Biorefine: Recovery of nutrients and metallic trace elements from different wastes by chemical and biochemical processes

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Global context (1)

- Nutrients (N, P, K) are necessary for maintaining soil fertility and ensuring global food production
- The demand for food is increasing
- The chemical fertilizers became essential
- Minerals are also required in other sectors (inorganic chemistry)

It is now necessary to close the nutrient cycles and evolve to more sustainable resource management

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Global context (2)

- The European Union is developing the environmental legislation
- Harmonising techniques, standards and markets is necessary
- Some countries of the NWE region produce large amounts of residues (agriculture and industries)
- Those materials contain useful nutrients

An asserted action on resource recovery is crucial to sustain our state of society

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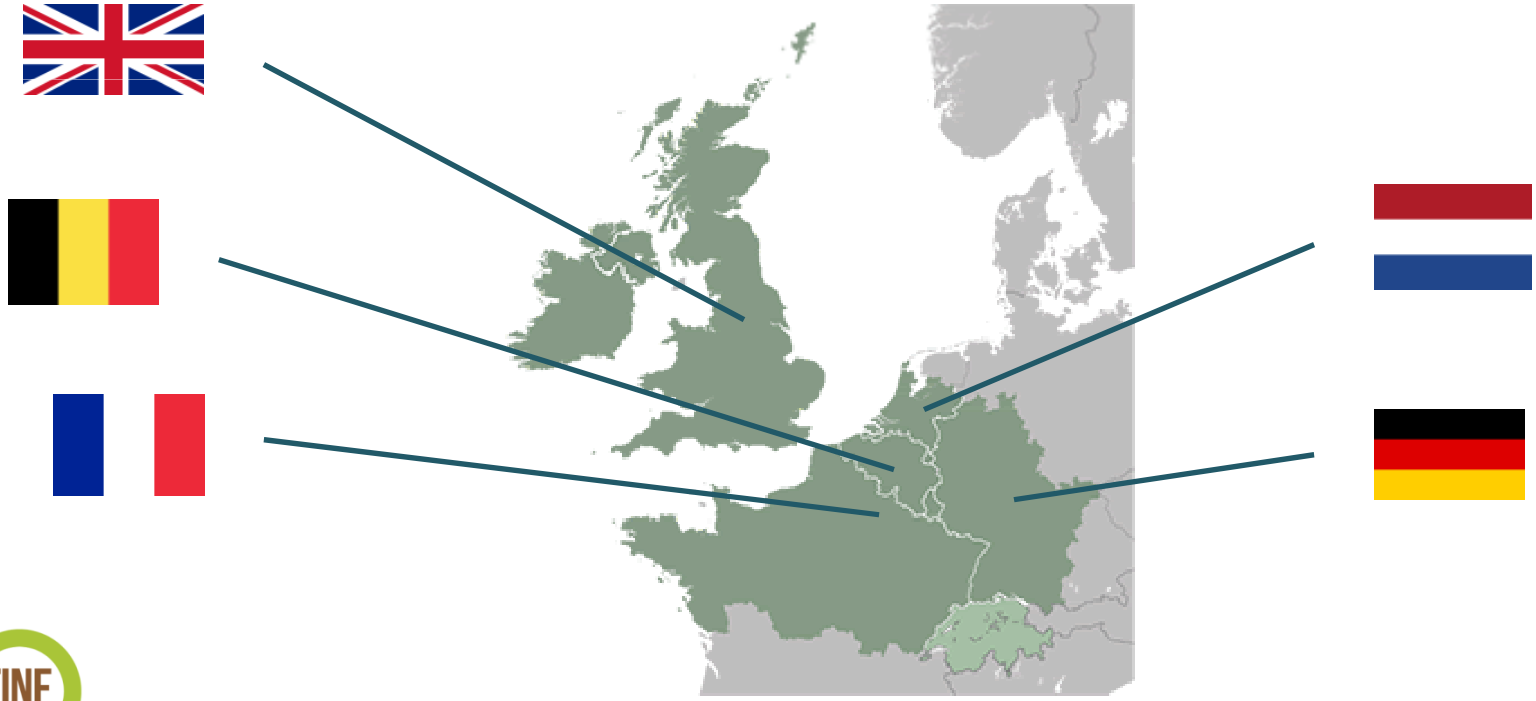
Interreg IVB Programme - Biorefine

- European Programme applicable to the NWE region
- Purpose : improve the economic, environmental, social and territorial situation in the EU



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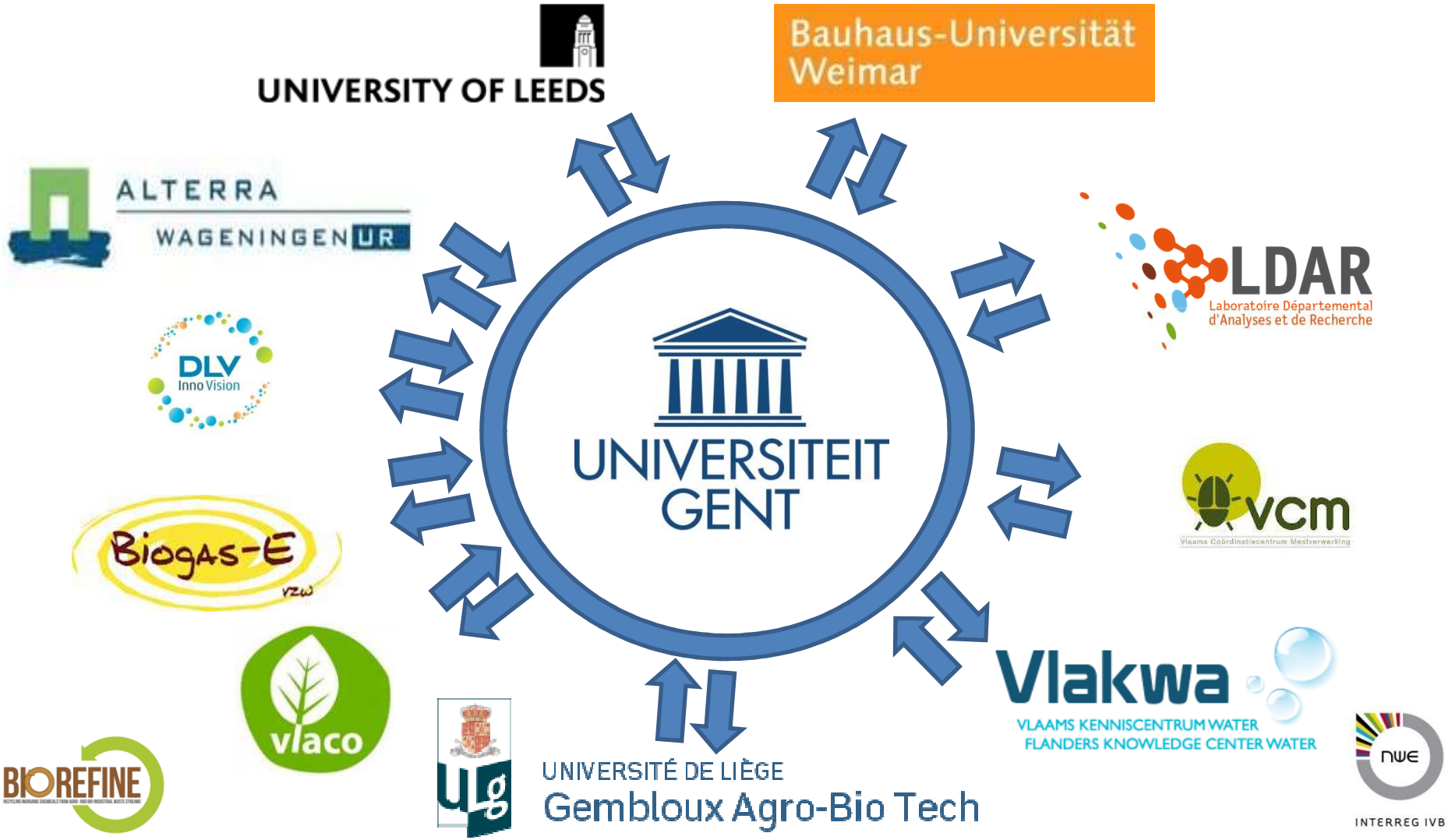
Partners of the Biorefine project



Examples of waste composition

- Some wastes contain N, P, K and MTEs in high concentrations

Parameter	*Digestate*	*Sewage sludge*	*Ashes of poultry manure*	*Wood ashes*
pH	8,3-9,9	6,7-7,6	13	highly alkaline
Ntot (%)	6,5-11,9	7,5-7,75	0	0
Norg (%)	3,4-5,6	7,5-7,75	0	0
NNH_4 (%)	2,3-10,9	0,48-0,75	0	0
NNO_3 (%)	<0,012	0-0,5	0	0
P_2O_5 (%)	1,24-3,0	2,4-3,5	12	2,87
K_2O (%)	4,5-4,8	0,67-1,25	12	3,64
C (%)	32-36,6	33,3-38,9	0	0
Cd (mg/kg)	0,26-1,87	0,54-0,85	0,8	7,5-9
Cr (mg/kg)	13-23	18-39	13	243-569
Cu (mg/kg)	55-188	104-145	350	124-994
Hg (mg/kg)	0,03-0,04	0,18-0,21	<0,05	0,3-0,36
Ni (mg/kg)	11-13	17-22	17	84-123
Pb (mg/kg)	25-83	26-32	10	316-680
Zn (mg/kg)	258-771	580-860	1550	559-2332
Co (mg/kg)	3-4,4	-	<5	-
As (mg/kg)	0,98-3,3	1,98-3,27	-	44-62

References

BEAGx

cra-w

Wallonie

SPW Service public de Wallonie

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Work packages of the Biorefine project

- 5 main objectives (Work Packages)
  - WP1: Networking & interlinkage with projects
  - WP2: Classification matrix of nutrient sources and recovery and reuse processes
  - WP3: Pilot scale explorations and demonstrations of good practice techniques
  - WP4: New strategies and synergies in cross-sectorial resource recovery
  - WP5: Road map for implementation of new strategies and policies

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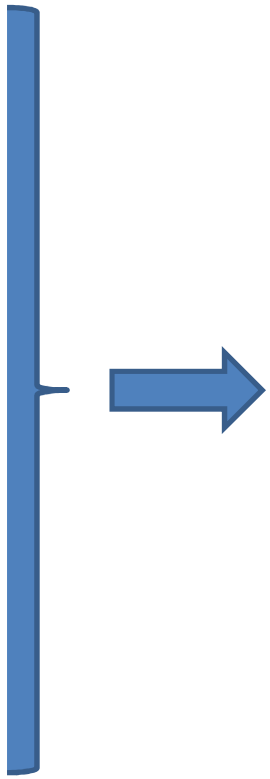
Inventory of resources

- What residues?
  - Manure – Slurry
  - Sewage sludge
  - Digestate
  - Ashes
  - Wastewater
  - Household wastes
  - Industrial wastes
  - Other(s)?



Inventory based on

eurostat

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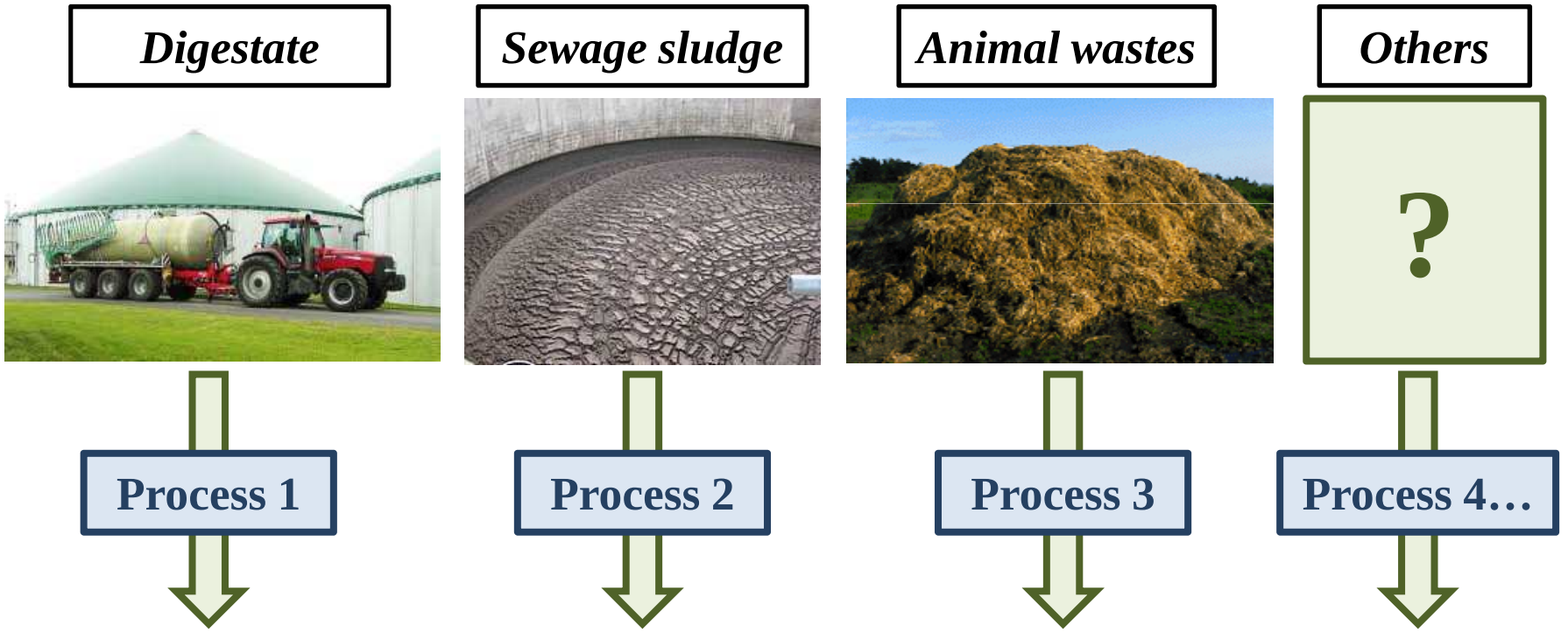
Inventory of existing recovery techniques

- The partners gather information about the recovery techniques applied in their own countries
- Detailed description of the processes (unit operations)

Mixing	Fermentation	Sedimentation	Distillation
Grinding	Filtration	Flotation	Evaporation
Screening	Osmosis	Magnetic sep.	Drying
Agglomerating	L/L extraction	Pervaporation	Fluidization
Crystallization	Ion exchange	Dust removal	Condensation
Precipitating	S/L extraction	Adsorption	Sublimation
Reaction	Centrifuging	Absorption	Freeze-drying

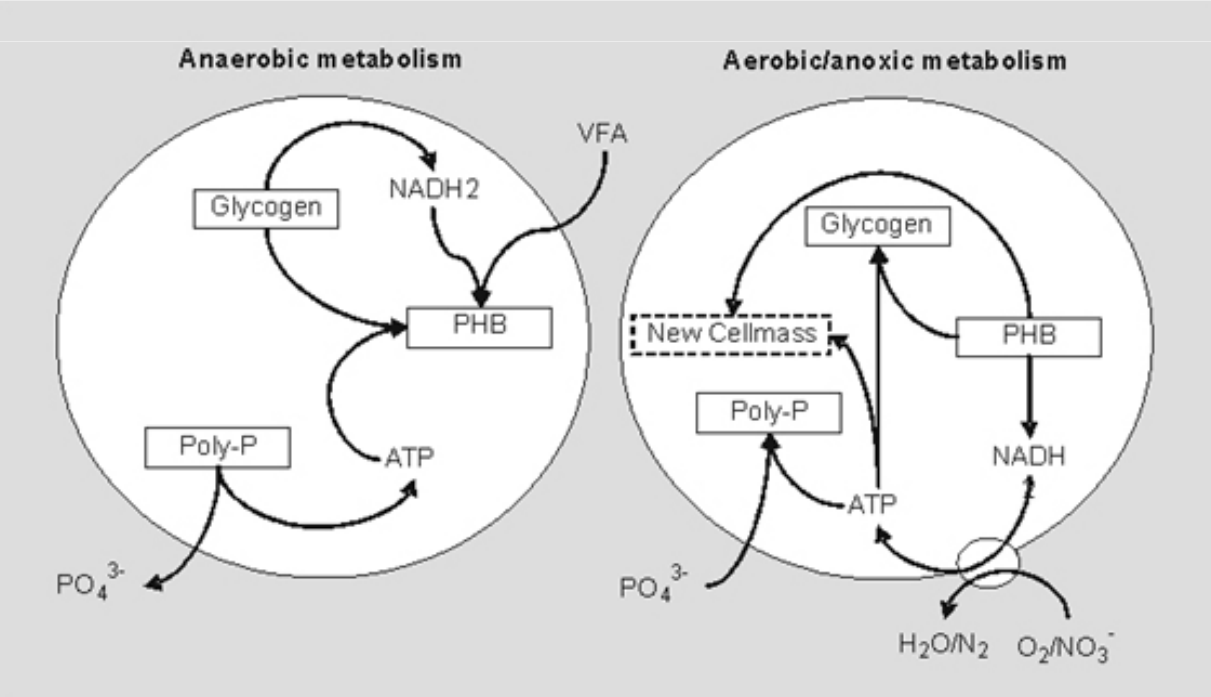
Creation of new recovery processes (1)

- Creation of new pilote plants specialized in the nutrient recovery from wastes → development of opportunities



Creation of new recovery processes (2)

- Some common processes can be exploited to recover nutrients…
- Example : some WWTPs achieve phosphorus removal by biological techniques (PAOs)



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Identification of legal constraints

- The partner countries have their own legislation applicable to wastes
- European legislation > National legislation > Regional legislation
- The exportation of wastes may be necessary
- The use of new fertilizers stemming from wastes must be allowed in the partner countries

Another capital aspect of the project consists in identifying the legal constraints of each partner country

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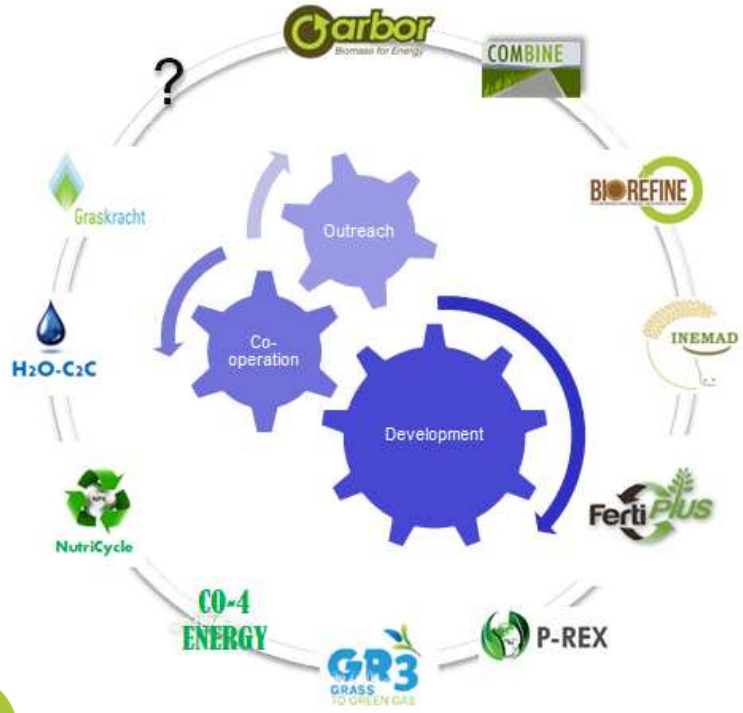
International linking between experts and projects

- A cluster has been established in order to gather people and projects concerned in the same objectives



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