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CENTRAL BALTIC
INTERREG IV A
PROGRAMME
2007–2013

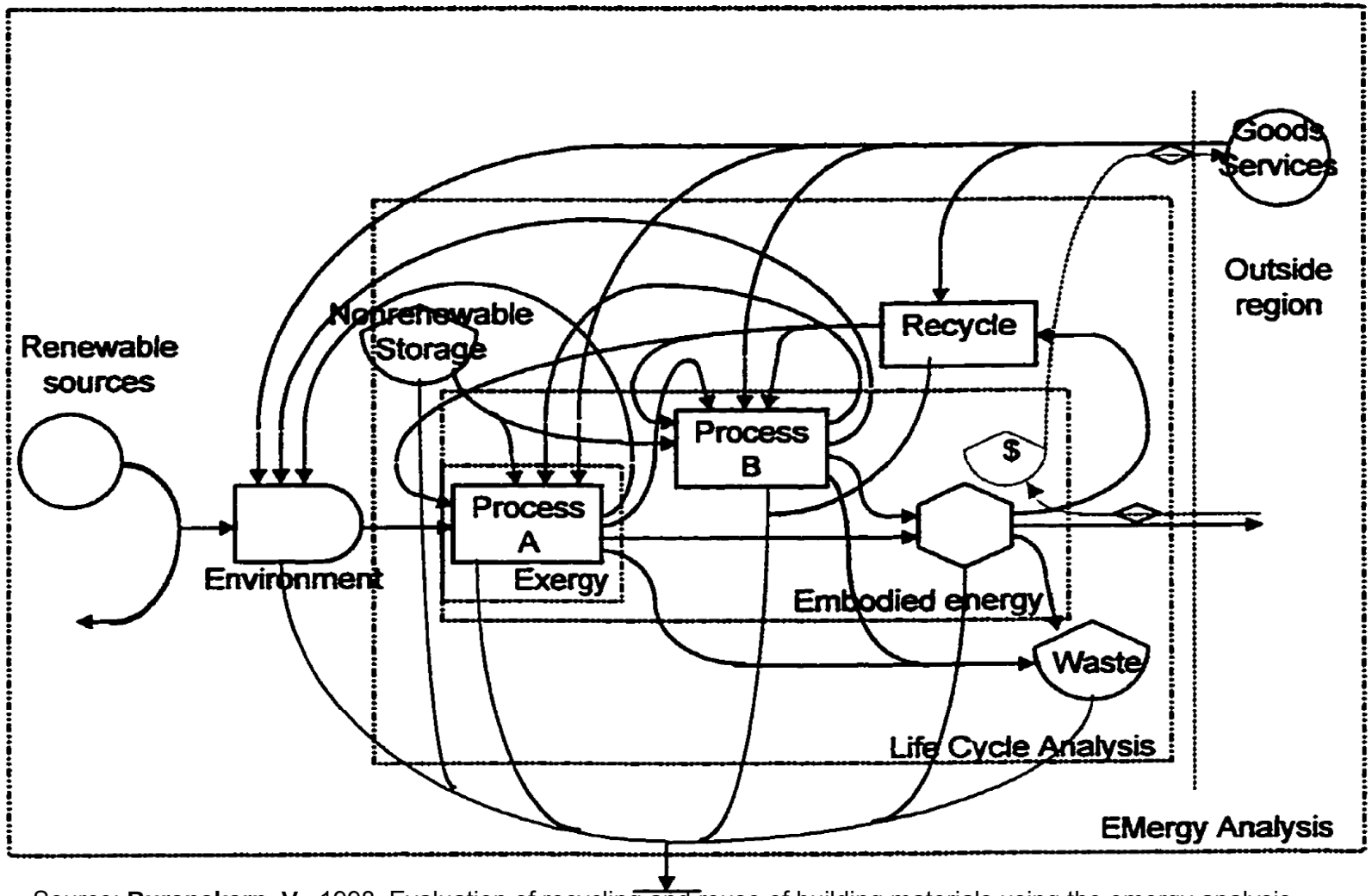
Energy Positive Farm - ENPOS

3 Balance Analysis I

Methodology comparison

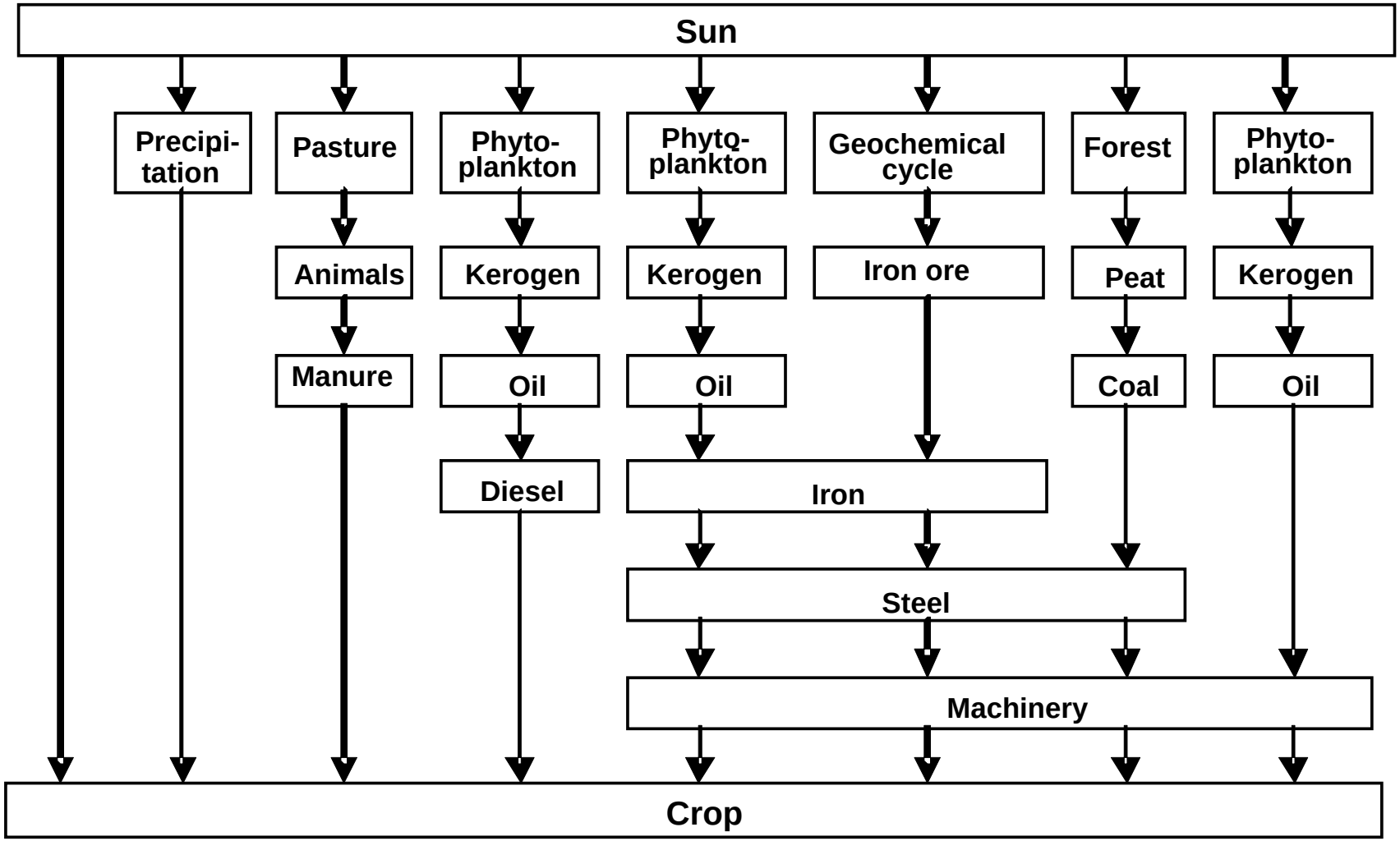
Methods:

- Exergy analysis
- Embodied energy analysis
- Life cycle analysis
- Emergy analysis



Source: **Buranakarn, V.**, 1998. Evaluation of recycling and reuse of building materials using the emergy analysis method. Ph.D. Dissertation. University of Florida. 279 p. Picture courtesy of Mark Brown

eMergy accounting

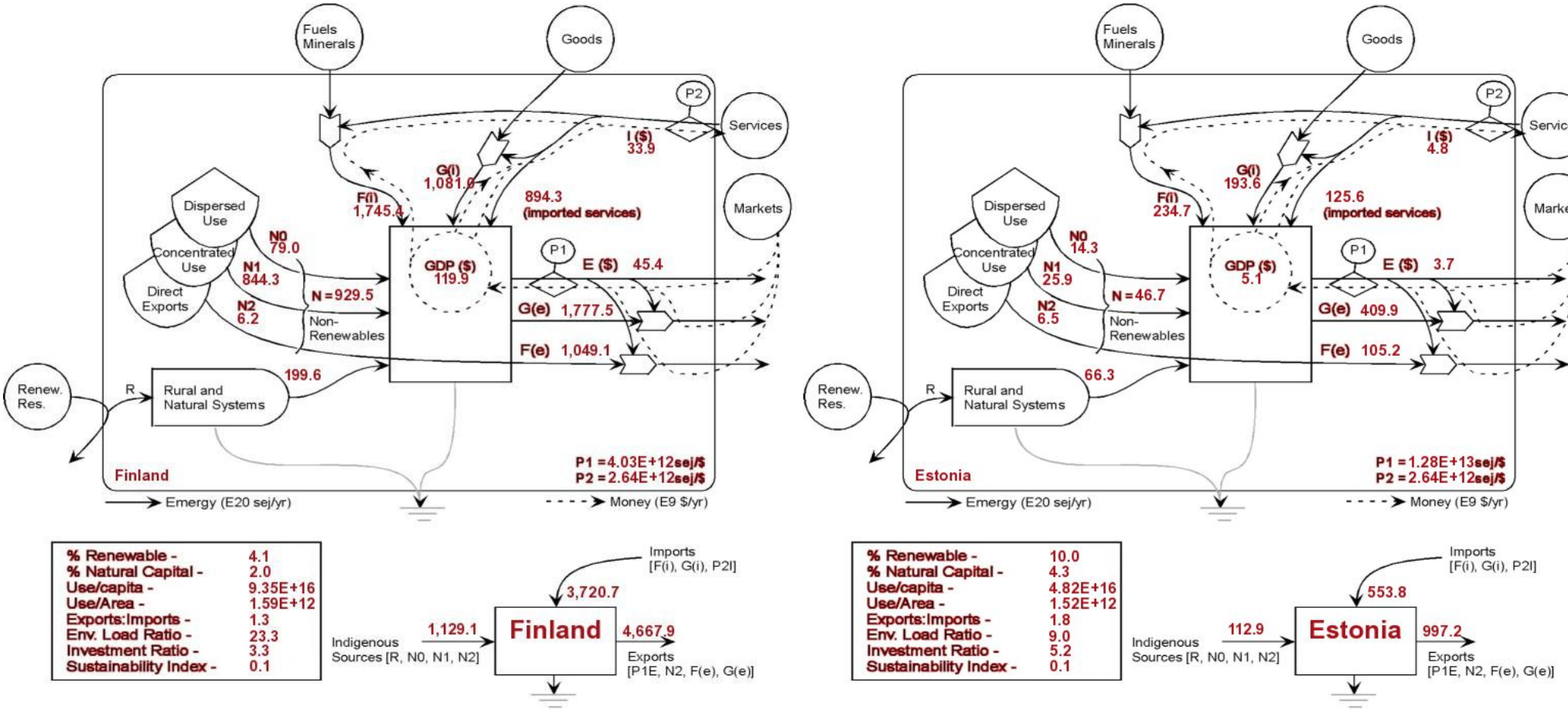


eMergy, spelled with an "m" measures both the work of nature and that of humans in generating products and services.

Simplified model of energy crop production. The model shows all the exergy flows directly or indirectly needed for the process and the partial efficiencies of the backward steps to the original solar exergy source. (Bastianoni et al. 2007, modified).

WP2 Energy need and energy resources
2.1 Analysis methods, assumptions, and definitions

Facts: Finnish agriculture is energy negative (import of fuel, feed, and artificial fertilisers (http://sahel.ees.ufl.edu/database_resources.php picture courtesy of Mark Brown)



WP2 Energy need and energy resources
2.1 Analysis methods, assumptions, and definitions

Facts:

- Energy price (energy policy) and energy value (agricultural policy) differ
- Depleting of natural (energy) resources like topsoil, precipitation, oxygen, insolation is free of charge
- Environmental pollution is free of charge

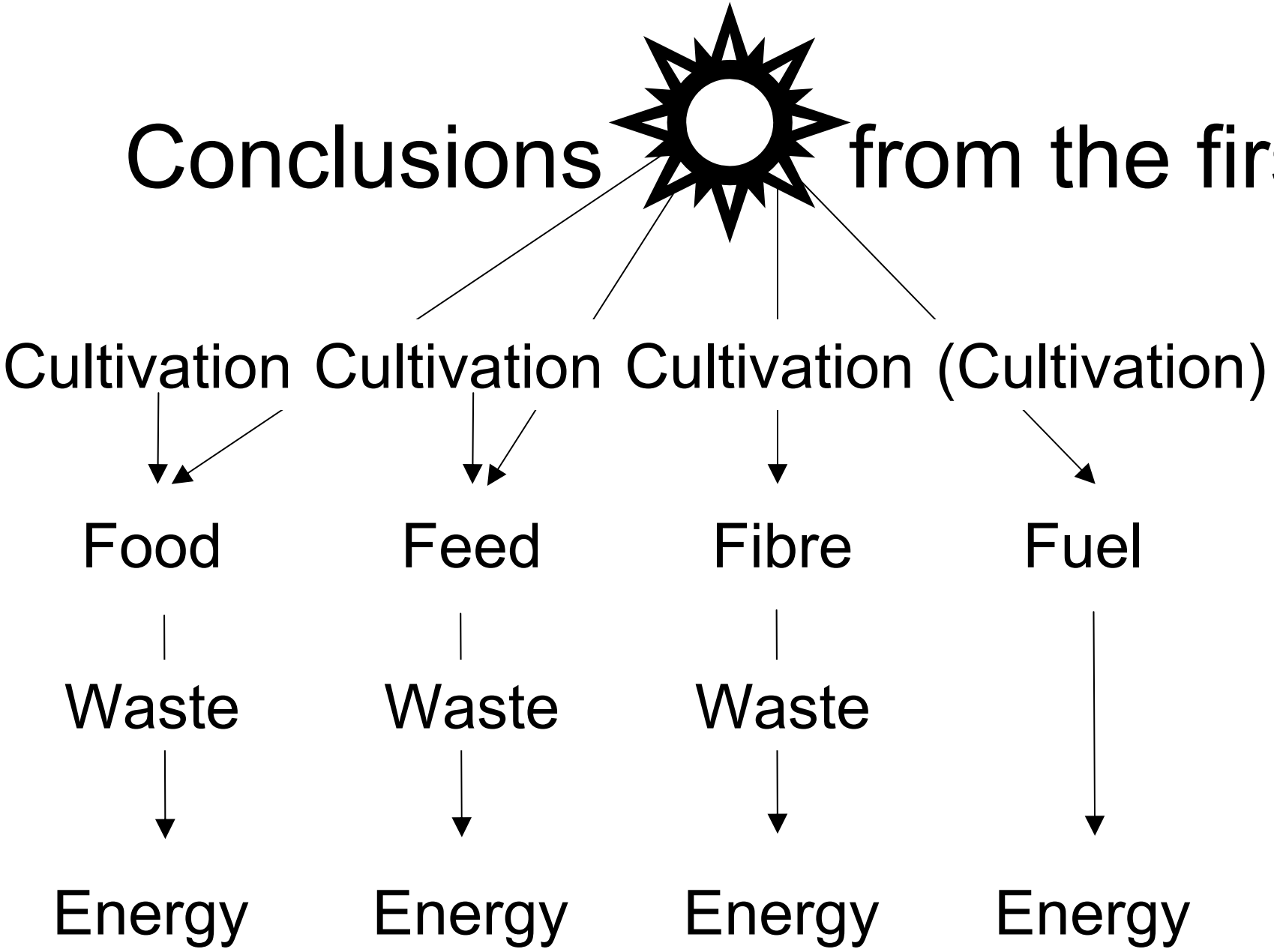
WP2 Energy need and energy resources
2.1 Analysis methods, assumptions, and definitions

Facts:

- Agricultural policy (subsidies) fosters indirect energy and nutrient import (farm specialisation, animal versus crop production areas, import of feed or food)
- Farmers optimise return on investment in terms of money not in terms of energy
- First law still valid:

  Sun → wood → heat = Sun → wood → desk → waste → heat
  Sun → feed → heat = Sun → feed → meat → waste → heat + losses
  Sun → fibre → heat = Sun → fibre → insulation → heat + savings

Conclusions from the first law



The law of conservation of energy states that energy can neither be created nor destroyed, it can only be changed from one form to another or transferred from one body to another, but the total amount of energy remains constant (the same).

Examples of main stream energy analysis of wheat production

	Bernesson et al. 2006	Richards 2000	Elsayed et al. 2003	CONCAVE 2002 ETSU
Input GJ/ha	**GJ/ha**	**GJ/ha**	**GJ/ha**	**GJ/ha**
Machinery/buildings	**6,02**			
Seeds	**0,52**	**0,93**	**1,62**	
Labor				
Transportation		**1,50**	**2,30**	**1,30**
Electricity	**0,52**		**0,89**	
Herbi-, pesticides	**0,32**	**1,05**	**2,31**	**1,60**
Fertiliser	**5,72**	**7,82**	**3,64**	**12,30**
Fossil fuel		**4,30**	**4,22**	**4,20**
Other		**0,45**		
Sum energy input crop	**13,10**	**16,03**	**14,97**	**19,40**
Output GJ/ha	**GJ/ha**	**GJ/ha**	**GJ/ha**	**GJ/ha**
Yield t/ha		**8,96**	**8,00**	**8,00**
Caloric value seed	**85,40**	**74,19**		
Caloric surplus	**72,30**	**58,16**		

WP3 Energy saving of case farms
3.5 Case farm energy plans and follow up

- Mass and energy inventory in the beginning
- Monitoring mass flow, and direct energy consumption, working time of machinery
- Recommendations based on observations

WP2 Energy need and energy resources
2.5.1 Case farms Resources and production

Mass balance

- Fuels
- Fertiliser
- Feed
- Goods
- Products
- By products

WP2 Energy need and energy resources
2.1 Analysis methods, assumptions, and definitions

Working thesis:

- Crop production usually energy positive
- Animal production usually energy negative
- Objectives of ENPOS only reachable if **animal + crop production** of case farms are energy positive
- Energy positive agriculture in Finland not competitive for the time being. Probably only marginal savings in energy and cost of case farms possible.