

# Energy consumption in animal production, specific figures

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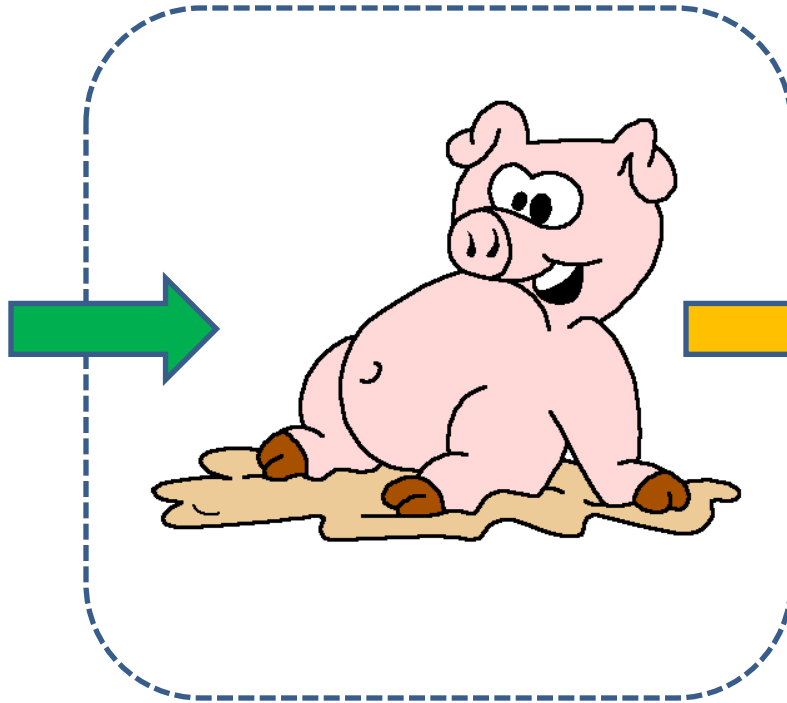
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ENPOS Energy Positive Farm

The logo for ENPOS Energy Positive Farm features the text 'ENPOS' in a bold, green, sans-serif font, followed by 'Energy Positive Farm' in a smaller, grey, sans-serif font. Below the text are two horizontal bars: a dark green bar under 'ENPOS' and a lighter green bar under 'Energy Positive Farm'.

# Energy use

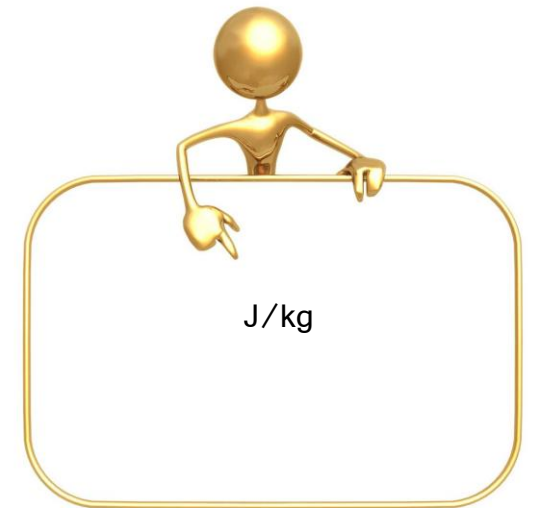
- Feed
- Water
- Concentrates
- Shelter
  - Heat
- Care
  - Ventilation
  - Illumination



- Meat
- Fat
- Bones
- Skin
- Manure
- Heat
- Water

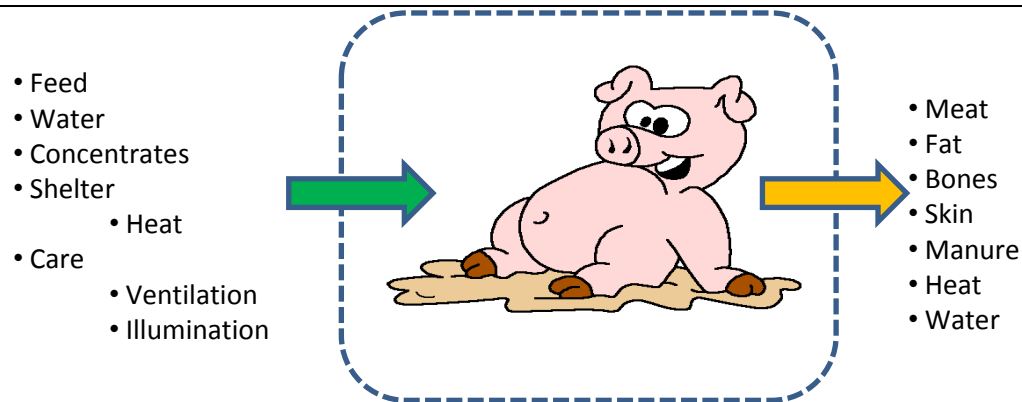
# Specific figures

- What is a specific figure?
- Specific figure is the same as functional unit
- What is a functional unit?
- We use units which is suitable for comparing production
- In milk production we can use:
  - Energy input/produced unit = J/kg milk
- In pork production we can use:
  - Energy input/produced unit = J/kg pork
- With specific (functional) units we can compare:
  - Different production inputs and their effects on production specific figures
  - Different farms
  - Different production types (traditional/organic)
  - Different countries



# Energy input/output

- Normal energy inputs are
  - Direct energy input
    - Fuels
    - Electricity
    - Feed
  - Indirect energy input
    - Some figures are hard to get, for instance building and machine manufacturing energy
    - The energies which are not included should at least mentioned that they are not included
- Energy outputs
  - Milk production
    - After utilizing the milk we will utilize also the meat, this is in most cases included
    - Cows produce also calves, this is also utilized
  - Pork production
    - Are skin and bones utilized, what is their energy content?
    - Is fat utilized, its energy content is very high



# Feeding material

- Feeding material is either from own field productions or it is bought
- Feeding material energy input figures can be:
  - heating values of the feed
  - feed production energy consumption figures
  - for concentrates figures found in literature



# Milk production

Source: Mikkola & Ahokas. Energy ratios in Finnish agricultural production

Specific figure MJ/kg	Source	Remark
1,6	Mikkola & Ahokas	Only feed production energy is included
3,2	Mikkola & Ahokas	Feed production and housing (+machine) energy included
2,1 – 4,1	Gröönroos	Organic and conventional production in Finland
2,2 – 3,6	Refsgaard	Organic and conventional production
3,1 – 5,0	Thomassen	Organic and conventional farms in Netherlands
1,2 – 3,9	De Boer	Sweden, Netherlands, Germany

# Milk production energy ratios

- Energy ratio = Output/Input
- 1 kg of milk = 3 MJ
- $E = 3/3,2 = 0,9$
- Milk production is not energy positive, more energy is needed in the production than the product has!



# Specific figure



**1,6 MJ/kg**  
**E = 1,9**



**3,2 MJ/kg**  
**E = 0,9**



# Milk production efficiency

- Energy ratio in plant production.  $E = 3 - 5$
- Milk production efficiency 20 %
- Energy ratio in milk production 0,6 – 1,0 without any shelter



# Pork production

Source: Mikkola & Ahokas. Energy ratios in Finnish agricultural production

Specific figure MJ/kg	Source	Remark
10 – 11	Mikkola & Ahokas	Only feed production included
25 – 29	Mikkola & Ahokas	Feed, machines and housing included
15,9 – 22,2	Basset-Mens & van der Werf	
22	Cederberg & Darelius	

# Pork production energy ratios

- Energy ratio = Output/Input
- 1 kg of meat = 9 MJ
- $E = 9/27 = 0,33$
- Pork production is not energy positive, more energy is needed in the production than the product has!



# Specific figure



**10 MJ/kg**  
**E = 0,9**



**27 MJ/kg**  
**E = 0,3**



This material has been produced in ENPOS project. ENPOS is acronym for *Energy Positive Farm*.

The project partners are

- University of Helsinki, department of Agricultural Sciences – Agrotechnology
- MTT Agrifood Research Finland - Agricultural Engineering
- Estonian University of Life Sciences

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**ENPOS** Energy Positive Farm



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