

An aerial photograph of a city neighborhood, likely Brøset, showing a dense arrangement of buildings, streets, and green spaces. A river or canal flows through the area. The text is overlaid on the lower portion of the image.

# **Urban Design for Climate Neutral Neighbourhood The case of Brøset**

**March 19, 2013, ECCA, Hamburg**

**Shady Attia, PhD, LEED AP**

**European Climate Change Adaptation Conference (ECCA)**

**Design boosting Urban Climate Change**

**Science-practice and practitioners session: Best Practice**

Part 1: Raising Awareness

**Part 2: Implementation**

Urban Design for  
Climate Neutral Neighbourhood  
The case of Brøset



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**Interdisciplinary Laboratory of Performance-Integrated Design (LIPID)**

**Swiss Federal Institute of Technology (EPFL)**

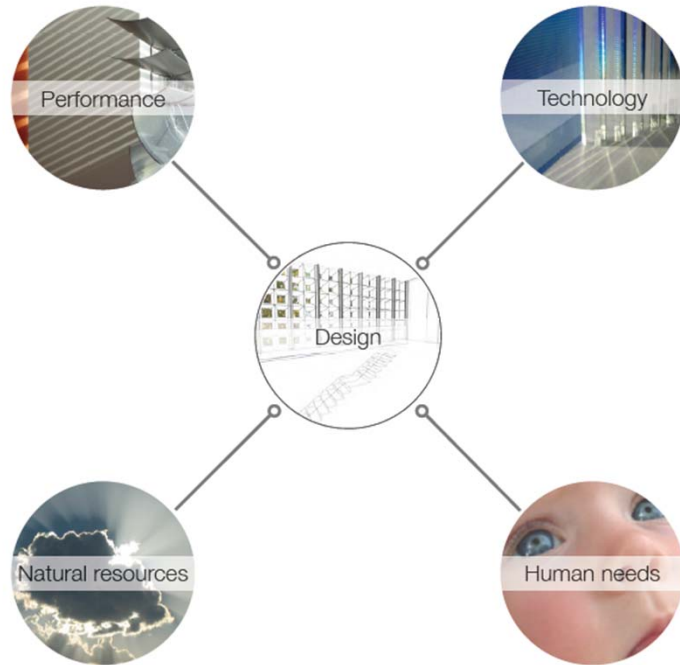
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# LIPID Interdisciplinary Laboratory of Performance-Integrated Design, EPFL



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Ecole Polytechnique Fédérale de Lausanne (EPFL)

## Future Cities urban networks to face climate change

### IEA- Task 51: Solar Energy and Urban Planning



# Brøset Context

Urban Design for Climate Neutral Neighbourhood  
The case of Brøset



# Brøset: Climate Neutral Neighbourhood



Brøset Project: Development of Climate Neutral Urban Development

- **1600 housing units + mixed use in Trondheim**
- **3500 inhabitant**



# Brøset: Climate Neutral Neighbourhood



**Can Urban Design contribute to urban climate change and cities resilience?**

**Can we achieve resilient cities and maintain high quality of life?**

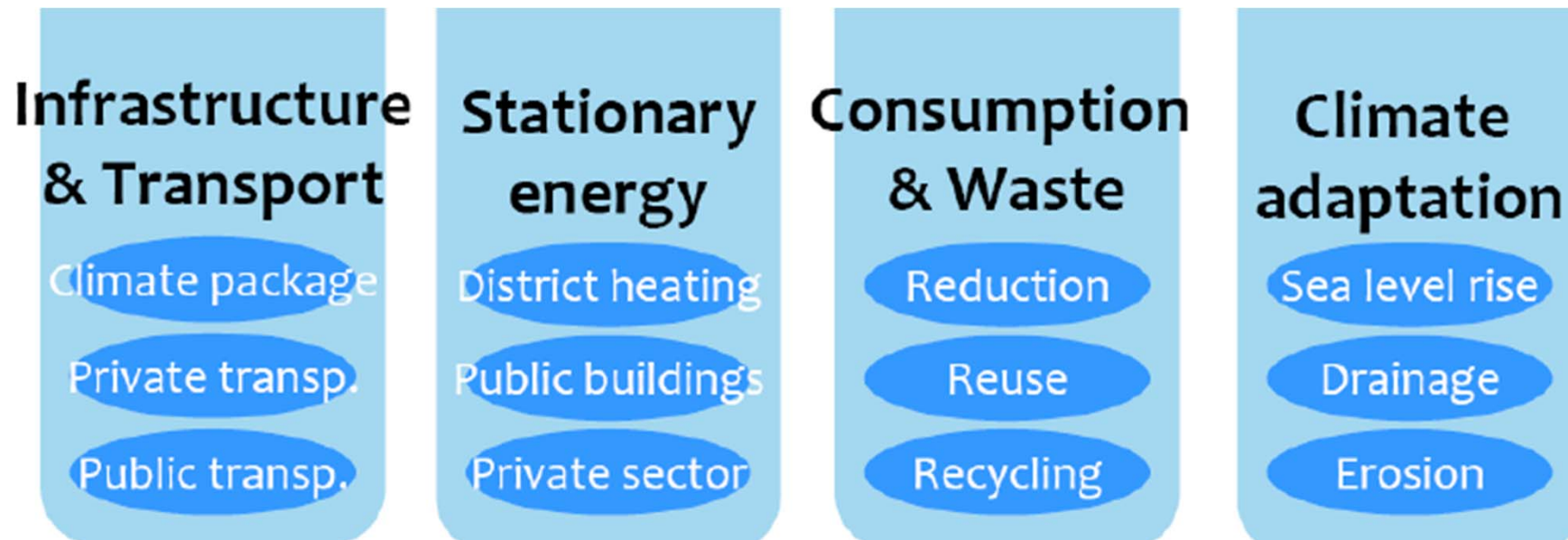


# Brøset: Climate Neutral Neighbourhood



## Brøset Project: Development of Climate Neutral Urban Development

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- 3500 inhabitant



# Design Process (Open Parallel Quest)

Urban Design for Climate Neutral Neighbourhood  
The case of Brøset

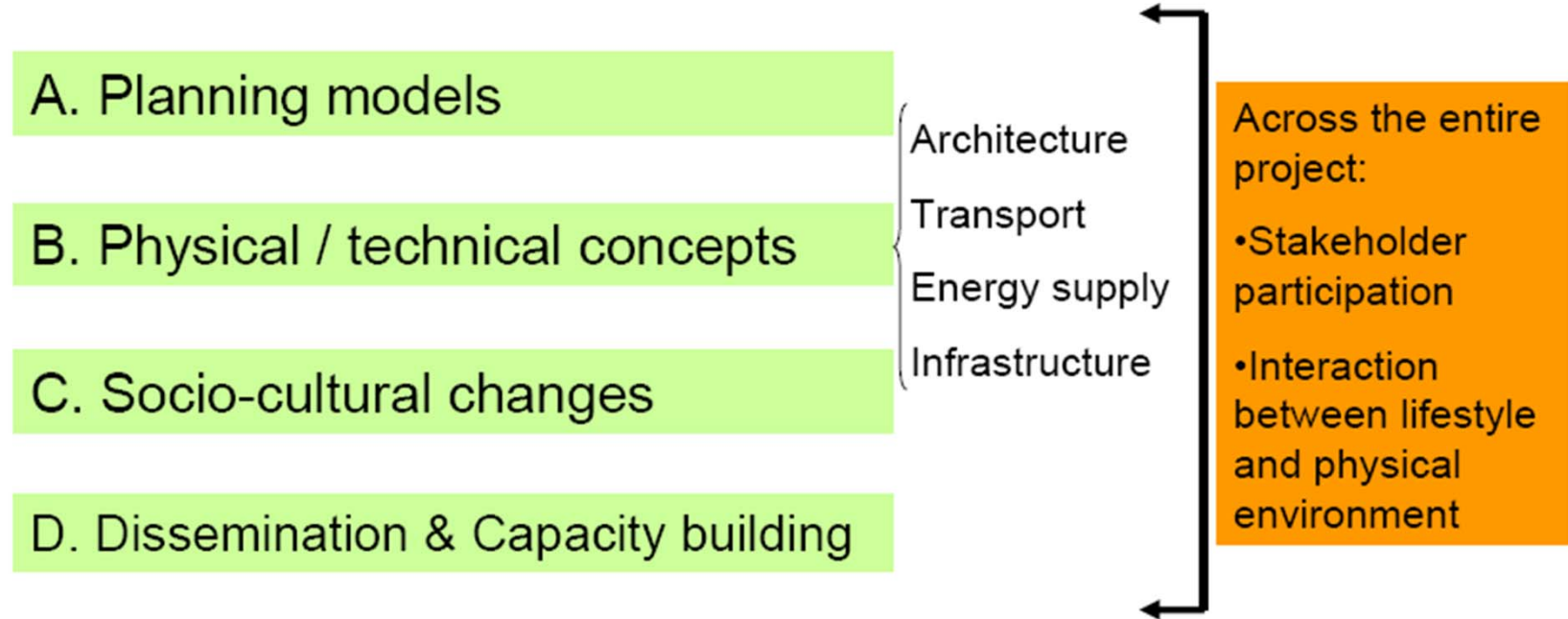




# Brøset: Climate Neutral Neighbourhood



*Making the easiest choice also the most-environment-friendly one*  
*- 4 Masterplan proposals*



# Brøset: Climate Neutral Neighbourhood



*Planning program Brøset - A climate neutral district" in 2009*



# Brøset: Climate Neutral Neighbourhood



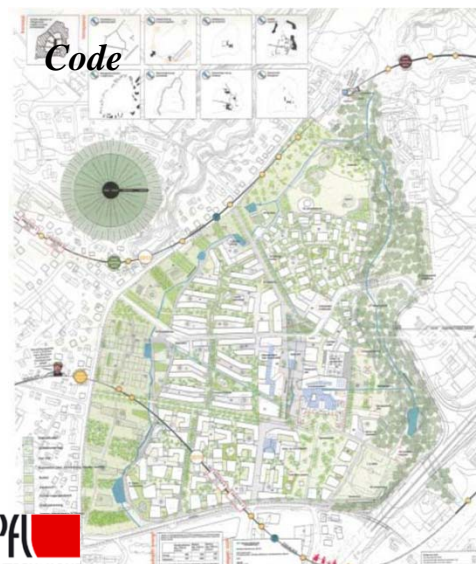
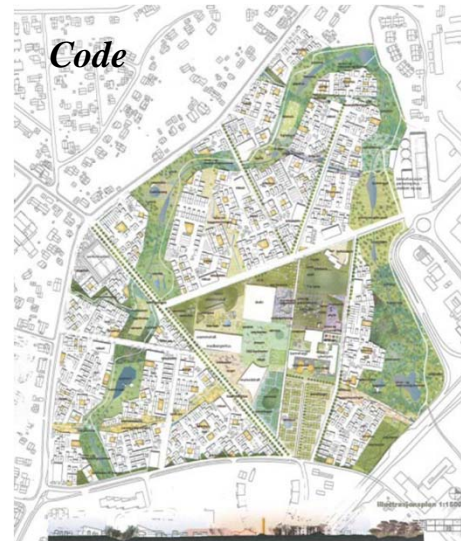
- **SWOT** "analysis (SWOT: Strengths, Weaknesses, Opportunities, Threat).
- **GHG calculator**
- **Municipality of Trondheim** were invited with a focus on lifestyle and further development vs. technological solutions

# Brøset Master Plans

Urban Design for Climate Neutral Neighbourhood  
The case of Brøset

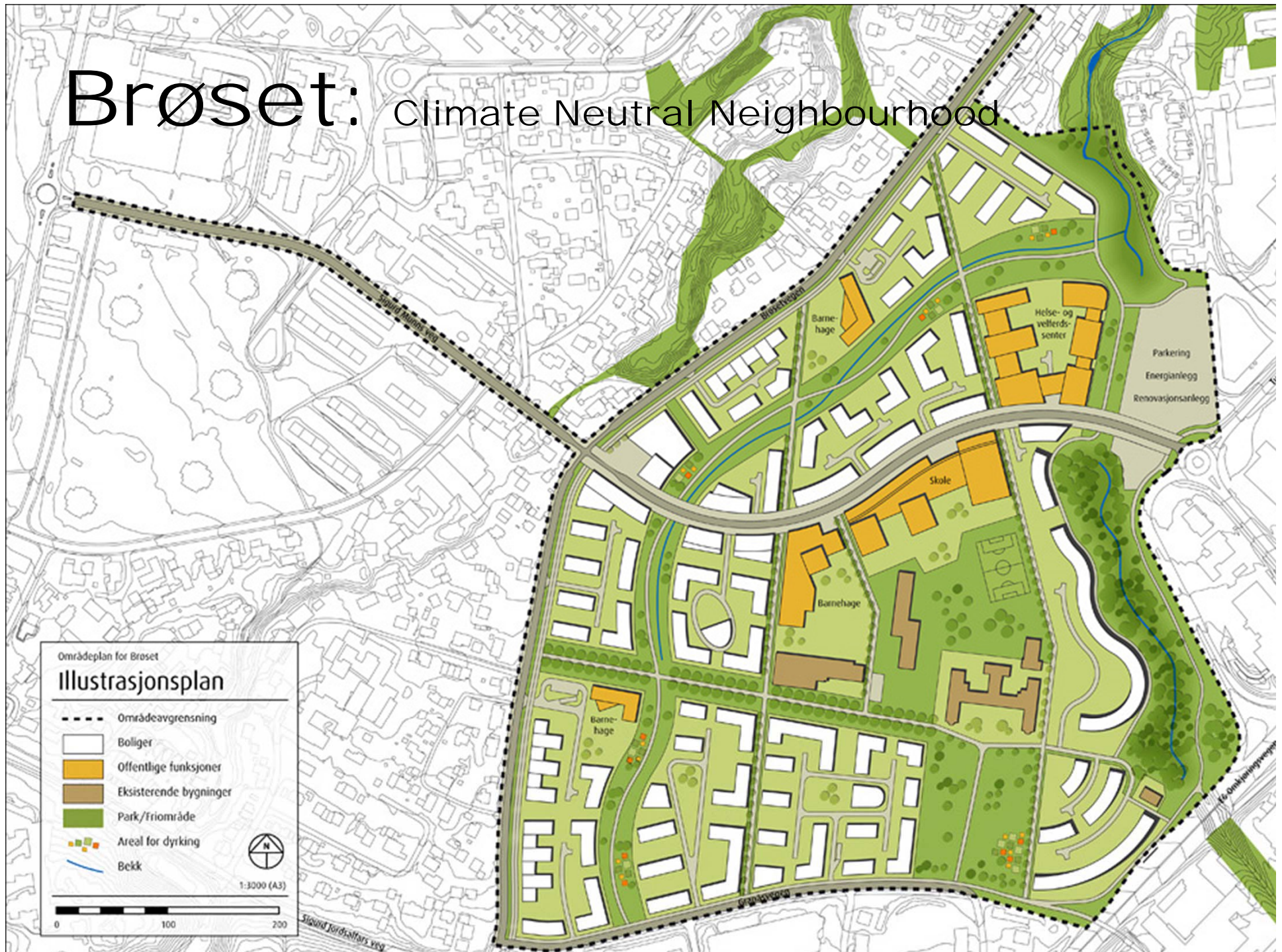


# Brøset: Climate Neutral Neighbourhood



- **SWOT** "analysis (SWOT: Strengths, Weaknesses, Opportunities, Threat).
- **GHG calculator**
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# Brøset: Climate Neutral Neighbourhood



# Brøset: Climate Neutral Neighbourhood



## *Urban Massing*



# Brøset: Climate Neutral Neighbourhood



## *Brøset Master Plan*





# Brøset: Climate Neutral Neighbourhood



## GREENHOUSE GAS CALCULATIONS

- All teams estimate GHG reductions
- Reductions often come = lifestyle changes = difficult to calculate.
- How to entice residents to live climate-friendly (eg. spend time in the community) when climate friendly choices in some areas and increased financial resources provides the basis for increased consumption (eg. long flights).



The world's most widely used LCA software called **SimaPro**.

SimaPro contains several databases of life cycle inventory, and many different characterization methods for several regions in the world. The tool is developed by Pré Consultants in the Netherlands.

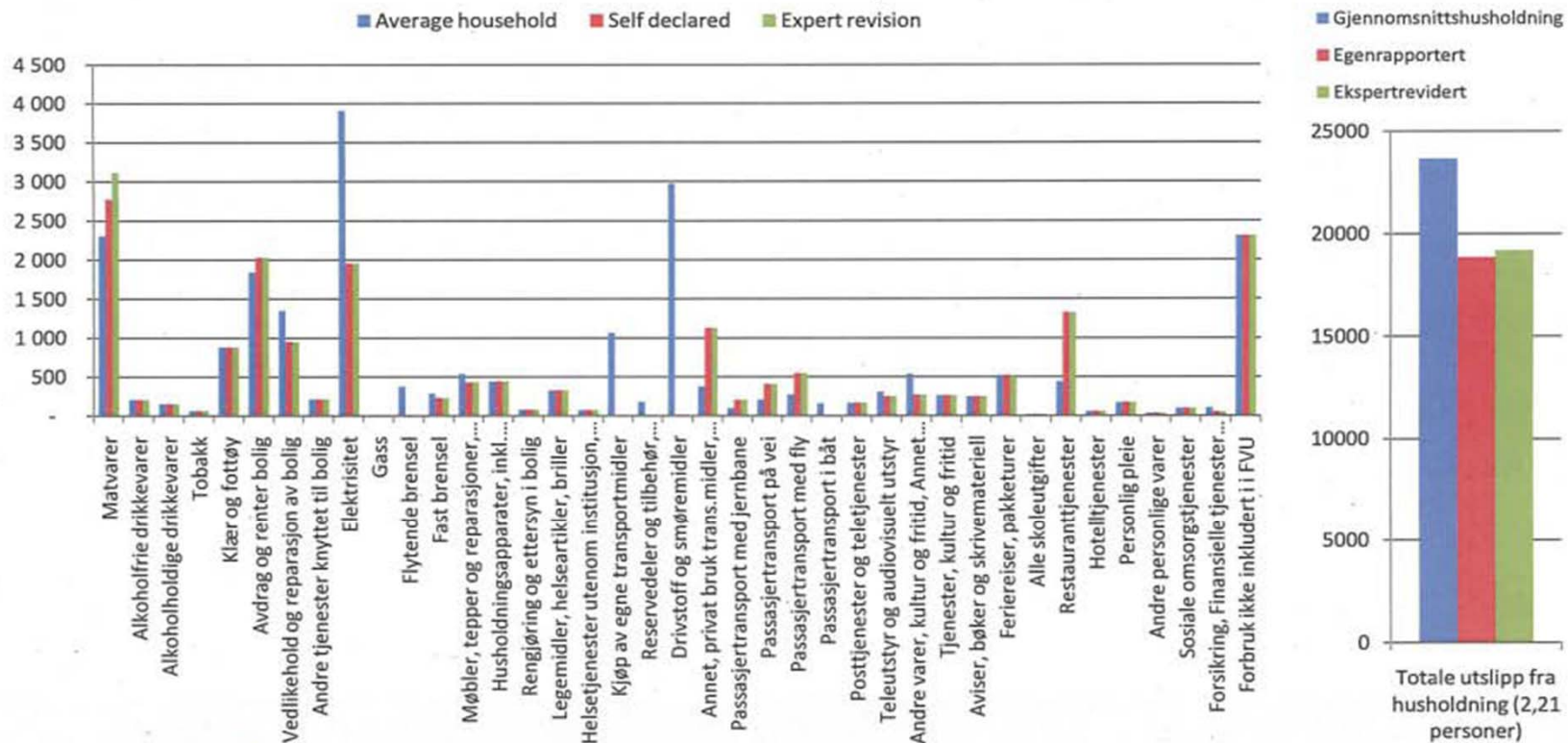
# Brøset: Climate Neutral Neighbourhood



## Example results from calculator

-kg CO<sub>2</sub>-eq/yr (1 avg household)

Performance Targets: 8-11 tons CO<sub>2</sub> emissions → person 3 tons CO<sub>2</sub> emissions person



brøset  
www.brøset.com

# Brøset: Climate Neutral Neighbourhood

*DENSITY The greater density the less the carbon foot print*



# Brøset: Climate Neutral Neighbourhood



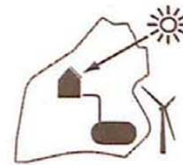
## ENERGY

### -Decrease demand

- How energy need to be reduced?  
*compact, space-efficient housing, more people per m<sup>2</sup>, -design of homes, exterior wall surface in relation to volume.*

-Passive house standard for dwellings?  
*ensures only the number kwh/m<sup>2</sup>, not necessarily carbon neutral buildings.*

-Materials essential-not steel and concrete high CO<sub>2</sub> emissions.



### Energiskaping

Brøset bruker energi kun fra grønne energikilder. Energien kommer fra nære energikilder som solfangere, biogass og geovarme fra området, eller fra fjerne energikilder som vindmøller, fjernvarme utenfor Brøset. Lokale, større, kollektive energi "hubs" vil skape og fordele energi innenfor boligområdene, men mindre installasjoner av t.eks. solfangere vil bli brukt hvis en funksjon trenger det.

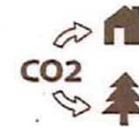


### Pedagogisk energi

Energiltøkene vil gjøres synlige for pedagogisk og informerende effekt. Eksposering av energiforbruket til Brøset som helhet, og i nabolaget. Er det en søster-bydel i Tyskland som man kan konkurrere med? En nettside som gjør det hele offentlig?

ALLE FELLESHUS HAR SYNLIGGJORT FORBRUKET - BEBOERNE KAN FØLGE MED HER.

Digitale verktøy som informerer nøyaktig om aktivt forbruk og utslipp vil være med på å skape en bevissthet på Brøset, og gjøre kampen mot CO<sub>2</sub>-utslipp enda enklere. En informert Brøsetboer, er en god Brøsetboer.



### Co2 lagring

Karbon tanges og lagres i konstruksjoner i tre og i grønne/blå konstruksjoner gjennom aktiv bruk av vassplanter og kompost til jord.



### Avfall/kompostering

Boligområdene har kompostering lokalt, slik at jord er tilgjengelig der det dyrkes. Annet hagesavfall/organisk avfall blir omgjort lokalt i biokvartallet eller til biogass i anlegg i Trondhemsregionen.

# Brøset: Climate Neutral Neighbourhood

## *Open Spaces*

*-The greater density the greater demands for quality of outdoor*

*Public & private spaces:*

*(public) to clearly open Brøset for all in Trondheim;*

*(semi public) to strengthen the local identify and space;*

*(private) to provide the opportunity to own gardens*



# Brøset: Climate Neutral Neighbourhood



Source : regjeringen.no

## ENERGY

*-Energy supply*

*-Smart-grid technology, yet uncertain, cycle storage in car batteries.*

*-All energy from renewable energy sources outside the area.*

*-Number of local renewable energy sources? what can be produced in the area?*

*-The district Brøset can become a net exporter of energy from local renewable sources.*

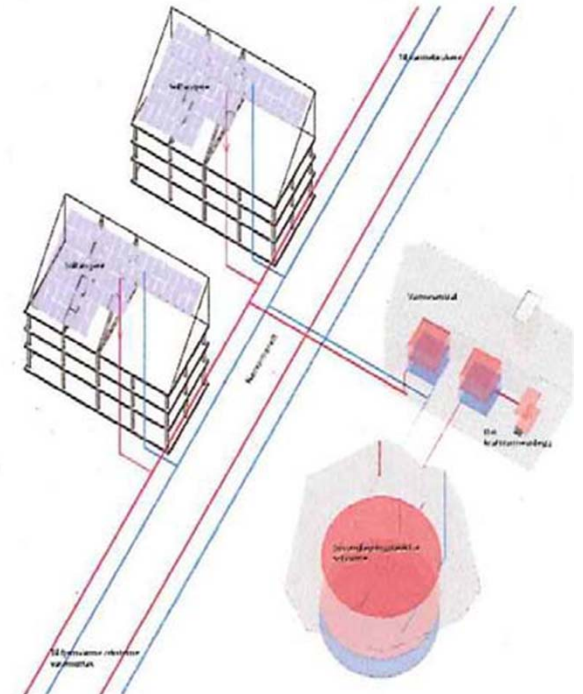
**Oppsummering energioppdekning**

Alternativ I: Sol 50+ med fløyt kraftvarmeanlegg

Energioppdekning alternativ I		Varme 12000kWh	El (gjennl) 12000kWh	SMR
Solenergi	Solvarme	5,0	0,0	5,0
Solenergi	Solvarme	0,0	0,7	0,7
Vindenergi	Vindkraft	0,0	0,18	0,18
Kjernerenergi	Kjernerenergi (Kernkraft)	0,0	4,2	4,2
	<b>OPPG</b>	<b>15,0</b>	<b>5,0</b>	<b>15,0</b>
Varmedekning til eksisterende kundesystemer		8,3		
Behov for kjøp av el på årsbasis			6,6	

Alternativ II: Sol 50+ med biometerdrevet kraftvarmeanlegg

Energioppdekning alternativ II		Varme 12000kWh	El (gjennl) 12000kWh	SMR
Solenergi	Solvarme	5,0	0,0	5,0
Solenergi	Solvarme	0,0	0,7	0,7
Vindenergi	Vindkraft	0,0	0,18	0,18
Kjernerenergi	Kjernerenergi (Kernkraft)	0,0	4,2	4,2
	<b>OPPG</b>	<b>5,0</b>	<b>5,0</b>	<b>14,7</b>
Varmedekning til eksisterende kundesystemer		0,1		
Behov for kjøp av el			9,9	



Bio Co-Generation Plant

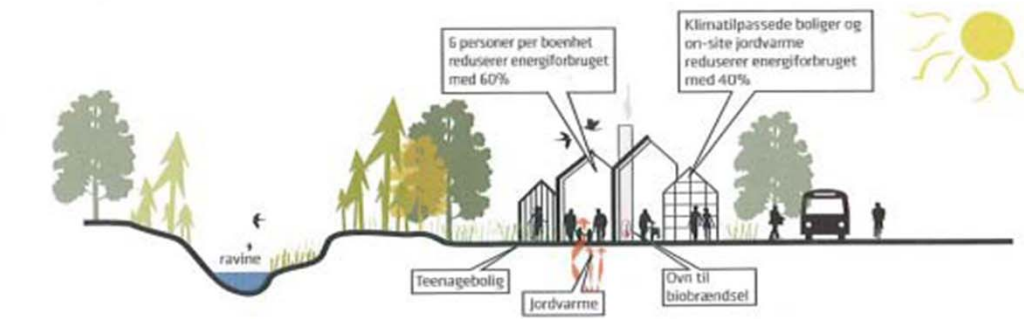


Biomass

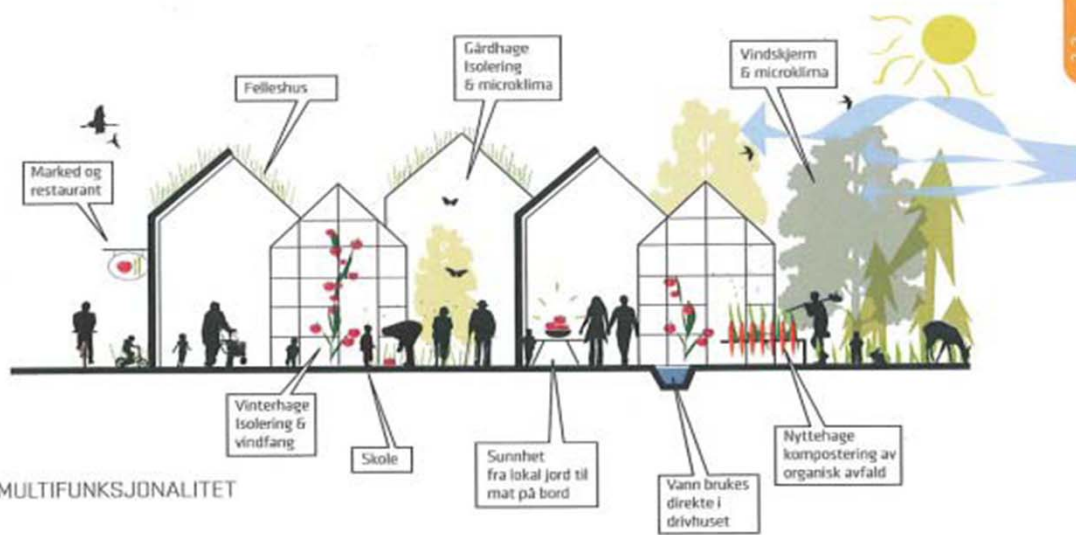
meko

# Brøset:

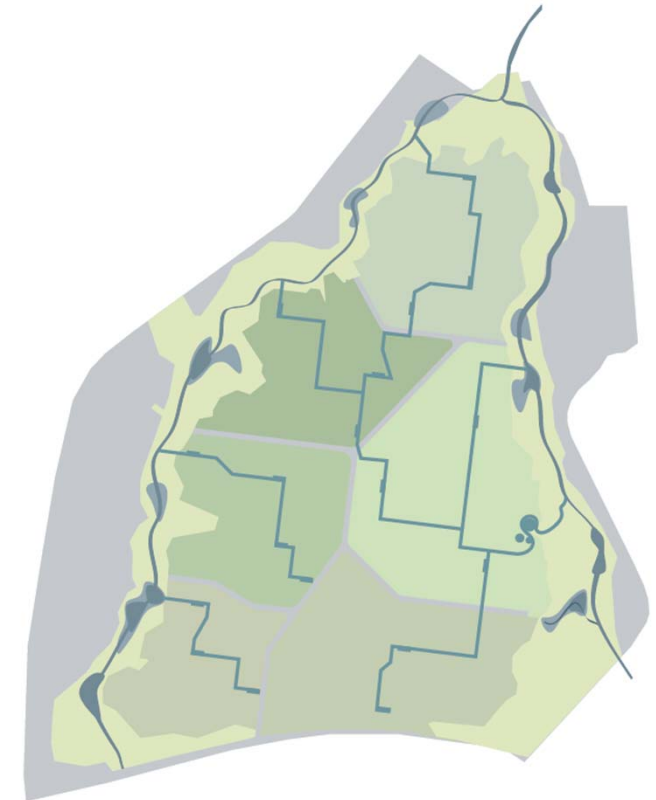
## Water Management



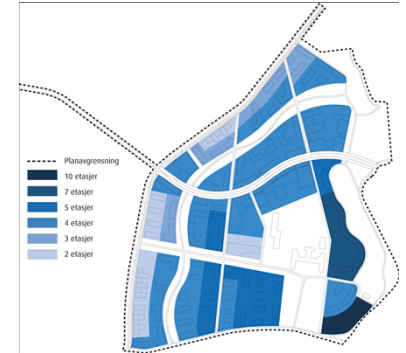
1. KOLLEKTIVE BOFORMER



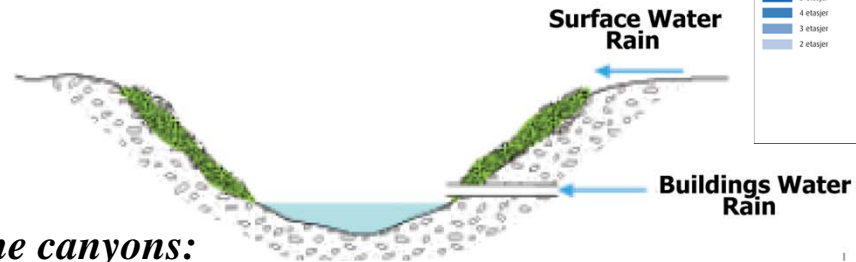
2. MULTIFUNKSJONALITET



# Brøset: Climate Neutral Neighbourhood

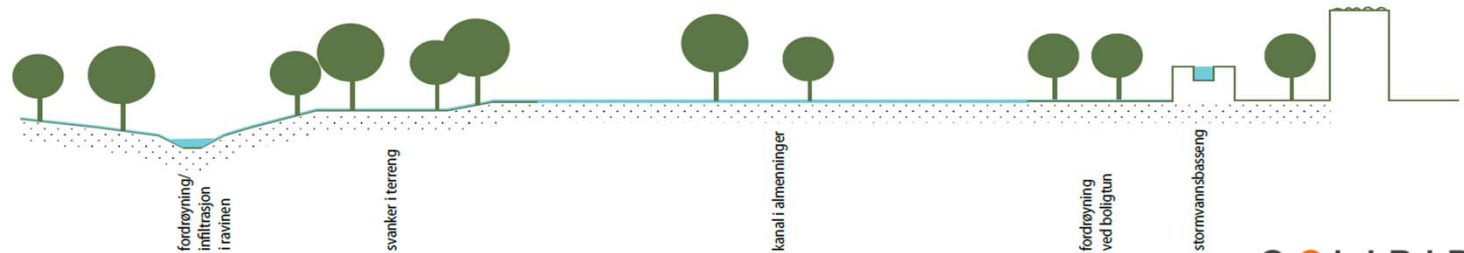
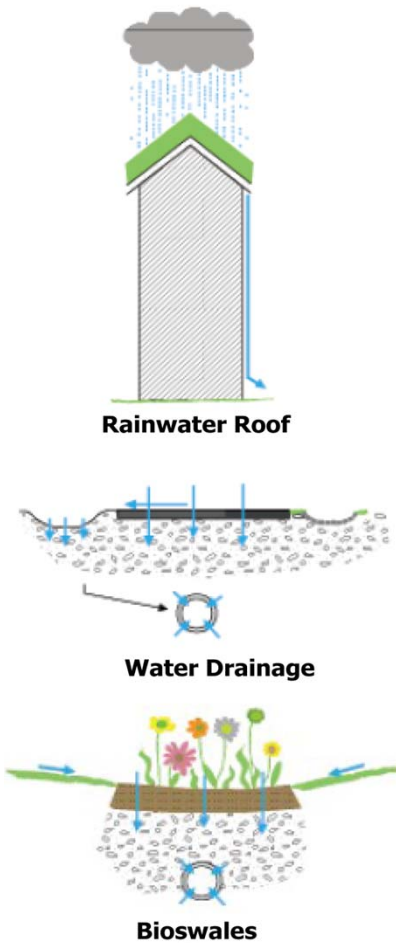


## Water Management



*Rain water runs to the canyons:*

- o Use of facade planting and green roofs (150 mm)*
- o Avoid impervious surfaces. Use of porous asphalt, grass reinforcement, coated with grout.*
- o Artificial infiltration, drainage and further transport to the canyons.*
- o Use of rain-bed for slow infiltration in vegetation areas.*
- o Vegetation attributed to the rain-bed for purification.*
- o Drain directly to streams / channel*



Asplan Vlak

SA | 19.03.2013



# Brøset: Climate Neutral Neighbourhood

## *LIFESTYLE*

- Sustainable planning = the triple bottom line ecology, social life and economy are intertwined.*
- Must propose strategic elements engaging future residents in the planning process*
- Show how Brøset can achieve its goal of becoming a climate neutral district. It involves strategies for the work process.*
- Suggestions on how to engage and inspire people to change their lifestyle, ie. focus on new qualities and benefits achieved, rather than lifting the index finger and moralizing.*
- Inspire all that a climate-friendly lifestyle is not only necessary, but also very attractive and feasible.*



# Brøset: Climate Neutral Neighbourhood

## ***GREEN AREAS & FOOD SUPPLY***

***-Provide surface, for food production in relation to stormwater management and infiltration***

***-Food provision is a crucial area for greenhouse gas reduction.***

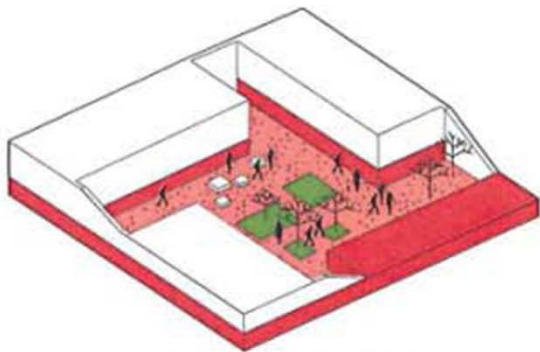
***- Areas and opportunities for cultivation.***

***-Are the areas set aside sufficiently in terms of providing a substantial contribution to reducing greenhouse gas emissions?***

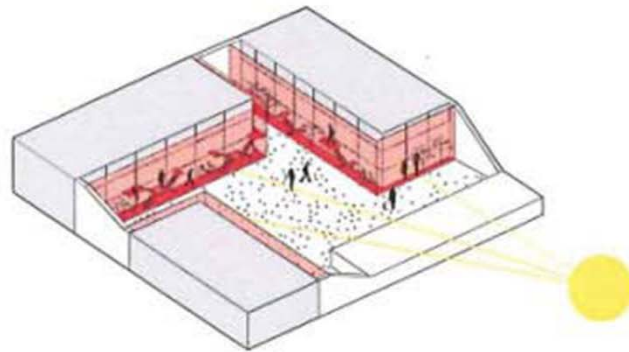
***- As well as offering residents meaningful activity locally, Is growing food interesting?***



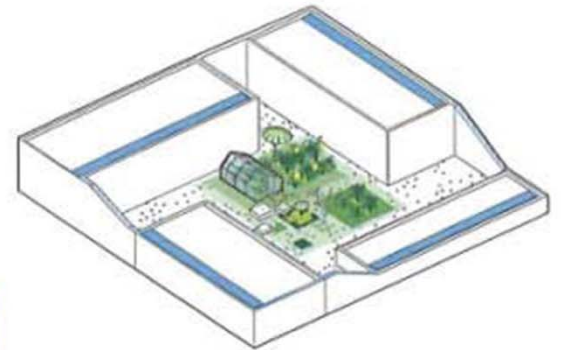
# Brøset: Climate Neutral Neighbourhood



*a wide range of community function*



*optimized in relation to the sun direction creates better lighting in homes*



*Harvesting rainwater to a shared laundry and opportunity soon greenhouses on roofs*



# Brøset: Climate Neutral Neighbourhood



## TRANSPORT

*-Less car use or avoid the car use*

*-Could Brøset be designed to live without a car?*

*-If yes this will be a strong proof to show that maintaining welfare and pedestrian lifestyle can be combined.*



# Master Plan Development Experience

Urban Design for Climate Neutral Neighbourhood  
The case of Brøset



# Brøset: Climate Neutral Neighbourhood



## *Adaptation of Brøset: Future Vision*

- *Importance to allocate sufficient space for the various functions and green spaces.*
- *Importance to embed climate change adaptation in the future work.*
- *Various possibilities for this:*
  - *Restrictive provisions for zoning (retention areas)*
  - *Guidelines for environmental program or quality program*
  - *Environmental commitment in sales contracts and development agreements*
  - *Support participation in the ongoing process to ensure understanding of the instruments and to ensure willingness to embrace environmental performance of the neighborhood. Important to identify "win-win" situations.*



# Brøset: Climate Neutral Neighbourhood



*Current phase: public hearing for the area master plan*

- Regulation text: *Site layout to facilitate use of solar energy is important*
- Illustrations: *only shadow diagrams, coarse layout*

*Near future:*

*Need for specific guidance on:*

- *KPIs (Key Performance Indicators)*
- *Assessment methods*
- *integrated process with developers / design teams*
- *follow-up during construction & management (plans for on-site environmental centre)*



# Brøset: Climate Neutral Neighbourhood



## *WHY ? Brøset PROCESS*

*-Parallel study with 4 teams not competitive but open process.*

*-Sustainability is complex, no one has the key.*

*-Creating innovation-not just "do what we can already"*

*-High expertise and access to high technical expertise*

*-Open Quest = better use of resources*



*-Know that it is NOT a winner is chosen and the Trondheim Municipality shall make the final plan.*



*-Important learning process for all concerned, including the municipality*

*-Opportunity for greater precision, more like the reality and its complexity early on, rather than deregulation of ideas*



# Brøset: Climate Neutral Neighbourhood



***PROCESS EXPERIENCE: What happened during the process experiences?***



***-Carbon accounting and its application influenced the process significantly- there was some resistance among the teams to a "calculus" approach***

***-Lack of local knowledge among teams were improved by local professionals, especially for road / transport solutions***

***-The Master Plans development allowed citizens participation & raised their awareness on the Climate Neutrality Challenge and will be crucial for consensus building and project acceptance***

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