2420	5095	4894
175	4	3389	6386	6104
240	5	4647	8064	7677

Source : ADEME/SYGMA (1993)

C.3 Energy consumption of heating oil water heaters.

The gas heaters' formula is used for oil heaters as the only thing that changes in the heater's technology is the burner. Therefore, it is possible to calculate the energy consumption of some heating oil water heaters. (Tables 2.40, 2.41)

Table 2.40 : Energy consumption of an heating oil individual system. Double usage.

Efficiency : 0,6 before 1988 ; 0,65 after.

Boiler's capacity : 150l.

					C with storage in kWh	
Hot water needs	n u m b e r o f r o o m s	E	C 83-88	C after 88	Before 88	After 88
70	1	1355	2259	2085	2865	2778
95	2	1840	3066	2830	3268	3151
125	3	2420	4034	3724		
175	4	3389	5648	5213		
240	5	4647	7746	7150		

Source : ADEME/SYGMA (1993)

Table 2.41 : Energy consumption of a heating oil collective system.

Double usage.

Storage capacity : 200l with an energy loss of 730kWh.

Energy loss in pipes : 1138 kWh.

Efficiency :0,75 before 1988 ; 0,765 after this date.

HOT WATER NEEDS	N U M B E R O F ROOMS	E	C 83-88 in kWh	C after 88 in kWh
70	1	1355	3675	3640
95	2	1840	4321	4265
125	3	2420	5095	5032
175	4	3389	6386	6298
240	5	4647	8064	7943

Source : ADEME/SYGMA (1993)

C.4. Another way of calculating hot water energy consumption.

If none of the technical characteristics of the water heater are known, it is possible to estimate energy consumption of hot water thanks to the following method given by Tribu Consultant⁶¹:

- Calculation of hot water needs

$\text{Hot water needs } E = 21 \times Sh$
--

Sh is the surface of the housing in m².

E is in kWh

- Efficiency multiplying coefficient to be used:

Collective heater oil or gas : 2,08

Individual heater gas or oil : 1,41

Electric heater aged >15 years : 1,85

aged <15 years and > 5 years : 1,30

aged <5 years : 1,27

Therefore:

⁶¹ Source :Conversation with B. Sesolis Tribu Consultant march 1999.

$C = E \cdot \text{Efficiency coefficient.}$

According to some types of surfaces, and to the type of housing, we can therefore calculate the energy consumption of hot water systems (Table 2.42).

Table 2.42 : Calculation of the energy consumption of hot water systems per housing surface.

			ENERGY CONSUMPTION IN KWH		Electric consumption in kWh		
	m2	Hot water needs in kWh	Collective heater Gas or oil	Individual heater gas	heater>15 years old	15<x<5	<5 years old
House	70	1470	3058	2058	2719	1911	1867
	110	2310	4805	3234	4273	3003	2934
	150	3150	6552	4410	5827	4095	4001
	210	4410	9173	6174	8158	5733	5601
Flat	40	840	1747	1176	1554	1092	1067
	70	1470	3058	2058	2719	1911	1867
	110	2310	4805	3234	4273	3003	2934
	150	3150	6552	4410	5827	4095	4001

Source : Tribu 1999

Conclusion :

- The influence of the year of construction is weak, the decrease in energy consumption is 2 or 3% for gas water heaters and a maximum of 10% for systems using heating oil.
- Results of the calculation of the average energy consumption per type of housing and energy are coherent with detailed results per type of heaters. In fact, using the tables given in the previous paragraphs, they correspond to a hot water need of 200 to 300 l in a house and of 150 l in a flat, this means an average of 4 to 5 rooms per house and of 3 rooms per flat.

This corresponds to the average figures given by official data (Omalek, Le Blanc, 1998) :

	1996 House	Apartment
Average number of people /household:	2,7	2,2

Average number of rooms per households	4,8	3,0
--	-----	-----

- While collective heating systems are more efficient than individual ones, it is the opposite when they are used to heat water because of energy losses in the pipes' networks and a weak adjustment capacity. $C = E \times \text{Efficiency coefficient}$.
- Collective water heating systems are more energy consuming than double usage systems with no water storage and are equivalent to double usage systems with storage. Therefore, the use of such systems - which are more efficient for general heating (cf. previous section) - would improve a lot with pipes' insulation and could be questioned anyway.
- Heating-oil heaters are much more efficient when they are individual ones.
- Gas systems without pilot lights are as efficient as electrical systems.

C.5 Conclusion : Breakdown of household's energy consumption per type of usage

To evaluate the relative part of household's energy consumption, the example of a 110 m² house and a 70m² will be taken, and two dates of construction 1974 and since 1988. One house will be considered to be « all electric » and the other, « all gas ».

Households are equipped with a fridge, a freezer, a dishwasher, a washing machine and all other electrical appliances except a computer. Collective heating is used for the flat. Examples of the calculation of some household's energy consumption per type of usage are given in Table 2.43.

Table 2.43 Examples of a calculation of a household's energy consumption per type of usage

110 m2 house	ENERGY CONSUMPTION IN KWH					
	electricity	% in 1974	% since 1988	gas	%	%
elec. appliances	2 660	11	17	2 660	6	10
cooking	203	1	1	520	1	2
heating 74(1)	18 000	75		40 000	83	
since 88 (2)	10 000		63	19 000		70
hot water	3 003	13	19	4 805	10	18
Total 1	23 866	100		47 985	100	
Total 2	15 866		100	26 985		100
70 m ² flat						
	electricity	%	%	gas	%	%
elec. appliances	2 660	24	30	2 660	12	18
cooking	203	2	2	520	2	3
heating 74(1)	6 000	55		15 000	7	
since 88 (2)	3 850		44	7 000		47
hot water	2 058	19	23	4 805	21	32
Total 1	10 921	100		22 985	100	
Total 2	8 771		100	14 985		100

- Whatever the importance of heating in global energy consumption, houses' hot water and electrical appliances consume more or less the same amount of energy which varies from 12 to 20% of the whole household's energy consumption. Together, electrical appliances and hot water systems represents 40% of the energy consumption , this level goes up to 50% in collective buildings.

- These results are confirmed when studying collective buildings (Table 2.44). In those buildings, part of the energy spending is allocated to a general spending item (standing charges), the energy spending for electrical appliances is as important as the heating one (Siedler, 1997) in buildings constructed in 1990, and more important in new efficient buildings (1996). This last result is at the opposite of most common ideas about the importance of heating in the energy bill.

Table 2.44 : Energy spending per type of energy and type of usage in collective buildings.

%	1990			1996
	LPG	gas	electricity	gas
heating	29.1	23.9	36.6	18.4
hot water	15.7	12.9	10.3	12.4
elec.appliances	29.3	25.3	24.3	38.6
cooking	5	5	5.1	5.8
general item	20.9	32.9	21.7	24.8

Source : Tribu/DGXI 1997

D Household's CO2 emissions.

As the main pollution linked with fuel consumption is CO2 and knowing its importance on the greenhouse effect, the study will concentrate on it.

D.1 Calculation of CO2 emissions

The amount of CO2 emissions differs according to the energy that is used. The equivalencies used for calculation are mentioned in Table 2.45.

Table 2.45 : CO2 emission per Tep

	Coal	Domestic oil	Heavy oil	Gas	Electricity
KCO2/Tep	3896	2990	2972	2346	291

Source : WWF & Utrecht University. Inesten, 1998

Therefore our energy consumption results must be converted in tep.

Conversion values (Chevalier, Barbet, Benzoni, 1986) : 1tep= 11 626 kWh or 4500 kWh (kWh electric)

We know that heat networks produce 6314 thousands T of CO2 per year (Ministère de l'Environnement, 1997)

D.1.1 Electrical appliances CO2 emissions (kgs)

Calculation of CO2 emissions (see table 2.46)

- The biggest energy consuming appliances also account for high pollution levels i.e. cold appliances. However, incandescent light bulbs pollution is the highest because of the number of bulbs used in the housing. This stresses the importance of developing a policy for implementing low energy consumption bulbs.

Table 2.46 : Calculation of Electrical appliances CO2 emissions (kgs)

		kWh/year appliance's cons	E q u i p m e n t level	Average House's cons.per year		C O 2 emissions
				kWh	tep	
cold	fridge	435,41	0,57	248,18	0,0552	16,049
	2nd fridge	435,41	0,12	51,81	0,0115	3,351
	freezer	609,03	0,51	308,17	0,0685	19,928
	2 nd freezer	609,03	0,02	10,96	0,0024	0,709
	combi	552,94	0,60	330,66	0,0735	21,382
washing	dishwasher	364,89	0,35	129,06	0,0287	8,346
	2nd dishwasher	364,89	0,02	5,47	0,0012	0,354
	washing machine	254,77	0,88	225,45	0,0501	14,579
	2nd washing machine	254,77	0,05	13,25	0,0029	0,857
drying	dryer	338,63	0,20	69,28	0,0154	4,480
lightning	incandescent	468,08		468,08	0,1040	30,269
	halogens	21,13		21,13	0,0047	1,366
	fluorescent	0,29		0,29	0,0001	0,018
	low consuming bulb	0,02		0,02	0,0000	0,001
leasure	TV	158,51	0,95	150,58	0,0335	9,738
	2 nd TV	52,47	0,20	10,39	0,0023	0,672
	video recorder	1,99	0,57	1,14	0,0003	0,074
	computer (PC)	124,66	0,13	16,82	0,0037	1,087
	hi fi	34,98	0,58	20,40	0,0045	1,319
cleaning	vacuum cleaner	20,81	0,89	18,42	0,0041	1,191
	iron	36,31	1,00	36,17	0,0080	2,339
pilot light	TV	27,05	0,95	25,70	0,0057	1,662
	2nd TV	8,92	0,20	1,77	0,0004	0,114
	Hi fi	103,35	0,58	60,28	0,0134	3,898
	video recorder	123,54	0,57	70,95	0,0158	4,588
	computer (PC)	4,36	0,13	0,59	0,0001	0,038
TOTAL					0,51	148,4

Source : INSEE 1995 (in bold)

D.1.2 Cooking devices'CO2 emissions

On the general level CO2 emissions can be calculated taking into account that 1 t of LPG produces 2,97 tons of CO2 (Inestene, 1999). The general CO2 emission of cooking appliances are described in Table 2.47.

Table 2.47 : General CO2 emission of cooking appliances

	Mtep	M t CO2
L P G		2,97
gas	671	1,57
elec	1 311	0,38
tota l	1 982	4,93

Source : Inestene 1998

As 43% of households are connected to a gas network, we will suppose that all of them are using gas for hotplates i.e. 57% of « gas » hotplates are used with LPG. As it is not the case in real life, the results are maximum levels.

As LPG is not easy to use for ovens, we will suppose that all of them are connected to a gas network. Calculation of CO2 emission of cooking appliances are described in Table 2.48.

Table 2.48 Calculation of CO2 emissions of cooking appliances in the French households

	kWh/year appliance's cons	Kg CO2 emissions	equipment level	kWh/year average house's cons.	Kg CO2 emissions
electric oven	111	7	0,66	73	5
hotplates elec	417	27	0,25	104	7
hotplates gas	536	46	0,72	166	34
hotplates LPG	536			220	nd
gas oven	420	84	0,32	134	27
micro waves	59	4	0,43	26	2
TOTAL				724	74

D.1.3 CO2 emissions from heating systems.

We know the amount of kWh used for heating purposes and the corresponding values in Mtep. It is therefore easy to calculate the CO2 emissions that are produced by heating activities. However, the situation is more complicated for electric heating as it can't be fully attributed to nuclear production. Heating is only used in winter. During this « peak time », EDF, the National electric utility, has to provide a bigger quantity of electricity at a minimal cost. In this situation,

the use of nuclear energy is inadequate as fixed costs are too high. Other means of production have to be used i.e. coal, oil or gas power plants. As there is an overproduction of nuclear electricity, part of it still contributes to provide electricity for peak time. Nuclear electricity use for residential heating is considered to be 60% (Sygma, 1993).

We will take this hypothesis as it represents the minimum contribution of electric heating to pollution. The origin of the 40% left can be calculated with the help DGEMP ⁶² figures that makes a breakdown of the energy sources from thermic origins used for residential electric heating :

- Coal : 81%
- Oil : 14%
- Gas : 5%

Hence, if we consider that these percentages represents 40% of the global electric consumption for heating purposes, the origin of the electricity used for residential heating is then :

- Nuclear : 60%
- Coal : 32,4%
- Oil : 5,6%
- Gas : 2%

The CO2 emissions can be calculated then as in Table 2.49.

Table 2.49 : Household's heating CO2 emissions

	M tep	CO2 Thousands tons
heating oil	8,2	24518
LPG	0,5	1,2
gas	7,8	18299
CEI	9,9	16 338
coal	1,6	6234
heat network	3	6314
wood	5,4	nd
Total	36,4	71 703

Source : Données économiques de l'environnement 1997, Inestene 1998

- While oil heaters equip 25% of French households, they produce 35% of CO2 emissions.
- With the same equipment level (29%), gas heaters pollute 25% less.

⁶² All DGEMP figures are quoted in the research paper of Sygma consultants.

- Electric heaters represent 20% of the stock but, since 1989, 60% of the heaters used in new housing. Electric heaters are more or less as polluting as gas heating while often presented to the consumers as a « clean » energy.

Of course, these results and those found when calculating energy consumption levels (importance of insulation, date of construction etc) come across again in CO2 emissions levels. Therefore, CO2 emissions have been calculated by climate areas and type of energy to follow the line adopted already.

D.1.4 Hot water

Hot water production is stable all year round except when the household is on holidays.

For electric boilers, the average CO2 emissions level associated with the use of electricity should be used for electric boilers. This point is sometimes questioned by saying that many electric boilers work at night because of low tariffs and therefore, that a unique nuclear energy source should be considered. However, we weren't aware of any data suggesting so. Therefore the breakdown of energy origins used for calculating CO2 emissions for hot water production (Table 2.50) is the same than the one used for electric heating.

Table 2.50 Calculation of Hot water CO2 emissions

k g s CO2		gas		oil		Electricity		
	m2	collective heater	individual	collective	individual	heater>15 years old	15<x<5	<5 years old
Hous e	70	617	415	786	529	176	124	121
	110	970	653	1236	832	276	194	190
	150	1322	890	1685	1134	377	265	259
	210	1851	1246	2359	1588	528	371	362
Flat	40	353	237	449	302	100	71	69
	70	617	415	786	529	176	124	121
	110	970	653	1236	832	276	194	190
	150	1322	890	1685	1134	377	265	259

Basis : one year

- Electric boilers pollute less than other systems, especially those that are less than 15 years old.
- Logically, oil heaters pollute the most.

2.1 e Focus on heating and hot water.

It could be interesting to evaluate the relative importance of energy consumption and pollution of water heating to the general heating contribution.

For this purpose, an example based on a 110 sq meters house and a 70m² flat (the French average) built during the years 1974-1982 in the H1 climatic region will be studied :

The Ceren study (Ceren, 1998) shows the following repartition of energy sources :

- Houses with electric heating are 90% equipped with an electric boiler, the percentage is 95% in flats.
- 60% of the houses and flats equipped with oil heating systems keep the same energy for water heating. Other houses (30%) use electric boilers, other flats use both electric (20%) or gas (20%) water heating systems.
- 87% of the houses equipped with gas heating systems keep the same energy for water heating.

Although the figures are from 1988 and relatives repartition between energies might have changed, the type of energy used must be the same. Therefore, the following cases will be studied :

- Electric heater + electric boiler
- Gas heater + gas water heater with pilot light
- Oil heater + oil water heater.
- Oil heater + electric boilers (houses), + electric boilers or gas water heaters (flats).

Electric boilers will be considered to be less than 15 years old and more than 5 years old.

A calculation will be made using the figures from the previous chapter(II 1 4.b e)).

Pollution levels per type of heating/hot water systems couple are calculated in Table 2.51.

Table 2.51 : Calculation of pollution levels per type of heating/hot water systems couple.

HOUSE 110 M²				FLAT 70 SQ M			
	heating system			heating system			
H1	oil	gas	electricity	ccc oil	cci gas	cccgas	electricity
Cons. kWh	46 344	46 344	21 693	16 886	17 548	16 886	7 122
Hot water cc oil	4 805			3 058			
Total kWh	51 149			19 943			
TOTAL CO2	13 155			5 129			
Hot water gas kWh	3 234	4 805		2 058	2 058	3 058	-
Total kWh		51 149		18 944	19 606	19 944	
TOTAL CO2	12 888	10 321		4 758	3 956	4 024	
Hot water electricity kWh	3 003		3 003	1 911			1 911
Total kWh							9 033
TOTAL CO2	12 113		7 308	4 466			2 459

- When using an oil heater, it is less polluting to have a gas or electric boiler. Coupled with an oil heater, both energies will generate more or less the same pollution level.
- Collective gas central heating is more efficient than an individual one but globally, the gap of efficiency is compensated by a low efficiency of water heaters and performances of both systems are equivalent.
- Electric systems are the less polluting.

The influence of the quantity of hot water used in a household on its CO2 pollution level.

To evaluate the importance of the quantity of hot water used in a household the same example will be used. Hot water needs will be calculated referring to the hot water needs/number of room figures given in Table 2.37 to Table 2.41. Energy consumption will be calculated using the multiplicative coefficients calculated previously.

Table 2.52 : Calculation of the influence of the quantity of hot water used in a household on its CO2 pollution level

ELECTRICITY	H O U S E KWH	CO2	TOTAL CO2	FLAT KWH	CO2	TOTAL CO2
heating kWh	21 963	7 202		7 122	2 335	
hot water (l)						
95		153	7 355		153	2 488
125		206	7 408		206	2 541
175		278	7 480		278	2 613
240		398	7 600		398	2 733

Gas	HOUSE kWh	CO2	TOTAL CO2	FLAT CCC kWh	CO2	TOTAL CO2
heating kWh	46 344	9 352		16 886	3 407	
hot water (l)						
95	2 575	520	9 871	3 826	772	4 180
125	3 389	684	10 036	5 035	1 016	4 423
175	4 744	957	10 309	7 048	1 422	4 830
240	6 506	1 313	10 665	9 666	1 951	5 358
Heating oil						
cons. kWh	46 344	11 919		16 886	4 343	
hot water cc oil						
95	2 575	662	12 581	3 826	984	5 327
125	3 389	872	12 790	5 035	1 295	5 638
175	4 744	1 220	13 139	7 048	1 813	6 156
240	6 506	1 673	13 592	9 666	2 486	6 829
hot water gas						
95	2 575	520	12 439	2 575	520	4 862
125	3 389	684	12 603	3 389	684	5 027
175	4 744	957	12 876	4 744	957	5 300
240	6 506	1 313	13 232	6 506	1 313	5 656
hot water elec						
95		153	12 072		153	4 496
125		206	12 125		206	4 549
175		278	12 197		278	4 621
240		398	12 317		398	4 741

➤ In most cases, water heating represents a maximum of 12- 14% of the whole CO2 emissions.

- In the case of a double usage collective central heating systems, water heating can represent up to 36% of the whole CO2 emissions. When oil heating systems are used with a gas water heater, the latter can represent up to 23% of the whole CO2 emissions.
- The influence of hot water consumption on global heating CO2 emissions is not always negligible.

D.2 Perspectives for household's energy savings and CO2 emissions.

A couple of studies have already examined household's energy savings' perspectives depending on different Demand Side Management scenarios all of which are based on governmental incentives towards households and/or various hypotheses about the main energy sources. (Houdant, Radanne, Banneyx, 1995; Le Strat, 1996).

The last one from the WWF (Bonduelle, Bailly, Connor-Lajambe 1998), considers that in 2005, a 10Mt of CO2 can be saved by :

- reinforcing buildings' construction regulations
- development of passive solar energy
- implementation of technical regulations on water heaters
- labels policy on all electrical appliances
- National plan for the renovation of >1975 housing at the speed of 3,5%of housing/year i.e. 600 000 housing with the help of new thermic regulations.

fiscal incentives for renovation

But one can wonder what the household's margin of action is in the absence of any incentives. In that case, households can influence their energy consumption due to their investments or to their behaviour.

D.2. 1 Margins of action linked to investments.

Households can affect their energy consumption through their investment choices.

Apart from the purchase of efficient light bulbs, most of these investments are quite big ie insulation, choice of energy, renewal of heating system, new electric appliances.

Influence of insulation devices.

It is possible to study the influence of insulation on energy consumption thanks to the data gathered in b).

Most energy saving's potential lies within housing built before 1974 as there was no thermic regulations by then. It will be calculated by subtracting figures of insulated housings from non insulated ones (see Table 2.53).

This table will be followed by the calculation of the corresponding CO₂ savings (Table 2.54). For individual heaters, the calculation will refer to gas with pilot lights as they are the most commonly found.

Tables 2.53: Calculation of energy savings achieved with insulation devices/ year of construction (in kWh)

Before 55	Surface	vol	Gas or heating oil with PL			CCI electricity			CCC gas or oil		
t y p e o f insulation	m ²	m ³	H1	H2	H3	H1	H2	H3	H1	H2	H3
Attic+cal											
House	70	196	10 170	9 910	4 998	5 752	5 605	2 827			
	110	308	15 981	15 574	7 853	9 039	8 809	4 442			
	150	420	21 792	17 697	21 419	12 326	10 010	12 115			
	210	588	24 407	24 776	41 231	13 805	14 014	23 321			
Flat	40	112	3 351	2 939	1 235	1 643	1 441	606	3 225	2 828	1 189
	70	196	6 516	6 350	3 202	3 196	3 114	1 570	6 271	6 111	3 082
	110	308	10 240	9 979	5 032	5 022	4 894	2 468	9 854	9 603	4 842
	150	420	13 964	11 340	13 725	6 848	5 561	6 730	13 437	10 912	13 207
Attic+ cal+ walls											
House	70	196	17 288	16 517	9 995	9 778	9 342	5 653			
	110	308	27 167	25 956	15 707	15 366	14 681	8 884			
	150	420	34 867	30 085	26 773	19 721	17 017	15 143			
	210	588	42 712	39 642	54 350	24 158	22 422	30 741			
Flat	40	112	5 630	5 117	2 965	2 761	2 509	1 454	5 418	4 924	2 853
	70	196	11 078	10 584	6 405	5 432	5 190	3 141	10 660	10 185	6 163
	110	308	17 408	16 632	10 065	8 537	8 156	4 936	16 751	16 004	9 685
	150	420	22 342	19 278	17 156	10 956	9 454	8 413	21 499	18 551	16 508
Attic+cal+wall s+windows	70	196	21 356	19 821	13 744	12 079	11 211	7 774			
House	110	308	33 559	31 147	21 597	18 982	17 617	12 216			
	150	420	43 584	37 164	33 467	24 651	21 020	18 929			
	210	588	54 915	49 552	61 846	31 061	28 027	34 981			
Flat	40	112	7 373	6 532	4 282	3 616	3 203	2 100	7 095	6 285	4 120
	70	196	13 684	12 701	8 807	6 711	6 228	4 319	13 168	12 222	8 474
	110	308	21 504	19 958	13 839	10 545	9 787	6 786	20 693	19 205	13 317
	150	420	27 928	23 814	21 445	13 695	11 678	10 516	26 874	22 915	20 635

	m ²	Vol	Gas or heating oil with PL			CCI electricity			CCC gas or oil		
1955-1974			H1	H2	H3	H1	H2	H3	H1	H2	H3
Attic+cal+walls											
House	70	196	10 170	9 910	4 998	5 752	5 605	2 827			
	110	308	15 981	15 574	7 853	9 039	8 809	4 442			
	150	420	21 792	17 697	16 064	12 326	10 010	9 086			
	210	588	42 712	29 731	26 238	24 158	16 816	14 840			
Flat	40	112	3 753	3 701	1 812	1 841	1 815	888	3 612	3 562	1 743
	70	196	6 516	6 350	3 202	3 196	3 114	1 570	6 271	6 111	3 082
	110	308	10 240	9 979	5 032	5 022	4 894	2 468	9 854	9 603	4 842
	150	420	13 964	11 340	10 293	6 848	5 561	5 048	13 437	10 912	9 905
Attic+walls+cal+windows	70	196	21 356	19 821	13 744	12 079	11 211	7 774			
House	110	308	33 559	31 147	21 597	18 982	17 617	12 216			
	150	420	43 584	37 164	33 467	24 651	21 020	18 929			
	210	588	57 966	52 030	44 979	32 786	29 429	25 441			
Flat	40	112	7 775	7 294	4 941	3 813	3 577	2 423	7 482	7 019	4 754
	70	196	13 684	12 701	8 807	6 711	6 228	4 319	13 168	12 222	8 474
	110	308	21 504	19 958	13 839	10 545	9 787	6 786	20 693	19 205	13 317
	150	420	27 928	23 814	21 445	13 695	11 678	10 516	26 874	22 915	20 635

- When fossil fuels are used, the level of energy savings is more or less the same whatever the energy and the heating system.
- The amount of energy saved increases significantly with each device. For example, for an H2 house of 110 square meters built before 1955, the insulation of the attic and draught proofing save 21% of energy. This level goes up to 35% with the insulation of walls and up to 43% with the insulation of windows.

Table 2.54 Calculation of the corresponding savings of CO2 emissions per type of heating energy and type of heating system.

		CCI gas			CCC oil			CCC electricity		
Before 55	m²	H1	H2	H3	H1	H2	H3	H1	H2	H3
Insulation type										
Attic+cal										
House	70	2 052	2 000	1 008	2 615	2 549	1 285	1 886	1 838	927
	110	3 225	3 143	1 585	4 110	4 005	2 020	2 964	2 889	1 457
	150	4 397	3 571	4 322	5 604	4 551	5 508	4 042	3 282	3 973
	210	4 925	5 000	8 320	6 277	6 372	10 604	4 527	4 595	7 647
Flat	40	676	593	249	862	756	318	539	473	199
	70	1 315	1 281	646	1 676	1 633	824	1 048	1 021	515
	110	2 066	2 014	1 015	2 634	2 566	1 294	1 647	1 605	809
	150	2 818	2 288	2 769	3 591	2 916	3 530	2 245	1 824	2 207
Attic+ cal+ walls										
House	70	3 489	3 333	2 017	4 446	4 248	2 571	3 207	3 064	1 854
	110	5 482	5 238	3 170	6 987	6 675	4 040	5 039	4 814	2 913
	150	7 036	6 071	5 403	8 967	7 737	6 886	6 467	5 580	4 966
	210	8 619	7 999	10 967	10 985	10 195	13 978	7 922	7 353	10 081
Flat	40	1 136	1 032	598	1 448	1 316	762	905	823	477
	70	2 235	2 136	1 292	2 849	2 722	1 647	1 781	1 702	1 030
	110	3 513	3 356	2 031	4 477	4 277	2 588	2 799	2 675	1 618
	150	4 508	3 890	3 462	5 746	4 958		3 593	3 100	2 759
Attic+ cal +walls + windows										
House	70	4 309	4 000	2 773	5 098	3 535	3 107	3 396	3 152	2 186
	110	6 772	6 285	4 358	8 010	5 554	4 882	5 337	4 953	3 435
	150	8 795	7 499	6 753	9 558	8 607	6 340	6 931	5 910	5 322
	210	11 081	9 999	12 480	12 744	15 906	7 988	8 733	7 880	9 836
Flat	40	1 488	1 318	864	1 680	1 101	930	1 017	901	590
	70	2 761	2 563	1 777	3 266	2 265	1 726	1 887	1 751	1 214
	110	4 339	4 027	2 793	5 133	3 559	2 712	2 965	2 752	1 908
	150	5 635	4 805	4 327	6 125	5 515	3 522	3 851	3 284	2 957

1955-1974	m²	CCI gas			CCI oil			CCI electricity		
Attic+cal+walls		H1	H2	H3	H1	H2	H3	H1	H2	H3
House	70	2 052	2 000	1 008	2 615	2 549	1 285	1 886	1 838	927
	110	3 225	3 143	1 585	4 110	4 005	2 020	2 964	2 889	1 457
	150	4 397	3 571	3 242	5 604	4 551	4 131	4 042	3 282	2 979
	210	8 619	5 999	5 295	10 985	7 646	6 748	7 922	5 514	4 867
flat	40	757	747	366	965	952	466	604	595	291
	70	1 315	1 281	646	1 676	1 633	824	1 048	1 021	515
	110	2 066	2 014	1 015	2 634	2 566	1 294	1 647	1 605	809
	150	2 818	2 288	2 077	3 591	2 916	2 647	2 245	1 824	1 655
Attic+walls+cal+ windows	70	4 309	4 000	2 773	5 492	5 098	3 535	3 918	3 636	2 521
House	110	6 772	6 285	4 358	8 631	8 010	5 554	6 156	5 714	3 962
	150	8 795	7 499	6 753	11 209	9 558	8 607	7 995	6 817	6 139
	210	11 697	10 499	9 076	14 908	13 381	11 568	10 633	9 544	8 251
Flat	40	1 569	1 472	997	2 000	1 876	1 271	1 237	1 160	786
	70	2 761	2 563	1 777	3 519	3 266	2 265	2 176	2 020	1 401
	110	4 339	4 027	2 793	5 530	5 133	3 559	3 420	3 174	2 201
	150	5 635	4 805	4 327	7 182	6 125	5 515	4 442	3 787	3 411

		CCC GAS			CCC OIL		
before 55	m2	H1	H2	H3	H1	H2	H3
Flat	40	651	571	240	829	727	306
	70	1 265	1 233	622	1 613	1 572	793
	110	1 988	1 938	977	2 534	2 470	1 245
	150	2 711	2 202	2 665	3 456	2 806	3 397
attic+ cal+ walls							
Flat	40	1 093	994	576	1 393	1 266	734
	70	2 151	2 055	1 244	2 742	2 619	1 585
	110	3 380	3 230	1 954	4 308	4 116	2 491
	150	4 338	3 743	3 331	5 529	4 771	4 246
Attic+ cal +walls + windows							
flat	40	1 432	1 268	831	1 825	1 616	1 060
	70	2 657	2 466	1 710	3 387	3 143	2 179
	110	4 176	3 875	2 687	5 322	4 939	3 425
	150	5 423	4 624	4 164	6 911	5 893	5 307
1955-1974							
Attic+cal+walls							
Flat	40	729	719	352	929	916	448
	70	1 265	1 233	622	1 613	1 572	793
	110	1 988	1 938	977	2 534	2 470	1 245
	150	2 711	2 202	1 999	3 456	2 806	2 547
Attic+walls+cal+windows							
Flat	40	1 510	1 416	959	1 924	1 805	1 223
	70	2 657	2 466	1 710	3 387	3 143	2 179
	110	4 176	3 875	2 687	5 322	4 939	3 425
	150	5 423	4 624	4 164	6 911	5 893	5 307

a) Energy savings thanks to a switch of energy sources

The decision to change energy source is most likely to happen at the end of a heater's life (more or less 15 years). In collective buildings individuals are not the only decision makers as the building's managers prepare and orientates the decisions to be taken by the homeowners' assembly. Such a switch is also more difficult. These are the reasons why individual heaters will be the only ones studied.

While consumption is the same with both energies, the switch from oil to gas is interesting for the convenience in delivery and also because of a smaller CO₂ emission level (see following pages examples using individual heaters with PL). This can be the case in suburban areas which are now connected to the gas network. Still, it is not possible in most of the French countryside.

The switch from oil or gas to electricity is not economically efficient and therefore is most unlikely to happen. For instance, if we take the energy consumption of :

- an individual oil heater
- an individual gas heater
- an electric system in a 70 m² house built before 1955 without insulation and in the same type of house built after 1988, the energy consumption will be much higher for oil and gas and the average bill is described in Table 2.55:

Table 2.55: Comparison of the benefits of a switch of heating energy sources.

	Gas	Oil	Electricity
Before 1955 bill in FF	11 695	15 559	22 145
kWh/year	50 848	50 848	28 760
After 1988 bill in FF	3 258	4 334	6 169
kWh/year	14165	4 334	6 169
Energy prices in Fc/kWh	23	18/efficiency	77

Source : Energie plus 1999

The price of electricity makes the use of wood as a complementary heating source very interesting. According to CEREN (Ceren, 1998) it is economically relevant only for houses equipped with an electric heater. The ADEME (Ceren/Ademe, 1995) recommend the use of wood as its contribution to CO₂ emissions is supposed to be counterbalanced in France by the amount of newly planted trees.

As far as global CO₂ emissions are concerned such a way of thinking is questionable and it is not valid when talking about other pollutants from wood combustion.

Anyway, the Table 2.56 shows an example given by the ADEME for a 100m² house with average insulation level.

Price of wood : 200 FF the stere

Price of electricity : 0,76 FF.

System power : 6kWh. Inflation level : 3% ;

Interest rate : 8,5 %. Length of loan 10 years

Table 2.56 : Comparison between various energy sources for a 100sq m house

Type of heating system	All electric	Wood « insert » + « all electric »	Closed hearth + electricity	Turbo wood central heating system.
Efficiency	95%	wood : 35%	wood : 65%	80%
Coverage of heating needs by wood	0%	50%	80%	100%
Investment (FF)	17 900	27 900	38 000	70 000
Spending/year*	19 400	17 000	14 400	15 700
Savings/all electric.	-	-2 400	-5 000	-3 500

Source : ADEME . * Average amount actualised over 10 years

Some CO₂ savings achieved thanks to a switch of energy sources are calculated in Table 2.57.

Tables 2.57: Switch from oil to CCI gas. Calculation of CO₂ savings (kg) per year of house's construction.

CO ₂ SAVINGS BY SWITCHING FROM OIL TO GAS (KG)			SURFACE	before 55
H1	H2	H3	m ²	without insulation
2 817	2 562	2 076	70	House
4 426	4 026	3 263	110	
5 553	4 902	4 449	150	
7 267	6 313	6 436	210	
1 017	905	730	40	Flat
1 805	1 642	1 330	70	
2 836	2 580	2 091	110	
3 558	3 141	2 851	150	
				Insulation attic+cal
2 253	2 013	1 799	70	House
3 541	3 163	2 828	110	
4 346	3 921	3 263	150	
5 915	4 941	4 153	210	
832	742	661	40	Flat
1 444	1 290	1 153	70	
2 269	2 027	1 812	110	
2 785	2 513	2 091	150	
				Attic+ cal+ walls House
1 859	1 647	1 523	70	
2 921	2 588	2 393	110	
3 621	3 235	2 966	150	
4 901	4 117	3 426	210	
705	621	566	40	Flat
1 191	1 055	976	70	
1 872	1 658	1 533	110	
2 320	2 073	1 901	150	
				Attic+cal+walls+w indows
1 634	1 464	1 315	70	House
2 567	2 300	2 066	110	
3 139	2 843	2 595	150	
4 225	3 568	3 011	210	
609	543	493	40	Flat
1 047	938	843	70	
1 645	1 474	1 324	110	
2 011	1 822	1 663	150	

			Surface	1955-1974
H1	H2	H3	m2	Attic+cal
2 817	2 562	2 076	70	House
4 426	4 026	3 263	110	
5 553	4 902	4 449	150	
7 436	6 588	6 021	210	
H1	H2	H3	m2	
1 047	953	766	40	Flat
1 805	1 642	1 330	70	
2 836	2 580	2 091	110	
3 558	3 141	2 851	150	
				Attic+cal+walls
2 253	2 013	1 799	70	House
3 541	3 163	2 828	110	
4 346	3 921	3 559	150	
5 070	4 941	4 568	210	
839	748	666	40	Flat
1 444	1 290	1 153	70	
2 269	2 027	1 812	110	
2 785	2 513	2 281	150	
1 634	1 464	1 315	70	Attic+walls+cal+w indows
2 567	2 300	2 066	110	House
3 139	2 843	2 595	150	
4 225	3 706	3 530	210	
616	549	493	40	Flat
1 047	938	843	70	
1 645	1 474	1 324	110	
2 011	1 822	1 663	150	

			Surface	1974-1982
H1	H2	H3	m2	1st regulation Non elec.
1 634	1 464	1 315	70	House
2 567	2 300	2 066	110	
3 139	2 843	2 595	150	
3 887	3 568	3 322	210	
579	521	462	40	Flat
972	871	782	70	
1 527	1 369	1 230	110	
1 867	1 692	1 544	150	

H1	H2	H3	SURFACE	1982-1988
1 046	892	771	70	House
1 562	1 335	1 111	110	
2 018	1 730	1 446	150	
2 511	2 166	1 832	210	
400	342	296	40	Flat
670	572	494	70	
1 001	855	712	110	
1 293	1 108	927	150	
				Since 1988
785	680	611	70	House
1 233	1 068	959	110	
1 457	1 365	1 239	150	
1 726	1 784	1 639	210	
303	269	237	40	Flat
503	436	391	70	
790	684	615	110	
934	875	794	150	

- As building's efficiency increases, the switch from oil to gas is less interesting
- Switching energy is very interesting in houses and big flats. Even though they are already well insulated, the potential of energy saving is in the same scale as the one achieved with insulation.

b) Energy savings thanks to a more efficient heater technology

An energy efficiency improvement can be made by the simple use of a gas heater without PL. It can also be bigger with the use of the new highly efficient technologies already available on the French market. The efficiency of new heaters for individual houses reaches 0,85 for gas heaters, 0,83 for oil ones . In collective buildings, gas condensation heaters have a 0,9 efficiency. One could also mentioned heating pumps which efficiency goes from 1,8 to 3,5 but there are very scarce in France.⁶³ Once again we will be interested in cases where individual's are decision makers. The use of efficient oil heaters will be studied for individual houses only as this new technology is not available for flats (See Tables 2.58, 2.59, 2.60).

⁶³ Figures given by B Sesolis.Tribu consulting agency. March 1999.

Generally speaking, the energy saved thanks to the absence of pilot light is equivalent to 25% of the savings achieved by a switch from oil to gas.

To give an example of what can be achieved, a house built before 1974 in an H2 area equipped with an oil heater will save 31 147 kWh /year thanks to the best insulation ie 5500 kgs of CO₂, by switching for a gas heater the CO₂ savings is + 2300kgs, by using a heater with no PL, the CO₂ savings increase again : + 1437 kgs and if an efficient heater is used, it represents an extra 2581 kgs of CO₂. The direct use of an efficient oil heater in an insulated environment will save 12 097 kWh or 3111 kgs of CO₂ which is equivalent to the saving achieved by a switch from oil to gas no PL .

Table 2.58 : Switch for a gas heater without PL. Calculation of CO2 savings.

	m ²	savings linked with the absence of PL			CO2 (kg)		
Before 1955		H1	H2	H3	H1	H2	H3
attic+cal+walls+window	70	5 058	4 532	4 071	1 021	915	822
House	110	7 948	7 122	6 398	1 604	1 437	1 291
	150	9 717	8 802	8 035	1 961	1 776	1 621
	210	13 081	11 048	9 321	2 640	2 229	1 881
Flat	40	799	370	647	161	75	131
	70	1 374	639	1 106	277	129	223
	110	2 160	1 004	902	436	203	182
	150	2 640	2 392	2 183	533	483	441
1955-1974							
House	70	5 058	4 532	4 071	1 021	915	822
	110	7 948	7 122	6 398	1 604	1 437	1 291
	150	9 717	8 802	8 035	1 961	1 776	1 621
	210	33 132	11 473	10 928	6 686	2 315	2 205
Flat	40	809	720	647	163	145	131
	70	1 374	1 232	1 106	277	249	223
	110	2 160	1 935	902	436	391	182
	150	2 640	2 392	2 183	533	483	441
1974-1982							
House	70	5 058	4 532	4 071	1 021	915	822
	110	7 948	7 122	6 398	1 604	1 437	1 291
	150	9 717	8 802	8 035	1 961	1 776	1 621
	210	12 034	11 048	10 285	2 428	2 229	2 075
Flat	40	760	684	606	153	138	122
	70	1 276	1 144	1 027	258	231	207
	110	2 005	1 797	1 614	405	363	326
	150	2 452	2 221	2 027	495	448	409
1982-1988							
House	70	3 239	2 762	2 388	654	557	482
	110	4 835	4 133	3 439	976	834	694
	150	6 247	5 355	4 477	1 260	1 081	903
	210	7 774	6 707	5 671	1 569	1 353	1 144
Flat	40	525	233	389	106	47	79
	70	880	751	337	178	151	68
	110	1 314	1 123	935	265	227	189
	150	1 697	1 455	631	343	294	127
Since 1988							
House	70	2 429	2 104	1 890	490	425	381
	110	3 817	3 307	2 970	770	667	599
	150	4 511	4 227	3 837	910	853	774

	210	5 344	5 524	5 074	1 078	1 115	1 024
Flat	40	398	353	311	80	71	63
	70	660	572	514	133	115	104
	110	1 037	899	807	209	181	163
	150	1 226	596	1 043	247	120	210

Table 2.59 : Switch for a high efficiency individual gas heater. Calculation of CO2 savings.**Table 2.59a- Before 1955**

	surface	Gas high efficiency cci kWh			savings			reduction in CO2 emissions		
before 1955	m2	H1	H2	H3	H1	H2	H3	H1	H2	H3
House	70	35 189	32 006	25 940	15 659	14 243	11 543	3 160	2 874	2 329
	110	55 297	50 295	40 762	24 607	22 381	18 139	4 965	4 516	3 660
	150	69 372	61 236	55 585	30 871	27 250	24 735	6 229	5 499	4 991
	210	90 787	78 872	80 413	40 400	35 098	35 784	8 152	7 082	7 221
Flat	40	11 019	9 798	7 905	7 346	6 532	5 270	1 482	1 318	1 063
	70	19 549	17 781	14 411	13 033	11 854	9 607	2 630	2 392	1 939
	110	30 720	27 942	22 646	20 480	18 628	15 097	4 133	3 759	3 046
	150	38 540	34 020	30 880	25 693	22 680	20 587	5 185	4 577	4 154
insulation										
attic+ cal House	70	28 151	25 148	22 481	12 527	11 191	10 004	2 528	2 258	2 019
	110	44 237	39 518	35 327	19 686	17 585	15 721	3 972	3 549	3 172
	150	54 291	48 989	40 762	24 160	21 800	18 139	4 875	4 399	3 660
	210	73 896	61 726	51 879	32 884	27 468	23 086	6 636	5 543	4 659
Flat	40	9 008	8 034	7 164	6 006	5 356	4 776	1 212	1 081	964
	70	15 639	13 971	12 489	10 426	9 314	8 326	2 104	1 879	1 680
	110	24 576	21 954	19 626	16 384	14 636	13 084	3 306	2 953	2 640
	150	30 162	27 216	22 646	20 108	18 144	15 097	4 058	3 661	3 046
attic+ cal+ walls House	70	23 225	20 575	19 022	10 335	9 156	8 465	2 085	1 848	1 708
	110	36 496	32 333	29 892	16 241	14 388	13 302	3 277	2 903	2 684
	150	45 243	40 416	37 056	20 133	17 985	16 490	4 063	3 629	3 328
	210	61 228	51 438	42 800	27 247	22 890	19 046	5 498	4 619	3 843
Flat	40	7 641	6 728	6 127	5 094	4 485	4 084	1 028	905	824
	70	12 903	11 431	10 568	8 602	7 620	7 045	1 736	1 538	1 422
	110	20 275	17 963	16 607	13 517	11 975	11 071	2 728	2 416	2 234
	150	25 135	22 453	20 587	16 757	14 969	13 725	3 381	3 021	2 769
attic+cal+wall s+windows	70	20 409	18 289	16 428	9 082	8 139	7 311	1 833	1 642	1 475
House	110	32 072	28 740	25 816	14 272	12 789	11 488	2 880	2 581	2 318
	150	39 210	35 517	32 424	17 449	15 805	14 429	3 521	3 189	2 912
	210	52 783	44 580	37 612	23 488	19 838	16 737	4 740	4 003	3 377
Flat	40	6 595	5 879	5 336	4 397	3 919	3 557	887	791	718
	70	11 339	10 161	9 127	7 559	6 774	6 085	1 525	1 367	1 228
	110	17 818	15 967	14 342	11 879	10 644	9 561	2 397	2 148	1 929
	150	21 783	19 732	18 014	14 522	13 154	12 009	2 930	2 654	2 423

Table 2.59b- 1955-1974

1955-1974	Surface	Gas high efficiency cci kWh			savings			reduction in CO2 emissions		
		H1	H2	H3	H1	H2	H3	H1	H2	H3
Attic+cal	m2									
House	70	35 189	32 006	25 940	15 659	14 243	11 543	3 160	2 874	2 329
	110	55 297	50 295	40 762	24 607	22 381	18 139	4 965	4 516	3 660
	150	69 372	61 236	55 585	30 871	27 250	24 735	6 229	5 499	4 991
	210	92 898	82 301	75 225	41 340	36 624	33 475	8 342	7 390	6 755
Flat	40	11 341	10 320	8 301	7 561	6 880	5 534	1 526	1 388	1 117
	70	19 549	17 781	14 411	13 033	11 854	9 607	2 630	2 392	1 939
	110	30 720	27 942	22 646	20 480	18 628	15 097	4 133	3 759	3 046
	150	38 540	34 020	30 880	25 693	22 680	20 587	5 185	4 577	4 154
Attic+cal+walls										
House	70	28 151	25 148	22 481	12 527	11 191	10 004	2 528	2 258	2 019
	110	44 237	39 518	35 327	19 686	17 585	15 721	3 972	3 549	3 172
	150	54 291	48 989	44 468	24 160	21 800	19 788	4 875	4 399	3 993
	210	63 340	61 726	57 067	28 186	27 468	25 395	5 688	5 543	5 124
flat	40	9 089	8 099	7 214	6 059	5 400	4 809	1 223	1 090	970
	70	15 639	13 971	12 489	10 426	9 314	8 326	2 104	1 879	1 680
	110	24 576	21 954	19 626	16 384	14 636	13 084	3 306	2 953	2 640
	150	30 162	27 216	24 704	20 108	18 144	16 470	4 058	3 661	3 323
Attic+walls+cal+windows	70	20 409	18 289	16 428	9 082	8 139	7 311	1 833	1 642	1 475
House	110	32 072	28 740	25 816	14 272	12 789	11 488	2 880	2 581	2 318
	150	39 210	35 517	32 424	17 449	15 805	14 429	3 521	3 189	2 912
	210	52 783	46 294	44 097	23 488	20 601	19 623	4 740	4 157	3 960
Flat	40	6 676	5 944	5 336	4 451	3 963	3 557	898	800	718
	70	11 339	10 161	9 127	7 559	6 774	6 085	1 525	1 367	1 228
	110	17 818	15 967	14 342	11 879	10 644	9 561	2 397	2 148	1 929
	150	21 783	19 732	18 014	14 522	13 154	12 009	2 930	2 654	2 423

Table 2.59c- Since 1974

	Surface	Gas high efficiency cci kWh			savings			reduction in CO2 emissions		
1974-1982	m2	H1	H2	H3	H1	H2	H3	H1	H2	H3
House	70	20 409	18 289	16 428	9 082	8 139	7 311	1 833	1 642	1 475
	110	32 072	28 740	25 816	14 272	12 789	11 488	2 880	2 581	2 318
	150	39 210	35 517	32 424	17 449	15 805	14 429	3 521	3 189	2 912
	210	48 560	44 580	41 503	21 609	19 838	18 469	4 361	4 003	3 727
Flat	40	6 274	5 641	5 001	4 182	3 760	3 334	844	759	673
	70	10 529	9 435	8 475	7 019	6 290	5 650	1 416	1 269	1 140
	110	16 545	14 826	13 318	11 030	9 884	8 879	2 226	1 995	1 792
	150	20 228	18 322	16 727	13 485	12 215	11 151	2 721	2 465	2 250
1982-1988										
non electric House	70	13 070	11 145	9 635	5 816	4 960	4 287	1 174	1 001	865
	110	19 512	16 680	13 879	8 683	7 422	6 176	1 752	1 498	1 246
	150	25 207	21 608	18 065	11 217	9 615	8 039	2 263	1 940	1 622
	210	31 368	27 066	22 882	13 959	12 045	10 183	2 817	2 430	2 055
Flat	40	4 332	3 700	3 212	2 888	2 467	2 141	583	498	432
	70	7 261	6 192	5 353	4 841	4 128	3 568	977	833	720
	110	10 840	9 266	7 710	7 227	6 178	5 140	1 458	1 247	1 037
	150	14 004	12 004	10 036	9 336	8 003	6 691	1 884	1 615	1 350
since 1988										
House	70	9 803	8 491	7 627	4 362	3 779	3 394	880	762	685
	110	15 404	13 344	11 986	6 855	5 938	5 334	1 383	1 198	1 076
	150	18 205	17 059	15 484	8 101	7 591	6 891	1 635	1 532	1 390
	210	21 566	22 290	20 474	9 597	9 919	9 111	1 937	2 002	1 838
Flat	40	3 286	2 911	2 569	2 191	1 941	1 713	442	392	346
	70	5 446	4 717	4 237	3 631	3 145	2 825	733	635	570
	110	8 558	7 413	6 659	5 705	4 942	4 439	1 151	997	896
	150	10 114	9 477	8 602	6 743	6 318	5 735	1 361	1 275	1 157

Table 2.60 Switch for a high efficiency oil heater in houses. Calculation of CO2 savings.

	m ²	oil high efficiency cci cons.			savings			reduction in CO2 emissions		
Before 1955		H1	H2	H3	H1	H2	H3	H1	H2	H3
No insulation	70	36 037	32 777	26 565	14 811	13 471	10 918	3 809	3 465	2 808
	110	56 629	51 507	41 744	23 275	21 169	17 157	5 986	5 444	4 412
	150	71 044	62 712	56 924	29 199	25 774	23 396	7 509	6 629	6 017
	210	92 974	80 772	82 350	38 212	33 197	33 846	9 828	8 538	8 705
Insulation										
Attic+cal	70	28 829	25 754	23 023	11 849	10 585	9 462	3 047	2 722	2 434
	110	45 303	40 470	36 178	18 620	16 633	14 869	4 789	4 278	3 824
	150	55 599	50 169	41 744	22 851	20 620	17 157	5 877	5 303	4 412
	210	75 677	63 213	53 129	31 103	25 981	21 836	7 999	6 682	5 616
Attic+ cal+ walls	70	23 784	21 071	19 481	9 775	8 660	8 007	2 514	2 227	2 059
	110	37 375	33 112	30 612	15 361	13 609	12 582	3 951	3 500	3 236
	150	46 333	41 390	37 949	19 043	17 011	15 597	4 897	4 375	4 011
	210	62 704	52 678	43 832	25 771	21 651	18 015	6 628	5 568	4 633
Attic+cal+walls +windows	70	20 901	18 730	16 824	8 590	7 698	6 915	2 209	1 980	1 778
	110	32 845	29 433	26 438	13 499	12 097	10 866	3 472	3 111	2 795
	150	40 155	36 373	33 206	16 504	14 949	13 648	4 244	3 845	3 510
	210	54 055	45 654	38 519	22 217	18 764	15 831	5 714	4 826	4 071
1955-1974										
Attic+cal	70	36 037	32 777	26 565	14 811	13 471	10 918	3 809	3 465	2 808
	110	56 629	51 507	41 744	23 275	21 169	17 157	5 986	5 444	4 412
	150	71 044	62 712	56 924	29 199	25 774	23 396	7 509	6 629	6 017
	210	95 137	84 284	77 037	39 101	34 641	31 662	10 056	8 909	8 143
Attic+cal+walls	70	28 829	25 754	23 023	11 849	10 585	9 462	3 047	2 722	2 434
	110	45 303	40 470	36 178	18 620	16 633	14 869	4 789	4 278	3 824
	150	55 599	50 169	45 539	22 851	20 620	18 717	5 877	5 303	4 814
	210	64 866	63 213	58 442	26 660	25 981	24 020	6 856	6 682	6 177
Attic+walls+cal +windows	70	20 901	18 730	16 824	8 590	7 698	6 915	2 209	1 980	1 778
	110	32 845	29 433	26 438	13 499	12 097	10 866	3 472	3 111	2 795
	150	40 155	36 373	33 206	16 504	14 949	13 648	4 244	3 845	3 510
	210	54 055	47 410	45 160	22 217	19 485	18 561	5 714	5 011	4 773
1974-1982	70	20 901	18 730	16 824	8 590	7 698	6 915	2 209	1 980	1 778
	110	32 845	29 433	26 438	13 499	12 097	10 866	3 472	3 111	2 795
	150	40 155	36 373	33 206	16 504	14 949	13 648	4 244	3 845	3 510
	210	49 731	45 654	42 503	20 439	18 764	17 469	5 257	4 826	4 493
1982-1988	70	13 385	11 414	9 867	5 501	4 691	4 055	1 415	1 206	1 043
	110	19 982	17 081	14 213	8 213	7 020	5 842	2 112	1 806	1 502

	150	25 814	22 128	18 500	10 610	9 095	7 604	2 729	2 339	1 956
	210	32 124	27 719	23 434	13 203	11 392	9 631	3 396	2 930	2 477
Since 1988	70	10 039	8 696	7 811	4 126	3 574	3 210	1 061	919	826
	110	15 775	13 665	12 275	6 484	5 616	5 045	1 667	1 444	1 297
	150	18 643	17 470	15 857	7 662	7 180	6 517	1 971	1 847	1 676
	210	22 085	22 827	20 967	9 077	9 382	8 617	2 334	2 413	2 216

c) Energy saved with efficient electrical appliances

◆ Light bulbs

The use of low consumption light bulbs is economically efficient when they are used at least 3 hours a day (1000 hours/year). The switch from incandescent light bulbs to low energy consumption ones is interesting only in the kitchen, the lounge and the dining room. We will take this hypothesis (one light bulb change in each room) for the calculation of energy consumption in Table 2.61.

Table 2.61 Calculation of CO₂ savings with a change of light bulbs.

equipment level	bathroom bedrooms	kitchen dining room	lounge	corridors	
incandescent	7,52	0,32	0,00	0,77	
halogen	0,00	0,00	0,33	0	
fluorescent	0,32	0,12	0,00	0	
low consumption	0,00	2,00	1,45	0	
power w	bathroom bedrooms	kitchen dining room	lounge	corridors	
incandescent	75	120	80	100	
halogen	200	500	350	200	
fluorescent	40	40	40	40	
low consumption	20	20	20	20	
duration of usage per year (hours)	bathroom bedrooms	kitchen dining room	lounge	corridors	
incandescent	186	739	782	900	
halogen	0	0	183	0	
fluorescent	7	39	0	0	
low consumption	0	0	24	0	
consumption	bathroom bedrooms	kitchen dining room	lounge	corridors	global consumption per year in kWh
incandescent	105039	2 838	0	69300	202,72
halogen	0	0	21130	0	21,13
fluorescent	99	186	0	0	0,29
low consumption	0	0	717	0	0,72
TOTAL					225.00
energy saved	264,66				
CO₂ saved in kg	17				

The simple change of 3 light bulbs saves 246 kWh i.e. 2,3 G Joule and 17 kg of CO₂ in a year.

◆ Cooking devices.

Efficiency figures of electrical appliances correspond to class A standards .

For gas appliances the most efficient equipment found during the store check have been used.

CO2 savings made with efficient cooking appliances are calculated in table 2.62.

Table 2.62 : Calculation of CO2 savings with efficient cooking appliances.

	hours	power	kWh/year	energy saved	C O 2		kWh/week	kWh/year
	duration of usage/ week	W	appliance's consumption	kWh	kg	equipment level	average house's consumption	average house's consumption
electric oven	2,92	546	84	26	1,71	0,66	1,05	56
hotplates elec.	5,43	990	285	132	8,58	0,25	1,34	71
hotplates gas	5,00	1750	464	72	14,6 5	0,72	6,30	334
gas oven	2,50	2950	391	29	5,83	0,32	2,36	125
m i c r o waves	1,13	800	48	11	0,74	0,43	0,39	20
							Total	606
							Global energy saving	117

➤ The biggest energy savings reservoir lies in hotplates whatever their energy is.

◆ Other electrical appliances. The CO2 savings allowed by efficient electric appliances are calculated in Table 2.63. Efficiency figures correspond to actual A class standards. The energy savings are almost equal to the energy consumption.

Table 2.63 Calculation of CO2 savings with efficient electrical equipment

Source : INSEE/ IESTENE1995 (in bold)		hours/ week duration of usage	w average power	kWh /week	kWh/year appliance's cons	energy saved p e r applian ce	CO2 kg	equipment level	kWh/year average house's cons.	e n e r g y saved kWh/year	CO2 kg
cold	fridge	168,00	22,8	3,83	203,0	232,39	15,03	0,57	116.0	132.00	8,57
	2nd fridge	168,00	22,8	3,83	203,0	232,39	15,03	0,12	24.0	28.00	1,79
	freezer	168,00	33,8	5,68	301,0	308,08	19,92	0,51	152.0	156.00	10,08
	2 n d freezer	168,00	33,8	5,68	301,0	308,08	19,92	0,02	5.4	5,50	0,36
	combi	168,00	34,03	5,72	303,0	249,94	16,16	0,60	181.0	149.00	9,67
washing	dishwasher	4,17	1177	4,91	260,0	104,76	6,77	0,35	92.0	37.00	2,40
	2 n d dishwasher	4,17	1177	4,91	260,0	104,76	6,77	0,02	4.0	1,60	0,10
	w a s h i n g machine	5,50	541	2,98	157,0	97,07	6,28	0,88	140.0	86.00	5,55
	2 n d w a s h i n g machine	5,50	541	2,98	157,0	97,07	6,28	0,05	8.0	5,05	0,33
drying	dryer	2,32	2651	6,15	326,0	12,66	0,82	0,20	67.0	2,60	0,17
lightning	incandesce nt			8,83	291,0	176,66	11,42		203.0	265.00	17,16
	halogens			0,40	21,0	-	-		21.0	-	
	fluorescent			0,01	0,2	-	-		0,3	-	
	l o w consuming bulb			0,00	0,7	0,70	0,05		0,7	- 0,70	- 0,05
leasure	TV	27,19	99	2,69	142,0	15,85	1,03	0,95	135,5	15.00	0,97
	2 nd TV	9,00	99	0,89	47,0	5,25	0,34	0,20	9,3	1.00	0,07
	v i d e o recorder	1,50	10	0,02	0,8	1,19	0,08	0,57	0,4	0,68	0,04
	computer (PC)	19,60	30	0,59	31,0	93,49	6,05	0,13	4.0	12,60	0,82
	hi fi	12,00	10	0,12	6,0	28,62	1,85	0,58	3,7	16,70	1,08
cleaning	v a c u u m cleaner	1,86	211,1	0,39	20,0	-	-	0,89	18.0	-	
	iron	1,69	405,4	0,69	36,0	-	-	1,00	36.0	-	
pilot light	TV	46,40	3	0,14	7,0	19,67	1,27	0,95	71.0	18,70	1,21
	2nd TV	15,30	3	0,05	2,0	6,49	0,42	0,20	0,5	1,30	0,08
	hi fi	156,00	5	0,78	41,0	62,01	4,01	0,58	24.0	36.00	2,34
	v i d e o recorder	166,50	3	0,50	26,0	97,07	6,28	0,57	15.0	56.00	3,60
	computer (PC)	2,74	10	0,03	1,0	2,90	0,19	0,13	0,2	0,40	0,03
Total									1 269	1 026.00	66,36

i n									11 792	9 534.0	
MJoule											
in FF										790	

These figures are coherent with those from the SAVE program (Sidler, 1997) measurements campaign which identifies an energy saving potential of 1026kWh/year from cold appliances, lightning and heaters. In this last case, the energy saved comes from a bad setting of the electric starter that equip gas or oil heaters. It represents a potential of 227 kWh/year. Globally, when including little appliances such as answering machines, satellite TV aerials, coffee machines, toasters and other cooking equipment, the whole energy saving potential goes up to 1800 kWh/year.

D.2.2 Margins of action linked with behaviour

A household's behaviour can influence its energy consumption mainly through appliances maintenance and use, and energy needs control

a) Appliances' maintenance and use.

In the last page, we saw that a correct setting of the heater's electric starter can provide a 227 kWh/year energy saving, it is part of the annual maintenance that should be done by household's. More generally speaking a regular maintenance of the household's heater helps to maintain the heater's efficiency.

Other savings can be achieved if people stop their appliances when they are not using them (Table 2.64) or when starting washing machines and dishwashers only when they are full (Table 2.65).

Table 2.64 Potential energy saving with a low usage of pilot lights.

	Equipment Level.	Consumption (W)	duration of use / week (hours)	Annual cons. (kWh)	Total annual cons./equipment (kWh)	Energy savings (kWh)
TV on	0,95	110	27,19	158,51		
pilot light	0,95	11	2,30	1,34	160	26
2nd TV on	0,19	110	9,00	52,47		
pilot light	0,19	11	1,00	0,58	53	8
Hi-fi on	0,58	55	12,00	34,98		
pilot light	0,58	12	2,00	1,33	36	102
video recorder on	0,57	25	1,50	1,99		
pilot light	0,57	14	2,00	1,48	3	122
computer on	0,13	120	19,60	124,66		
pilot light	0,13	30	2,74	4,36	129	0
TOTAL					382	258

Source: ADEME/INESTENE 1995 (in bold)

- The rate of energy saving compared to the average consumption is 40% . If the main TV set is always on stand by mode when not in use, the energy saving achieved by switching it off reaches 80 kWh/year i.e. 743 MJoule. The SAVE measurement campaign considers a potential of a 100kWh i.e. 9 292 MJoule for each of the following appliance : TV set, video recorder, satellite TV aerials and Canal + decoder (a French paying TV).

As mentioned in the first section, the hypothesis is that the use of full machines leads to a 20% reduction in the amount of washes. In that case the energy savings can be calculated as in Table 2.65:

Table 2.65 Calculation of the energy saved with a 20% reduction in the amount of washes.

Energy Consumption per week				Annual energy Consumption	average number of use	average duration of use per usage	energy saving	equipment level	Global energy savings
	duration of usage (Hours)	average power (W)	appliance's cons (kWh)	(kWh)	per week	hours	(kWh)		(kWh)
dishwasher	3,34	1651	5,51	292	3,41	0,98	73	0,35	25
2 nd dishwasher	3,34	1651	5,51	292			73	0,02	1
washing machine	4,46	874	3,90	206	3,60	1,24	51	0,88	45
2nd washing ma.	4,46	874	3,90	206			51	0,05	3
Total									74

Source : INESTENE 1995 (in bold)

- This calculation takes into account a repartition of washes with 12% at 90°C, 32% at 60°C and 56% at 40°C. A German study (Griesshammer, 1998) found that through selecting low washing temperatures and using a high filling rate, a 50% improvement in energy consumption and emissions could be achieved compared to the average washing cycle. Tests done in Germany shows that the difference in energy consumption between what is called the « scrubbed » household and the « smart » one (i.e. with good environmental practise) can reach a factor of 11,4 !

b) Control of energy needs.

Referring to the formula of energy needs calculations, one can control the volume to be heated and/or the temperature.

◆ Controlling the volume to be heated

It is possible to reduce the volume to be heated by turning off the radiator of an empty room.

As an example, in Table 2.66, calculations has been made for turning off the radiator in a 12m² room in 110 m² houses or flats and in a 20m² room for bigger surfaces. It is an extreme calculation as most of the time, radiators are not totally switched off.

- The level of energy savings is equivalent to the one achieved with the use of a gas heater without PL or the insulation of the attic +drought measures.

Table 2.66 Example of the energy saved when turning off the radiator in an empty room/year of housing's construction.

			G			Energy needs			Savings		
before 55	m ²	Vol	H1	H2	H3	H1	H2	H3	H1	H2	H3
Attic+cal+walls+ windows	70	196	1,45	1,60	1,90	17 348	15 546	13 964	-	-	-
House	110	274	1,45	1,60	1,90	24 287	21 764	19 550	2 974	2 665	2 394
	150	364	1,30	1,45	1,75	28 885	26 164	23 886	4 444	4 025	3 675
	210	532	1,25	1,30	1,45	40 593	34 284	28 926	4 273	5 066	8 557
Flat	40	112	0,82	0,90	1,08	5 606	4 997	4 536	-	-	-
	70	162	0,81	0,89	1,06	7 986	7 156	6 428	1 652	1 481	1 330
	110	274	0,81	0,89	1,06	13 493	12 091	10 861	1 652	1 481	1 330
	150	364	0,72	0,81	0,97	16 047	14 536	13 270	2 469	2 236	2 042
1955 -1974											
Attic+walls+cal+ windows	70	196	1,45	1,60	1,90	17 348	15 546	13 964	-	-	-
House	110	274	1,45	1,60	1,90	24 287	21 764	19 550	2 974	2 665	2 394
	150	364	1,30	1,45	1,75	28 885	26 164	23 886	4 444	4 025	3 675
	210	532	1,25	1,35	1,70	40 593	35 603	33 913	4 273	3 748	3 570
Flat	40	112	0,83	0,91	1,08	5 674	5 052	4 536	-	-	-
	70	162	0,81	0,89	1,06	7 986	7 156	6 428	1 652	1 481	1 330
	110	274	0,81	0,89	1,06	13 493	12 091	10 861	1 652	1 481	1 330
	150	364	0,72	0,81	0,97	16 047	14 536	13 270	2 469	2 236	2 042

1974-1982			G			ENERGY NEEDS			SAVINGS		
non electric heater	m2	m3	H1	H2	H3	H1	H2	H3	H1	H2	H3
House	70	196	1,45	1,60	1,90	17 348	15 546	13 964	-	-	-
	110	274	1,45	1,60	1,90	24 287	21 764	19 550	2 974	2 665	2 394
	150	364	1,30	1,45	1,75	28 885	26 164	23 886	4 444	4 025	3 675
	210	532	1,15	1,30	1,60	37 345	34 284	31 918	3 931	3 609	3 360
Flat	40	104	0,84	0,93	1,09	5 333	4 795	4 251	-	-	-
	70	151	0,81	0,89	1,06	7 415	6 645	5 969	1 534	1 375	1 235
	110	255	0,81	0,89	1,06	12 529	11 228	10 085	1 534	1 375	1 235
	150	364	0,72	0,81	0,97	16 047	14 536	13 270	1 146	1 038	948
1st regulation elec. heater.	70	196	1,20	1,25	1,35	14 357	12 145	9 922		-	-
House	110	274	1,20	1,25	1,35	20 100	17 003	13 891	2 461	2 082	1 701
	150	364	1,10	1,15	1,25	24 441	20 751	17 061	3 760	3 192	2 625
	210	532	1,00	1,05	1,15	32 474	27 691	22 941	3 418	2 915	2 415
flat	40	104	0,69	0,72	0,78	4 380	3 712	3 042	-	-	-
	70	151	0,67	0,69	0,75	6 137	5 191	4 241	1 270	1 074	877
	110	255	0,67	0,69	0,75	10 369	8 771	7 166	1 270	1 074	877
	150	338	0,61	0,64	0,69	12 608	10 705	8 802	1 940	1 647	1 354
1982-1988											
non electric House	70	182	1,00	1,05	1,2	11 110	9 473	8 189	-	-	-
	110	255	0,95	1,00	1,1	14 776	12 631	10 510	1 809	1 547	1 287
	150	338	0,90	0,95	1,05	18 569	15 918	13 308	2 857	2 449	2 047
	210	494	0,80	0,85	0,95	24 124	20 815	17 598	2 539	2 191	1 852
Flat	40	104	0,58	0,61	0,7	3 682	3 145	2 730	-	-	-
	70	151	0,56	0,58	0,67	5 114	4 361	3 770	1 058	902	780
	110	255	0,53	0,56	0,61	8 209	7 017	5 839	1 005	859	715
	150	338	0,50	0,53	0,58	10 316	8 843	7 393	1 587	1 360	1 137
ElectricHeater. House	70	182	0,90	1,00	1,1	9 999	9 022	7 507	-	-	-
	110	255	0,90	0,95	1	13 998	11 999	9 554	1 714	1 469	1 170
	150	338	0,85	0,90	0,95	17 537	15 080	12 040	2 698	2 320	1 852
	210	494	0,80	0,85	0,9	24 124	20 815	16 671	2 539	2 191	1 755
Flat	40	104	0,53	0,59	0,66	3 365	3 042	2 574	-	-	-
	70	151	0,50	0,56	0,61	4 603	4 153	3 456	952	859	715
	110	255	0,50	0,53	0,56	7 777	6 666	5 308	952	816	650
	150	338	0,47	0,50	0,53	9 743	8 378	6 689	1 499	1 289	1 029
since 1988											
House	70	182	0,75	0,80	0,95	8 332	7 218	6 483	-	-	-
	110	255	0,75	0,80	0,95	11 665	10 105	9 077	1 428	1 237	1 111
	150	338	0,65	0,75	0,90	13 411	12 567	11 407	2 063	1 933	1 755
	210	494	0,55	0,70	0,85	16 585	17 142	15 745	1 746	1 804	1 657
Flat	40	104	0,44	0,48	0,56	2 793	2 475	2 184	-	-	-

	70	151	0,42	0,44	0,53	3 835	3 322	2 984	794	687	617
	110	255	0,42	0,44	0,53	6 481	5 614	5 043	794	687	617
	150	338	0,36	0,42	0,50	7 450	6 981	6 337	1 146	1 074	975

◆ Controlling housing's temperature

The studies done by the ADEME after the oil shock have showed that, in housing built before 1974 with a low insulation level, the increase of the inside temperature by 1° was leading to a 7% increase of energy . In the Mediterranean area the increase was of course proportionally bigger i.e. 12%.

Nowadays, it should represent some 14% of an energy consumption which on the whole has greatly decreased.⁶⁴

CONCLUSION:

By far, the best way of influencing energy use CO2 emissions is the change of heating technology and the use of insulation devices when the housing was built before 1974, with the restriction that a fully insulated house would not be good for the health as humidity and/or low air renewal can cause asthma

But the addition of energy saving behaviour can lead to important energy saving especially those linked with temperature control.

If we take the same example of an insulated 110sq m house built before 1974 in the H2 region heated with an individual gas system, double usage.

-	Average annual heating energy consumption: 41 MWh	
-	Average annual hot water consumption: 3 MWh	
-	Average annual cooking consumption: 520 kWh	
-	Average annual electrical appliances: 2294 kWh	
•	Savings:	kWh
•	switching off electrical appliances PL:	258
•	use of full machines:	74
•	switching off the radiator in an empty room	2665

	Total:	2997

If we add the control of room temperature (18° instead of 19°) 4 153

Total : 7150

i.e. 66 GJoule

An other important way of saving energy and CO2 would be to use solar panels for the production of hot water more particularly in the H2 and H3 regions that are the sunniest.

⁶⁴ Conversation with Mr B. Guyot. ADEME. April 1999.

Unfortunately, France is the 5th producer of solar energy in Europe largely behind Greece, Germany, Austria and Spain. The solar hot water production is less than 0,1% of the whole hot water production (Inestene, 2000) In 1998, in Metropolitan France 1800m² of solar panels from French production were used and 2000 m² were imported⁶⁵. Finally, in April 2000, the French government and the ADEME have decided to launch an advertising campaign coupled with a financial help that goes from FF 4500 (Euro 687) to FF 7500 (Euro 1145) to promote the use of solar panels for the production of hot water. The whole marketing operation will last until 2006. It is called « Helios » and goes with subsidies for the promotion of collective solar heater for hot water and the promotion of « Direct solar floors » that answers to heating and hot water needs.

Windmills could also be an answer to the reduction of air pollution levels. As for solar energy, their use is still very rare in France : 1 000 tep in 1998 (IFEN, 1999) i.e.

41 855 G Joule. The development of these renewable forms of energy has begun more slowly in France because of the importance of the nuclear industry who considers as an unacceptable threat the introduction of these energies while the negotiation to renew nuclear power plants is starting.⁶⁶

⁶⁵ Press conference ADEME April 14th 2000.

⁶⁶ Colloque Energie et Environnement au XXI ème siècle. ADAPES. 3-4 MAY 2000. French Senate. Paris.

E) TRANSPORTS

E.1 Energy consumption and pollution of the household's transportation system.

In France traffic is increasing all the time whatever the transportation mode- the train being apart as numerous local services has been closed. Ground transport represents 26% (Morcheoine, Orfeuil 1998) of the whole of French energy consumption. The share of ground transport in the national petrol bill was less than 30% in 1973, it is now 63% and has been growing by 1% in the last five years. It consumes more energy than the industrial sector (without the steel industry) and its dependence rate to petrol imports is up to 96%. This last figure questions in itself the government's ongoing official policy that is to « secure French energetic independence ».

The growth of energy consumption is mainly due to road transports among which the share of private cars is the most important (but tends to be challenged by commercial cars). Private cars represents 46% of global transport's energy consumption (Table 2.67).

Table 2. 67 : Energy Consumption of French Transports.

Millions of tep	1973	1985	1987	1988	1989	1990	1991	1992	1994*
Private cars									
oil	12,9	16,0	16,6	16,9	16,6	16,4	16,0	16,0	
diesel	0,5	2,6	3,0	3,4	4,0	4,5	5,1	5,8	
LPG		0,1	0,1	0,1	0,1	0,1	0,1	0,1	
Total private cars	13,4	18,7	19,7	20,4	20,7	21,0	21,2	21,9	22,1
Total commercial cars	8,6	10,1	11,5	12,7	13,6	14,4	14,9	15,3	17,0
Bikes	0,4	0,5	0,5	0,5	0,5	0,5	0,6	0,6	0,6
Total road transport	22,4	29,3	31,7	33,6	34,8	35,9	36,7	37,8	39,7
Train	2,2	2,1	2,1	2,1	2,1	2,2	2,3	2,2	
Planes	1,9	2,7	3,1	3,5	3,8	4,0	3,9	4,4	
Sea & river	5,9	3,0	2,9	2,9	3,0	3,2	3,4	3,2	
TOTAL	32,4	37,1	39,8	42,1	43,7	45,3	46,3	47,6	
Total in TeraJoule	1 356 102	1 552 821	1 665 829	1 762 096	1 829 064	1 896 032	1 937 887	1 992 298	

Source : Les chiffres clé de l'énergie. Transports n°190 1996

Although the most important mean of transportation, private cars are the least energy efficient (Table 2.68). In terms of pollution levels, a traveller using his car will produce : twice as much CO₂ , 28 times more CO, 19 times more unburned hydrocarbons per kilometre than what he would have been responsible for by taking the bus. « During peak hours, these gaps are even bigger as most buses are packed while drivers are often alone in their car » (Morcheoine, Orfeuil, 1998)

Table 2.68 : Energy efficiency of French transports

Traveler*km/kep	Urban transports	Inter cities transport
Trains	47,6	56,8
RER	44,2	
Parisian buses	42	
Other buses	37,4	
Parisian subway	36,3	
Private car	19	37
TGV		82,6
Coaches		56,2
Regional trains		41,7
Plane		19,5

Source : INRETS/ADEME. 1994

Private cars produces lots of air pollutants (Table 2.69), most of them have an effect on human health or are greenhouse gases. Many reports have been published on this question which is not the research subject, therefore I will just list the main pollutants (Inrets 1995).

CO : carbon monoxyde . By saturation of the oxygen available in the blood, it diminished the distribution of oxygen in the body.

Nitrogen Oxydes NO_x : they appear at the end of pipe as a gas. The main forms are nitrogen dioxides NO₂, nitrogen monoxides NO and ozone NO₃ .They generate the smog, affect the lungs especially when people have asthma and irritates the eyes.

Particles : they make a deposit in the lungs which affect breathing capacities.

Carbon dioxide CO₂ is a greenhouse gas.

Hydrocarbons HC : some of them interfere in ozone formation and can affect the central nervous system. They include NMVOCs : Non Methane Organic Volatile Compounds : these HC evaporate all the time, not only when the engine works. Because of high temperatures other components appear that are not present in petrol such as :

- Methane CH₄ : a greenhouse effect gas.

- Other HP : benzene, butadiene and PAH (Polycyclical Aromatic Hydrocarbons) are particularly dangerous because of their carcinogenic properties.

Lead : its pollution is less important because of new petrol's characteristics and catalytic pipes.

Sulphur dioxide SO² :it alters kids' breathing function and amplifies adults' breathing problems.

Table 2.69 : Air pollutants emissions of household's transports in France.

	Thousands tons
CH ₄	17
CO	5 227
CO ₂	55 427
N ₂ O	2
COVNM	918
N ₀ x	553
SO ²	71

source: Données économiques de l'environnement 1997

➤ Households transports represent :

- 40% of the whole household's CO₂ emissions, 15% of the national CO₂ emissions, 55% of the transports' sector emissions (Ministère de l'Environnement. 1997).
- 48% of the national CO emissions.
- 38% of the national COVNM emissions.
- 35% of the national N₀x emissions.

The impact of those components varies with concentration, type of people exposed, duration of exposure but the risk is not considered to be negligible (see box enclosed). One will notice that emissions of dangerous components such as HAP and benzene are not submitted to any regulation and not even measured regularly.

These figures must be related to the global evolution of road transports pollution described in Table 2.70.

Table 2.70 Evolution of road transports emissions of pollutants.

%	1990-1995
CO ₂	+ 7,3
Particles	+ 30
CO	- 18
Pb	- 67
Relative contribution to the greenhouse effect	+ 3

Source : IFEN 1999

The case of the Parisian area (Duport. JP 1999) :

One out of two people is exposed to NO₂ doses which are above recommended levels (5 million people).

The standards of NO₂ emissions are not met in 40% of the air measurement stations.

The standards of exposure to nitrogen is exceeded 40 days a year.

In summer, when high temperature and no wind concentrate the pollution, there is: +8% of hospitalisation of asthmatic children, + 20% of emergency calls for asthma crisis, + 15% increase of paediatric emergency cases in one of Paris' biggest children's' hospitals, +23% of sick leave for heart problems at EDF (Ministère de l'Environnement/Ministère de la Santé, 1995) Globally, pollution increases the risk of death because of heart problems by 2 to 5%, because of breathing problems by 1 to 6%. The socio-medical cost of a high level ozone pollution is estimated to be FF 8,9 million per day(Euro 1,3 million), FF12,3 million per day (Euro 1,8 million) in the case of a high SO₂ pollution (IFEN, 1999).

This situation is in conflict with energy efficiency and with the control of the greenhouse effect. Hence the importance of raising the awareness of private car owners.

Focus on household's location : the Energy Environment Transportation Budgets.

To apprehend specific household's car(s) energy consumption is rather difficult : members of the household don't use the same transportation system and the energy consumption itself depends on the route taken, the age of the vehicle, its type of engine, its type of fuel, its equipment (air conditioning, light on or off etc) and the way it is driven.

As so many factors interfere in the calculation of a household's transport energy consumption, an attempt has been made to calculate it on a local level taking into account the type of travel and distances. The result is the construction of Energy Environment Transportation Budgets (BEED) (Gallez, Hivert, 1998)

These budgets give data about energy consumption and pollution linked with people's mobility within their area of residence. They are calculated for a day of an ordinary week.

They describe each trip with its distance, its speed, its mode and therefore, its energy consumption and the pollution linked with it (Inrets/Ademe 1998).

They only describe the trips made within the area studied and don't include energy consumption linked with roads or public transport's building and maintaining.

They also don't include pollutants from petrol's evaporation.

Presentation of the BEED.

The comparison of BEED established for the Parisian area (1991), Grenoble (1992), Bordeaux (1998) and Lille (1996) (Hivert, 1994, 1998 ; Gallez, 1995, 1996) can give us an idea of city households' energy consumption (Table 2.71). For the country we can only refer to car's consumption studies as they are the main transportation system used

Distances are calculated « as the crow flies » for Grenoble, Lille and the Paris area. In the case of Bordeaux, real distances have been measured with the help of the « Davis » network a computer measurement program that is used for town transportation planning.

One should also notice that as figures were not always available for households, individual's BEED were used instead when necessary .

LEGEND

DIST MOY : average distance/day in km

Transportation modes :

- MAP : walking, cycling
- VP PASS : passenger in a car
- VP COND : driver of a car
- TC : public transport system

Time : Time spent in transportation in mn/day

Speed : Average speed of transportation in km/h

Cons. : Energy used for transportation in one day in gep.

Table 2.71 : Average consumption and pollution budgets/inhabitants

	DISTANCE BUDGET					T I M E BUDGET		C O N S.	POLLUTANTS				
	DIST	PARTS				time	spee d		CO2	CO	H C	N ox	P a rt
	MOY KM	M A P %	V P PASS %	VP cond %	T C %	mn	k m / h	gep	g	g	g	g	g
Paris	23,3	5,6	9,4	9,8	42,9	83	16,8	1051	2023	351	59	20	0,7
Bordeau x	16,1	8,6	16,3	64,1	11,0	53	18,2	1112	2326	435	74	23	1,0
Lille	12,2	11,5	19,7	55,7	13,1	52	14,1	805	1531	369	60	16	0,3
Grenobl e	13,7	9,8	15,5	55,2	19,5	60	13,6	851	1956	371	58	17	0,7

Source : INRETS/ADEME 1991, 1992, 1996, 1998

- We can observe that the average distance in the Parisian area is higher than in other urban areas but leads to energy consumption and pollution levels equivalent to those of smaller urban areas thanks to the importance of journeys made with public transports (43%).
- The Bordeaux area seems to be dedicated to cars. As the city council has been hesitating for years over the choice of a new public transportation system (a decision was made finally to implement a tramway system in 1998), this delay together with a higher equipment level in diesel cars might be one of the explanation for the highest levels observed in energy consumption and pollution.
- An average 10% of distances is walked, it is a little less in the Parisian area on average distances are longer and public transport easily available.
- An average 16% of people are driven by others. This is not a lot compared to the proportion of people driving alone and emphasises that there should be a potential for car sharing.

However, the BEED per household size can also contribute to the creation of the Energy Environment Budgets for the participants of the Cognitive Transfer Group that are held in the Lille area (Table 2.72).

Table 2.72 BEED per household's size.

Paris data were not available.

HOUSEHOLD'S BUDGETS/		DISTANCE BUDGET					TIME BUDGET		EEB	POLLUTANTS				
household size		DIST	PARTS				t i me	speed		CO2	CO	H C	N o x	Part
		MOY KM	MAP	V P PASS	V P cond	TC	mn	km/h	GEP	g	g	g	g	g
1	Paris	12,5							566					
	Bordeaux	12,7							1068	2119	413	72	19	1,0
	Lille	8,7							597	1064	249	47	12	0,2
	Grenoble	10,88	9,60%	11,80%	51,80%	26,70%	60	10,51	634	1438	291	45	14	0,4
2	Paris	26,3							1456					
	Bordeaux	30,9							2298	4768	916	155	46	1,8
	Lille	23,7							1757	3300	800	130	34	0,8
	Grenoble	24,68	8,80%	13,70%	61,30%	16,20%	122	14,16	1605	3737	670	104	31	1,6
3	Paris	40,8							2437					
	Bordeaux	50,5							3372	7129	1314	221	72	2,8
	Lille	40,1							2749	5256	1309	212	56	0,9
	Grenoble	36,04	9,20%	15,60%	58,30%	16,90%	171	14,45	2357	5294	1077	167	47	1,7
4	Paris	44,6							2667					
	Bordeaux	69,5							4560	9566	1775	302	97	4,0
	Lille	55,6							3627	6981	1665	270	72	1,6
	Grenoble	51,22	8,00%	20,80%	55,20%	16%	240	14,94	3092	7303	1321	204	66	2,8
5+	Paris	55,6							2931					
	Bordeaux	78,2							4324	9463	1580	277	93	4,6
	Lille	63,8							3454	6658	1501	247	70	1,8
	Grenoble	50,07	15,90%	13,90%	41,80%	28,30%	322	10,13	2604	6153	1018	162	56	3,2

Source : INRETS/ADEME 1991, 1992, 1996, 1998

- Mobility and pollution levels depends on the amount of activities done by households' members outside of home and the type of transportation mode. It is then logical, that energy consumption and pollution levels increase with family size as they induce more activities. But, as seen before, the transportation mode can make a big difference.
- The energy consumption levels double when the household goes from 1 to 2 people as it often means that both are active and that retired people, less equipped are numerous in the first category.
- With 3 people and more, the consumption increases proportionally less than the family size. This is due to the presence of children who can't drive and of scale savings.

E.2 Calculation of the household pollution

It is not possible to make a perfect synthesis of all aspects of private car's pollution taking into account all the factors, data is available per car which integrate speed and type of traffic but don't integrate the household's location. On the contrary, BEED referring to household's location are specific to four French areas, and give pollution levels for the average transport system type. Anyway it is possible to weight those figures with the behavioural coefficients. These coefficient will help to describe the situation of the people who will be studied in the Cognitive transfer groups. For example a diesel car used for a 5 km distance (i.e. cold start) will produce the pollutants described in Table 2.73.

Table 2.73 pollutants from a diesel car

	CO	CO2	HC	NOX	PART	CONS
g/km	1,9	0,38	0,81	265	0,26	86,00
5 k m s (g)	9,5	1,90	4,05	1324	1,30	430,00
cold start	9,7	1,95	4,63	1322		430,21

Source: Inrets 1994

(The impact of cold starts which pollute much more because the catalyse pipe will not be efficient before this amount of kilometres is driven)

If the car is equipped by an air conditioning system, the pollutant emission level becomes as shown in Table 2.74.

Table 2.74 : influence of air conditioning on pollution levels

	CO	CO2	HC	NOX	PART	CONS
g/km	1,90	0,38	0,81	265	0,26	86,00
5 kms (g)	9,50	1,90	4,05	1324	1,30	430,00
cold start	9,69	1,95	4,63	1322		430,21
air conditioning (g)	11,63	2,44		2247		

Other margins of action exist for the household such as avoiding pollution when investing, the influence of car age, the contribution of the type of engine to pollution, reducing speed, avoiding the succession of acceleration and deceleration phases, avoiding the use of car for short distances and maintaining one's car without talking of modal change.

F WASTE

F.1 Household's waste : a very imprecise definition, a very imprecise measure.

We saw in chapter 2 that it is not possible to have a specific view on the household's waste production because of the absence of specific data in France.

Another distortion in household's waste measurement is introduced by the organisation of the collection system.

Three factors have been recognised to influence the amount of waste collected (Le Bozec, 1990) :

- The characteristics of the containers that have been studied in chapter 2.
- The type of waste collection.

There is a +7% increase when all types of waste are collected door to door vs. a system with door to door collection for usual garbage + fix collecting containers for other types of waste. Another study (Cordeau, 1990) quotes a glass collection of 15kgs/pers/year with door to door collection, the figure decreases to 8,5kg/pers/year with fixed containers but increases up to 18,2 kg /person/year when both systems are used. Therefore the easier it is for people to get rid of their garbage, the more garbage is collected.

An other consequence of this situation is that it is sometimes easier to go to an other town to get rid of some waste, therefore the quantities collected in one area can be bigger than they should be.

- The dwelling's localisation.

People living in large cities (i.e. a majority of flats), don't have a lot of storage capacity or an easy access to « waste reception centres » were they can get rid of toxic or bulky waste. On the other hand, people living in the country can get rid of their garbage by other means (fire, compost etc) and have easier access to waste reception centres. This is an other explanation of the lower level of garbage weight/capita in the countryside.

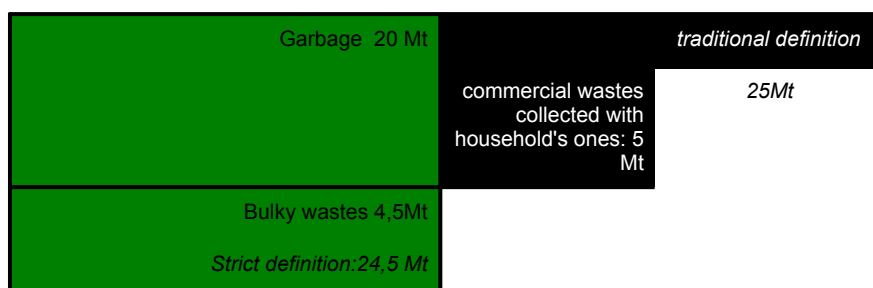
An other distortion could also be added in tourist areas. Le Bozec in 1990 calculated that tourists living in hotels or houses were producing an average quantity of waste of 0,6 to 0,8 kg/person/day. When camping their production was 0,3 to 0,6 kg/person/day. When just passing by, the production was still 0,1 to 0,2 kg/person/day.

Considering the rapid evolution of waste composition (particularly the growing volume of plastics)and the distortions due to collecting systems, it is impossible to use data of waste components per type of households or per social items that are 10 years old in order to reconstitute the actual waste production. For example, 10 years ago, upper middle classes were consuming many more glass bottles than the lower middle classes or workers but nowadays it is not sure that this is still the case as mineral water consumption has increased.

F.2 Figures of households' waste in France

The figure A show the evaluation of waste according to the different definitions.

Fig A Household's waste in France



Source: ADEME 1997

Since 1960, the amount of domestic waste has doubled : from an average of 220 kg/inh/year it has reached 416 kg in 1993, 427 in 1997. As far as households are concerned, the 1997 figures corresponds to the following breakdown :

Total kg/household /year: 1 058 (864 for garbage only)

kg/inhabitant/week : 8,19

kg/inhabitant/day : 1,17

These are the figures that were used for the construction of the Energy Environment Budgets.

In 2002, new data were available. There are not more specific but more up to date.

Household's waste strict definition was 28 millions tons for year 1998 (Ademe, 2002).

F2.1 Components of the garbage bin.

The evolution of the components of the average garbage bin shows an important increase in glass and plastics while the ratio of organic matters and papers is stable (Table 2.75). However, in absolute terms the quantity of OM and papers has also doubled. (Guellec. A 1997 ; Jolivet.P 1998, Ademe 1999)

Table 2.75: Breakdown per components of household's garbage.

1995	kg/inhabitant/year	%	% in1960	Kg/inh/year
Organic	125	0,29	0,26	57,2
Papers/cardboard	110	0,25	0,26	57,2
S a n i t a r y textiles	13	0,03	nd	
Textiles	11	0,03	0,05	11,0
Plastics	48	0,11	0,01	2,2
Glass	57	0,13	0,04	8,8
Metal	18	0,04	0,06	13,2
Various non flammable	30	0,07	nd	
Complexes	6	0,01	nd	
Fuels	14	0,03	nd	
Specific waste	2	0,01	nd	
Total	434	1,00	0,68	220

Source : ADEME, C3ED, Assemblée Nationale 1995

Specific wastes include toxic wastes. The main ones are defined as in Table 2.76 :

Table 2.76 Quantity of specific wastes in France

S P E C I F I C WASTE	TONS/YEAR
lubricating oil	290 000
battery mercury	6,5 tons. Expectations for 1996: 3,5 tons
nickel	27
cadmium	50
lead batteries	120 000
sulphide acid	21 000
medicines	15% non used medicines
cold appliances	CFC to be recycled from 30 millions of white products before 2004
paints	Lead in 75% of the products sold
aerosols	500 millions units consumed per year

Source : Ademe 1994

The use of mercury has been banned for stick batteries therefore the estimation for 1996 was 3,5 tons instead of 6. It will decrease again as mercury based batteries are to be banned from January 1st 2000.⁶⁷ Medical mercury thermometers have been banned in France since 1999 and a program of reclamation of old thermometers has been implemented.

The implementation of « waste reception centres » specialised in the salvation of bulky and specific wastes is an aid in avoiding the presence of such items in the domestic garbage bin.

But they don't provide a full answer to the problem : in 1991, a survey (Ined, 1991) showed that waste reception centres were mostly used by families >40 years old, almost never by young or old people and much more in the country than in the Parisian area (this can be explained by the access problems as mentioned before).

An other study (Maresca. B Poquet. P 1997) has shown that 30% of white products thrown away were ending up in dumps. Among the 70% remaining, 45% were taken to waste reception centres, 50% were given back to retailers. The proportion of brown products sent to dumps was 90%, 70% of the 10% left was sent to a waste reception centre. Such a situation was explained by the lack of public-spiritedness and by the lack of waste reception centres.

Bulky waste are defined as in Table 2.77 :

⁶⁷ European regulation 28/12/1998.

Table 2.77 : quantity of bulky waste.

Garden	
Monsters	
Gravels	
Total Mt	4.5

Source : ADEME 1994

F.2 .2 The influence of the socio-economic variables on the components of household's garbage.

F.2. 2 1 Main studies

Most research on socio-economic items in this field are at least 10 years old. As a reminder, here are the results of two of the principal studies :

Bertolini has researched the area of the city of Lyon (Bertolini, 1988) and the difference in garbage components per type of neighbourhood and per type of family. His main findings were the following :

- A correlation between the size of the family and the amount of waste. The marginal waste production per person was increasing proportionally less than the household's size which suggest a scale effect.
- Upper middle classes were producing more waste/person than average but less waste/household than average . This was explained by an average smaller size of UMC families. Both of these results may still be valid.
- No correlation between incomes and production of organic matters.
- A negative correlation between the quantity of paper & cardboard and the quantity of organic matter and no correlation between the production of paper & cardboard and living standards. A positive correlation is found when focusing on newspapers.
- No correlation between glass waste and family size. A small positive correlation between family size and paper waste for families with children under 15.
- No correlation between quantity of plastic waste and quantity of glass waste.

He also quotes a 1972 study showing the percentage of waste/global consumption per SPC that is obviously not accurate anymore.

Studying the composition of garbage bins, Gouhier (Gouhier, 1991,1992) has tried to establish links between family size, type of dwelling (house/flat), apparent incomes (defined by dwelling's standards and characteristics of the neighbourhood) and consumption patterns. He defines the « garbage of the essential », the « garbage of possible choice » and the « garbage of freedom of choice » and their subdivisions. The consumption patterns have now evolved so much that, according to the author himself⁶⁸, this work can't be the basis for a bottom-up study for reconstituting types of garbage/socio-economic items.

If updated, both works could lead to a better understanding of waste production and therefore to targeted actions for implementing waste reduction and/or recycling tools.

F.2. 2 2 Breakdown per socio-economic factors.

a) Influence of the family size

Even though the amount of waste should increase less proportionally than the family size, Table 2.78 calculated on strict proportional measures, can give an idea of the influence of the family size on waste production.

Table 2.78 : Influence of the family size on waste's production.

family size	1	2	3	4	5+
Organic	125	250	375	500	625
Papers/cardboard	109,8	219,6	329,4	439,2	549
Sanitary textiles	13,4	26,8	40,2	53,6	67
Textiles	11,3	22,6	33,9	45,2	56,5
Plastics	48,2	96,4	144,6	192,8	241
Glass	56,8	113,6	170,4	227,2	284
Metal	17,8	35,6	53,4	71,2	89
Various non flammable	29,5	59	88,5	118	147,5
Complexes	6,1	12,2	18,3	24,4	30,5
Fuels	13,9	27,8	41,7	55,6	69,5
Specific waste	2,2	4,4	6,6	8,8	11
Total kg/year	434	870	1305	1740	2170

Source : ADEME 1999

⁶⁸ Conversation with J Gouhier. October 1998.

b) Influence of the housing's location.

The influence of the housing location can be described as in Table 2.79.

A single item has been updated (Ademe, 1998): the influence of the dwelling's location on the garbage composition.

Areas are defined using the origin of domestic waste that arrive in treatment plants i.e. « Urban » for plants settled in areas with a town > to 50 000 inhabitants, « Peri-urban » for areas with a town of 10 000 to 50 000 inhabitants, « Country » for areas with towns of less than 10 000 inhabitants. This distortion shows again the limits of measures that are made at the door of the treatment plant.

- Urban areas are characterised by a bigger production of paper and cardboard and a lower production of organic matter. Referring to research from Bertolini and Gouhier, this could be explained by the distribution of free press and leaflets more frequently in those areas while vegetable consumption and the size of the gardens is smaller.
- Rural areas' garbage contains more plastics.
- Peri-urban areas garbage look a lot like the country's but is characterised by a higher level of non-flammable products (pebbles, stone etc). This could be explained by more do-it-yourself work on houses and gardens.

As mentioned before, although there is a clear increase of the quantities collected when going from rural to urban areas, there is no evidence that this increase is due to households.

Table 2.79 : Breakdown of garbage components per area of residence

% of the dry weight	Urban	Peri urban	Country	Average
Organic	14,3	17,7	18,4	15,8
Papers	19,6	14,9	16	17,5
Cardboard	9,7	8,3	8,4	9,2
Sanitary textiles	1,9	2	2	1,9
Textiles	2,5	3	2,8	3
Plastics	12,4	12,2	13,3	12,6
Glass	19,1	19,9	18,4	19,3
Metal	5,4	5,8	6,1	5,6

Various non flammable	8,3	10,5	8,9	8,9
Complexes	1,6	1,6	1,8	1,6
Fuels	4,1	3,5	3,2	3,9
Specific waste	1,1	0,6	0,7	0,7
Total	100	100	100	100

Source : ADEME 1993

F.3 Packaging : a growing part of household waste.

In 1993, packaging was representing 39% of household's garbage weight and more than 50% of its volume. Glass, plastic and cardboard represented 80% of packaging's waste components (Table 2.80). This can be explained as they are the components commonly used to manufacture food packaging which represents the largest tonnage of waste.

Table 2.80 : Packaging in domestic garbage (classical definition)

% of wet weight	% of household's garbage	% of packaging 's waste	kg/inh
paper	1	3	4,34
cardboard	9	23	39,06
complexes	1	3	4,34
plastics	10	25	43,4
glass	13	33	56,42
metals	4	10	17,36
others	1	3	4,34
Total	39	100	169,26

Source : ADEME 1993/Assemblée Nationale

The weight has been calculated referring to 1995 figures in order to give an idea of proportions.

A study (Ademe, 1997) has tried to evaluate the « waste deposit » of household consumption. A method referring to production figures couldn't give an exact idea of what was the contribution of households (there are other purchasers), sampling garbage containers doesn't give an idea of the origin of the garbage and uses the wet weight. Therefore a third method was chosen : to use a consumer panel, to count the number of product unit sold (UVC), to calculate an average weight per type of packaging and then the tonnage per market.

The results per components (Table. 81) are quite similar to the results found by classical sampling methods for metals & papers but the percentage of plastics is lower while the percentage of glass is higher.

This could result again from a distortion due to the use of wet weight and the presence of garbage from small and middle size companies in the first calculation .

Table 2.81 : Breakdown of garbage per packaging components

	thousands tons	%	% 1993 classic sampling
steel	360	0,090	0,10
aluminium	40		
paper & cardboard	1 000	0,220	0,26
plastic	900	0,190	0,25
glass	2 300	0,500	0,33
others	20	0,004	0,06

Source : Ademe 1997

Anyway, even though it is difficult to calculate the exact share of plastic and glass in household waste, this study shows the major influence of food packaging (Table 2.82). They represent 80% of the tonnage. Drinks themselves represent 60%, grocery & fresh products 20%.

Table 2.82 : Packaging used in the French household.1994.

Food	Millions UVC	Tons
Frozen food	384	59 093
Syrups	178	59 927
Jam & fruits in syrup	818	62 668
Baby food	625	65 883
Yoghurts	6 876	87 086
Tin cans	1 195	88 851
Sauces	711	97 186
Pet's food	1 492	97 327
Milk	3 876	117 784
Soft drinks	2 420	133 573
Fruit juices	828	145 313
Champagne	191	150 886
Whiskies & other alcohol	354	187 769
Water	4 345	298 243
Wines	1 684	670 013
Beers, cider	4 287	693 758
Others products		
White products	15	18 000
Shoes	150	18 180
Hair products	419	18 640

Animals products	400	19 278
Brown products	435	19 993
Furniture	13	21 346
Hygiene (paper)	840	21 724
Linen	194	22 310
Gardening	310	28 550
House keeping	573	30 677
Tobacco	4 893	32 440
Paints	203	34 193
Body wash	930	38 074
Toys	105	42 798
Pharmaceuticals	2 487	62 267
Washing	1 277	84 579

Source : Ademe 1994

The importance of food packaging can be explained by the change of consumption patterns (for example, more frozen food i.e. plastics and cardboard, etc) and the change in selling modes (vegetables wrapped in plastics) all the more so as the proportion of packaging in the global weight of products tends to decrease.

Main food producers and other companies have made efforts to reduce the weight of their packaging (DPP, 1996) and they sometimes use more environmental friendly ways of manufacturing them. For example (Leroy. JB, 1992), the plastic packaging of a 1kg packet of pasta is about 18 g. On a 1 litre bottle of mineral water, the packaging weighs 50 g. Other examples (Table 2.83) shows figures such as a 10% reduction of the glass quantity used to make bottles or of the polystyrene quantity used to make yoghurt's cartons are increasing.

Table 2.83 : Evolution of packaging weight

in g	1950	1970	1980	1990	1995
Glass					
wine bottle 75 cl	550	450		350	285
beer bottle 33 cl.		210	185	130	
Steel					
tin can 1/2			69	56	
drink can 33cl			35	30	22
Aluminium					
tin can 1/2			30	27	
drink can 33cl			20	16	14

Paper					
bags			247	215	
Plastics					
1,5l bottle			58	35	
Y o g h u r t carton		6.5		3,5	

Source: Bertolini 1995

A study done in 1990 (Credoc) has shown that packaging was still representing 31% of the product's weight. For 1995, the forecast was an increase up to 35 % (Table 2.84). This figure seems quite relevant as other forecasted elements have turned out to be correct (Table 2.85). It shows that while the food industry has made big efforts to reduce the packaging weight, this is not the case for a lot of other products. On the other hand, the use of recycled materials can increase the packaging weight. For example, plastic films made with recycled matter must be heavier to keep their resistance.

Table 2.84 : Coefficient packaging weight/product weight

	1988	Forecast 1995
Food	0,24	0,26
Othe r	0,55	0,66
Total	0,31	0,35

Source : Ademe 1990

Table 2.85 : Comparison forecast/reality of waste packaging.

	forecast 1990	reality 1995
total/inh	436,28	434
nb of households	22895	23155
tons of garbage	19,278	20

Source : Ademe 1990/1997

On the contrary, lighter glass bottles can't be re-used.

Therefore the usual focus on packaging's weight is not relevant any more and researchers should rather concentrate on a product's life assessment while, in an ideal world, consumers would modify their behaviour to help waste reduction.

An example is the research done by Nestlé (Nestlé,1997) for their ready-made mash potatoes « Mousline » : the use of a single 5g packet replacing the old 30g one has led to a

410tons saving of packaging and consequently to a reduction of volumes to be transported that represents 360 less trucks on the roads.

F.4 The household's margin of action is significant

Households can reduce their waste production and /or recycle or re-use their wastes.

F.4.1. Margin of action at the source

As for energy and water, the best way to avoid pollution is to avoid the action that pollutes i.e. in this case to avoid some type of consumption.

The Eco-citizen guide (Ministère de l'Environnement, 1999) suggests some behaviour: the usage of both faces of a paper sheet, the choice of product's that require refills and the choice of « eco products » using the NF environment label or the European Eco-label.

An other document (Pétre. L., Year unknown) stresses the importance of :

- choosing products that don't need packaging (bananas)
- using your own basket instead of plastic bags
- preferring fresh fruits & vegetables to frozen ones or ready to take away packets ; both are often over packaged
- preferring one large capacity packaging to an addition of small capacity ones (i.e. yoghurts)
- using boxes instead of aluminium wrapping paper
- drinking tap water instead of bottled one. This last action can be thwarted by the poor quality of tap water. The assessment made in 1993 on water distribution units in cities > 5000 inhabitants has shown that at least 4 million people were not supplied with drinkable water (Ministère de l'Environnement 1996).

F.4.2 Margins of action after consumption.

1) Of course, the first thing is to avoid throwing things away - anywhere.

This can be considered as a minimum level of public mindedness but is sometimes difficult to do when adequate service is not provided. There were 900 waste reception centres in 1998, special days of door-to-door collection were organised and 50% of municipalities were providing special containers for bulky wastes. (Ministère de l'Environnement 1999).

2) Re-use of products :

- For household's with gardens, making compost can be a practical way of reusing peelings and garden's waste.
- Use of bottle deposit systems.

F.4.3 Recycling or waste saving actions are only implemented with the good will of French citizens.

- In France, in 1997, recycling systems were implemented in 38% of the French municipalities (Eco emballages, 1997). This corresponds to 28% of the French population.
- 90% of the population have a glass container next to their dwelling but only 64% are using them (IFEN/INSEE, 1998).
- Even though there is a quantitative increase, only 6% of household's wastes are recycled (Table 2.86). (ADEME, 1997).

Table 2.86: Destination of household's waste (traditional definition)

%	1993	1997
Municipal dump	62	60
Incineration with re-use of the energy.	24	29
Incineration without re-use of the energy.	9	
Biologic treatment	5	5
Recycling	1	6
Total	100	100

Source: ADEME/IFEN 1997

A household can change to « green behaviour » by :

- participating in recycling programs including those conceived for toxic wastes ie battery collection, medicine collection in drugstores.
- paying attention to the sorting of its waste properly as it is important for the quality of the recycling programs.
- participating in the local institutional life
- educating neighbours and family.

90% of households declare to be ready to sort their garbage. 53% think that refusing to recycle is unacceptable (INSEE 1998). This positive trend could be more productive if the supply of recycling elements was more important and if there was a financial incentive for people in such

actions. But, as seen before, there are not conceived for producing less waste or for recycling. On the contrary, local taxes based on « renting values » are increasing : the amount of waste taxation has gone from FF 6 billion in 1993 (Euros 0.91 billion) to FF 13 billion in 1995 (Euros 1,98 billion), (Guellec. A 1997).

Meanwhile, public action for increasing waste sorting behaviour appeals to citizens' good-will through advertising campaigns or the implementation of « ambassadors of waste recycling » who are doing a door-to-door work for the promotion of waste reduction and recycling (Ministère de l'Environnement. 1998). Still, 43% of French people don't know where their garbage goes to.

Appendix 4:
Elements given to the participants to the Cognitive Transfer

- «The Eco-citizen Guide» displayed on The French Minister of Environment's web site.
- « Housing: Control the energy» a supplement to the consumer magazine “ 60 millions de consommateurs » dated 1997.
- An extract of a document of the French Minister of the Environment about phosphorus and nitrates that stress people should reduce their phosphate consumption (Agences de l'eau, 1997).

Appendix to the Chapter 3

Appendix 1: Information requested before the first cognitive transfer group.

Madam, Sir,

Thank you for accepting to join our group next XXXX.

We are going to talk about the consequences of our lives on the Environment, therefore we would appreciate if you could fill the following questionnaire in order to let us prepare a lively discussion.

Those information will be kept confidential and only used for research purposes.

Please return this form before XX as we need time to prepare the meeting.

Many thanks

NB If you have any question please contact XX at the following phone number XXX. We will answer immediately.

Please make a cross on the right answer.

About your house.

type of housing

flat ☐ house ☐

surface

number of bedrooms

localisation

city centre ☐ which one :
suburb ☐

country side ☐

do you have a garden ? yes ☐ no ☐

If yes what is its surface ?

You housing was built in

insulation type

walls
windows
roof

type of heater

individual ☐
collective ☐

energy used

gas ☐

electricity ☐
oil ☐,
other ?

average heating temperature °C

hot water system
individual ☐
collective ☐
and its source of energy ?

household's electric equipment

fridge ☐
combi ☐
freezer ☐
dishwasher ☐
washing machine ☐
dryer ☐
TV ☐
video recorder ☐
if you have more than one of those equipment please tell.

Approximate amount of light bulbs

Standard
halogens
low consumption

cooking equipment
oven ☐
hot plates, ☐
micro wave ☐

energy source for
oven
hot plates,

About your household's life.

how many people live in your household ?

how do they wash themselves ?

Shower Bath

Mrs
Mr
child 1
child 2
child 3
child 4

type of detergent used in the washing machine

brand

type of packaging

cardboard ☐ ☐

plastic ☐

other

how many people stay home at day time ?

Which transportation mode is used for the every day life ?

	car	p u b l i c transports	bicycle
Mr			
Mrs			
child 1			
child2			
child 3			
child 4			

Number of cars used by the household.

If possible, can you join a copy of your last energy and water bills ?

Appendix 2: Conversation guide for the cognitive transfer group

Topic	Tool	Discussion
Introduction of organiser and of the participants		Presentation of the session Objectives Ethics Presentation of the participants

Topic	Tool	Discussion
From general issues to specific ones.	n a t u r e / environment? In this part ideas and actions about the protection of the environment are spontaneous.	In a few words can you describe HOW you are concerned by the environment, why, what are the mechanisms that make you involved ? What do you think about this ? What are you doing for the environment ? In which fields ? In what circumstances? Why ? With which frequency ? Why? What are you not doing that you can imagine doing ? How are decisions taken in your household ? Why ? Which topics are the most stimulating ? Why ? Are there any rules in these field ? good ones ? bad ones ? Can we talk about them ? As a first conclusion do you feel involved ? why ? Since when ? By which topic do you feel concerned? To what extent ? With who ? For instance, are there any person , profession with which it is easier to talk about these subjects ? (doctors...) Are there any places where it is easier to talk about that (schools)

Topic	Tool	Discussion
Assisted questions	Presentation of EEB	There are some specific areas where one can imagine doing something for the environment. within the household , within the work place..... transports heating water transports washing powders recycled goods equipment goods (such as low consuming energy items) waste In each case, let's talk about what could be done, what we are thinking about ?
Results of the analysis		Now..... We are going to discover the results of the calculation we have made thanks to the figures you gave us a week ago. After each presentation reactions of the person and of the other participants. What do you think ? Are you surprised ? Is this an important information ? Does it suggest something you could do or you could improve in your daily life? Would you need something to support you ? To keep those actions in mind ? How ? Technical supports? Human support ? (colleagues, friends, technicians What actions seem possible ? Difficult ? Why? In which field is it or is it not easy to do something? heating water transports washing products recycled goods equipment goods WASTE What would be the institutions ? the organisations that could participate to such actions ? that could help you ? Why ? What can you expect from them ? Is there a missing organisation ? We were talking about rules, do you think some rules could be of a help ? Which ones ? Why ? What's about bonuses ? rewards ? What could you imagine ?

Appendix 3.Detailed interview sheet. Valence

1- The first part was made of open question focused on the effective actions made for the environment, to understand their motivation, the influence of other social groups.

Q1 : Have you already done something for the environment ?

→ If yes a) what ? Why ? Tell me the story. Did you talk about it with someone before doing it ? What does your family think about it ?

Do other people have done like you ?

If no : what should be done to encourage them ?

Have you done something else ? If yes a) again

If no, why ?

→ If no b) Are you in the situation to be interested in a subject in this field but with no time to dedicate to it ?

If yes, What ? tell me ?

If no, Lots of people are like you, why ? What could make you change your mind ?

Q2 : As far as the Environment is concerned, what do you think the most important subjects are ?

Why ?

Is someone/something responsible for that ?

Are you talking about it in your neighbourhood ? at work ? with your friends and family ?

Did you look for more information about it ?

→ If the answer is coherent with Q1, apart from what you have done, is it possible to consider other personal actions ? What could attract people so that they want to do it ? Who could do it ?

→ If the answer is incoherent with Q1, can somebody do something about it ?

If yes, What's missing that explains that people don't do anything ?

Where could you get more information ? Why didn't you do anything ?

(If the answer is of a NIMBY type, Q2 will be asked again referring this time to the planet environment)

Q3 : Were there some times in your life when you have felt specially concerned by the environment ?

If yes, tell me about it.

If no, is it a constant attitude ? Do you remember talking about it at school ?

Q4 : Do you think that some of your household's daily actions have an impact on the environment ?

If yes, Which one ? Why ? How ?

Do you think you can do something to increase/minimise this impact ?

→ if yes, at what level ? why didn't do it until now ? What's missing ? What help would you need ? Do you think that such action will have a negative impact on your living standards ?

→ if no, Why ? If somebody proves to you the opposite, who would be this person ? would you listen to her ? how do you imagine the situation ?

If no, let's imagine that somebody is proving to you that you can do something, who could that be ? where could that be ? etc...

Q5 : Let's imagine now that you are on charge of telling people that something can be done for the Environment in their every day life, what would you do ?

2- The second part of the interview was a questionnaire meant to check if there was a gap between what people declared and what they do. For example, some people could declare that they were not doing anything for the environment while having a very sustainable way of living. An other objective of the questionnaire was to give indicators of what was people's position on some ideas often conveyed by the media on science in general, religion etc.. and to check their degree of knowledge of some environmental subjects.

Q6 To help France to protect the Environment, what trust do you have in the following people :

A lot of trust Trust No trust Don't know

Scientist

Businessmen

NGO

The government

Citizens

Local representatives

Unions

Q7 Do you agree with the following sentences ?

Agree

Don't agree

Don't know

Too often we trust science instead of our intimate conviction

Generally speaking, science does more harm than good

Every modification made by man on nature make it worse

To protect the environment is a way of feeling solidarity with people

The protection of the environment creates jobs

I agree to pay what I buy a little more if it can help the environmental conservation

A good solution would be the implementation of a tax on polluting products
 People worry too much about the state of the environment and not enough about prices or jobs.
 People worry too much about the consequences of the economic growth on the environment
 Economic growth is necessary for the protection of the environment
 Science will solve the problems of the environment without any change in people's way of living.

Q 8 The idea of nature is linked with the idea of God. Yes/ No/ I don't know.

The idea of nature is linked with spirituality

Nature is important but has nothing to do with spirituality

Q9 : Tell me if you are doing the following things

Always Often Seldom Never I am not concerned

I use unleaded fuel

Organic food

Recycled paper

Biodegradable products

A washing powder without phosphates

Products with a recyclable packaging

French products

European products

I use the special bin for used glass

I use the special bin for papers and cardboard

I try to recycle all my garbage

I cycle or walk for my everyday travels instead of using my car

When on the motorway, I reduce my speed

I use low consumption bulbs

The TV and the video player are off when not in use (no little red light)

I switch off the light when nobody uses a room.

At night, I diminish the heating temperature

I switch off radiators of a room that is not used.

I take showers and I ask my family to do so as well.

I have changed the toilet's flush or I have put a brick in the reservoir.

Once a year, I check whether there are any leaks in my home.

(If owner of the housing),

Windows are insulated

The roof too

The heater is less than 5 years old

I have a thermostat.

Q10 : Among all the actions that you have just been asked about, draw a cross in front of those that seem to you as environment friendly

Q11 What do you think of the following sentences (circle the word that corresponds to your opinion) :

To save energy at home helps the reduction of the glass house effect
 Nuclear waste will stay dangerous for thousands of years
 In France, cars are not an important cause of air pollution
 Every time I use gas or oil at home , I contribute to the glass house effect
 The glass house effect is a little problem today
 The glass house effect is caused by a hole in the earth's atmosphere
 Fumes that goes out of incinerators are only slightly toxic
 Supplying drinking water soon is going to be a problem in industrialised country
 Recycling is the cheapest solution
 Recycling is the less polluting solution
 It is difficult to have a easy return of investment when buying a low consumption bulb
 Most of the energy used in a house is for heating
 Insulating water tanks pays for itself within a few months
 House insulation allows important energy savings
 To let the water run while brushing one's teeth equals to a consumption of about 150 l per month
 Within a year my TV and the other equipment I've got can use more electricity when they are off
 with the pilot light on than when they are on.
 The electric consumption of my combi- fridge can be responsible for 20% of my electricity bill
 (not taking electric heating into account)

True Might be true Wrong Might be wrong Don't know

3- The third part of the interview was an open discussion about sustainable behaviours based on the answers given in Q8.

Q12 Did you know that such behaviours (referring to Q8) were good for the environment ?

Q13 Do you think that adopting them could lead to a decrease in you living standards ?

Q14 What could give other people the desire to adopt such behaviours ? What's about you ?

4- Part four was about objectives characteristics of people interviewed.

Age, income, sex, profession, number of people in the households, house-work distance,
 transportation mode, heating temperature, number of cars in the household, education level, age
 of kids, belonging to a union, a party, an NGO, a non profit organisation, political trends (from
 extreme right to extreme left), a religion, been brought up religiously, type of housing,
 localisation, favourite papers, radio and TV programs.

Appendix 4: Individual questionnaire for the group assessment. (face-to-face interview)

Have you learned something during the group meetings ?

If yes

in which fields ?

if no, why ?

Do you think that you were already aware of the issues that were debated ?

2) Were there some elements that were more interesting for you than other one ? O/N

if yes → which ones ?

if no → why ?

boost : in the matter of :

awareness of pollution ?

awareness of the impact of transportation modes ?

awareness of the impacts of your every day life on the environment ?

water saving ?

energy and electricity saving ?

purchase of recycled goods ?

purchase of green goods ?

information to be considered for important purchases (car, heaters, white products)

3) What was positive in the meetings ?

4) What did you dislike ? ?

5) Have you used the Energy Environment tables that were calculated ?

If yes, why ?

If no, why ?

In both cases, what was the impact of a having a personalised item ?

6) Did you read the documents that were given to you as well ?

if yes, which ones ?

if no why ?

7) After participating in those meetings :

How do you consider the sustainable action that were described ?

Do you consider that the sum of people's effort can change the situation ?

If yes in which fields , why and to which condition ?

boost : more specifically, do you think that the group was a motivating factor ?

Do you feel more motivated to express your views to institutional representatives ? why ?

Are you interested by a form of participation such as group meetings ? why ?
(finding the relative importance of group' constraint)

8) What would be the best solution ?

to receive written information, committing oneself to communicate one's achievements to a central office and having feedback of collective achievements?

to receive those kind of information through internet ?

Participating to groups at your work place ? somewhere else (associations for example)

9) What elements should be improved ?