

Scenario analysis of fuel-pellet production – the influence of torrefaction on material flows and energy balances

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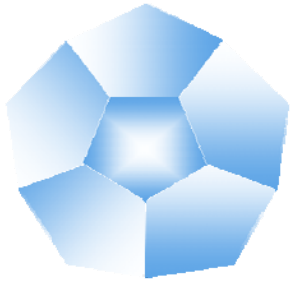
² *VTT*

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OUTLINE

- "Traditional" pellet production (2005)
- Trends & visions
- Pellets in Eforwood
- Introducing new process: Torrefraction
- Torrefraction affect material and energy balances of pellet production - how?

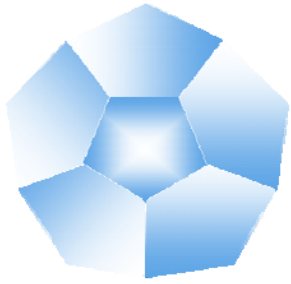


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Pellet production in Europe 2005

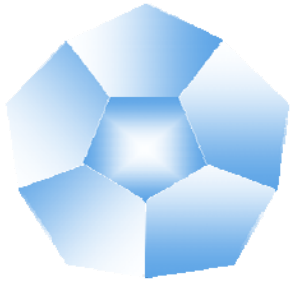
- 2-3 million tonnes produced (10-15 TWh)
- ~200 pellet plants
- ~1-2 % of harvested wood ended up in pellets
- present raw material: saw dust (by product)
- branch dependence!

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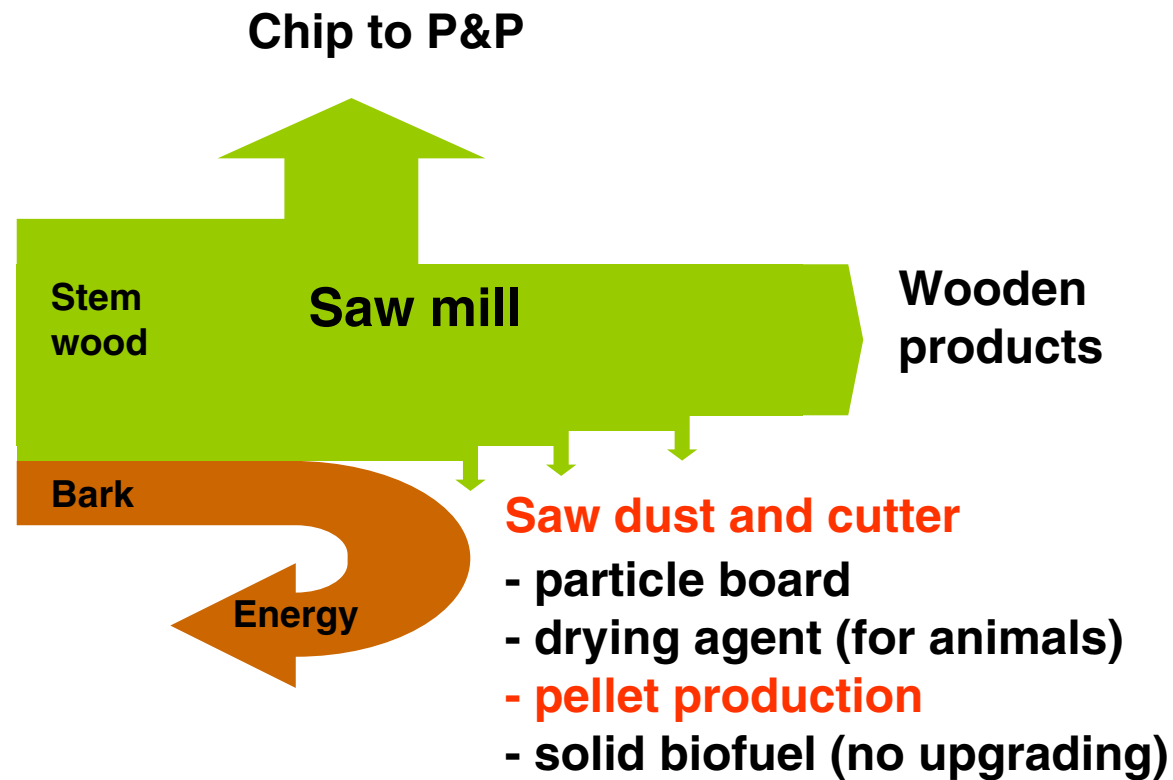


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Traditional pellet raw material

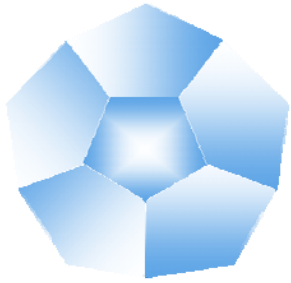


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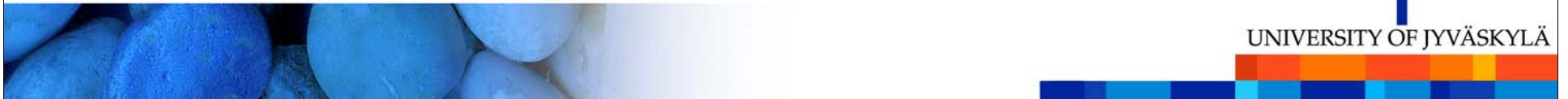
2005 -> 2008 rapid changes

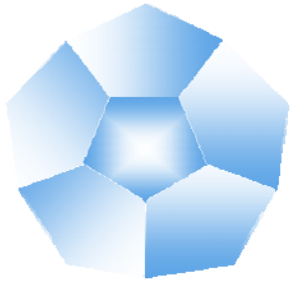
- Germany: production capacity 2005 & 2008
- Danmark and Netherlands: pellet production capacity expands - despite limited forest biomass resources!
- Scenarios: Even a moderate growth (10 %/a?) until 2025..10-12 % of harvested wood would end up in pellets!
- New raw materials needed!

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But also forest industry is changing...



SAW MILL VISION (prof. Usenius, VTT)

- eg. TECH scenario (Eforwood, Scandinavian case):

- new or improved technologies

 - ➔ increased efficiency of raw material use

- sawn wood share in output products 50 ➔ 55 %

- share of saw dust decrease from 15 ➔ 13 %,

- ➔ producing 1 t of sawn timber:

 - present technology 0,30 t saw dust

 - TECH scenario 0,24 t

 - ➔ **20 % less saw dust!**

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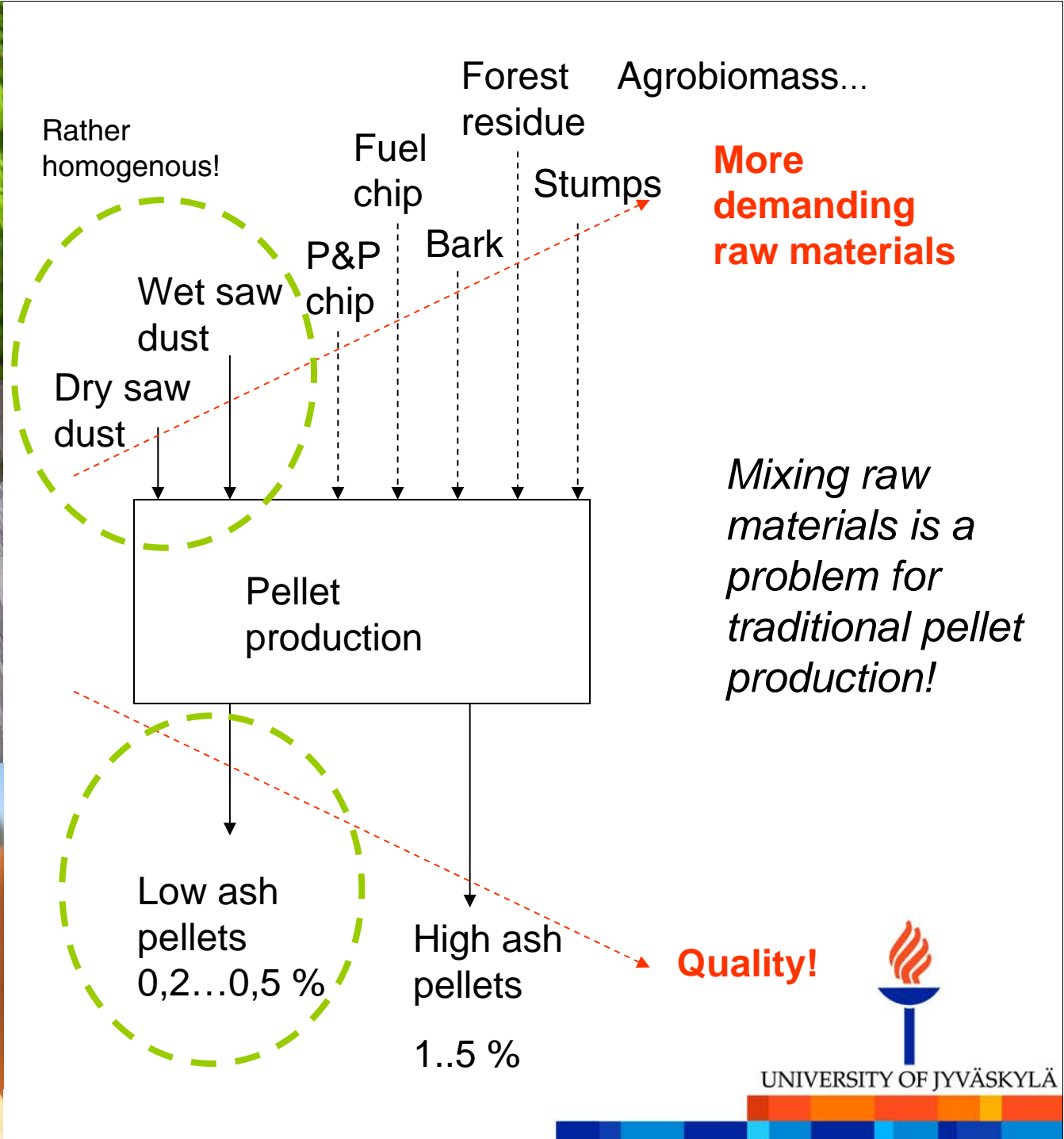
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Photos: Agar 2009





Pictures from: Kiel, J.H.A. et al., BO2-technology for biomass upgrading into solid fuel

- pilot-scale testing and market implementation, 16th European Biomass

Conference & Exhibition, Valencia, Spain, June (2008).

Torrefraction?

Pre-treatment process (~pyrolysis)

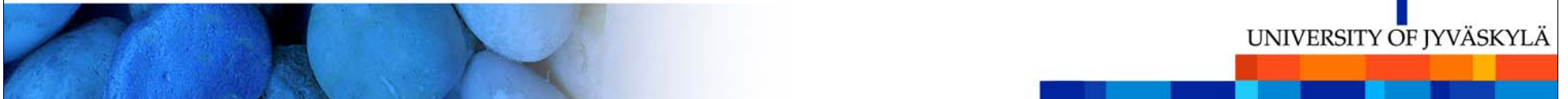
- heterogenous input -> more **homogenous output**
- **mixing** raw materials possible (?)
- improves energy **density** of biomass
- treated material very dry and **hydrofobic**, less storage emissions(?) & resistance to biodegradation

=> Better durability, handling and storage properties

Process can be situated separately!

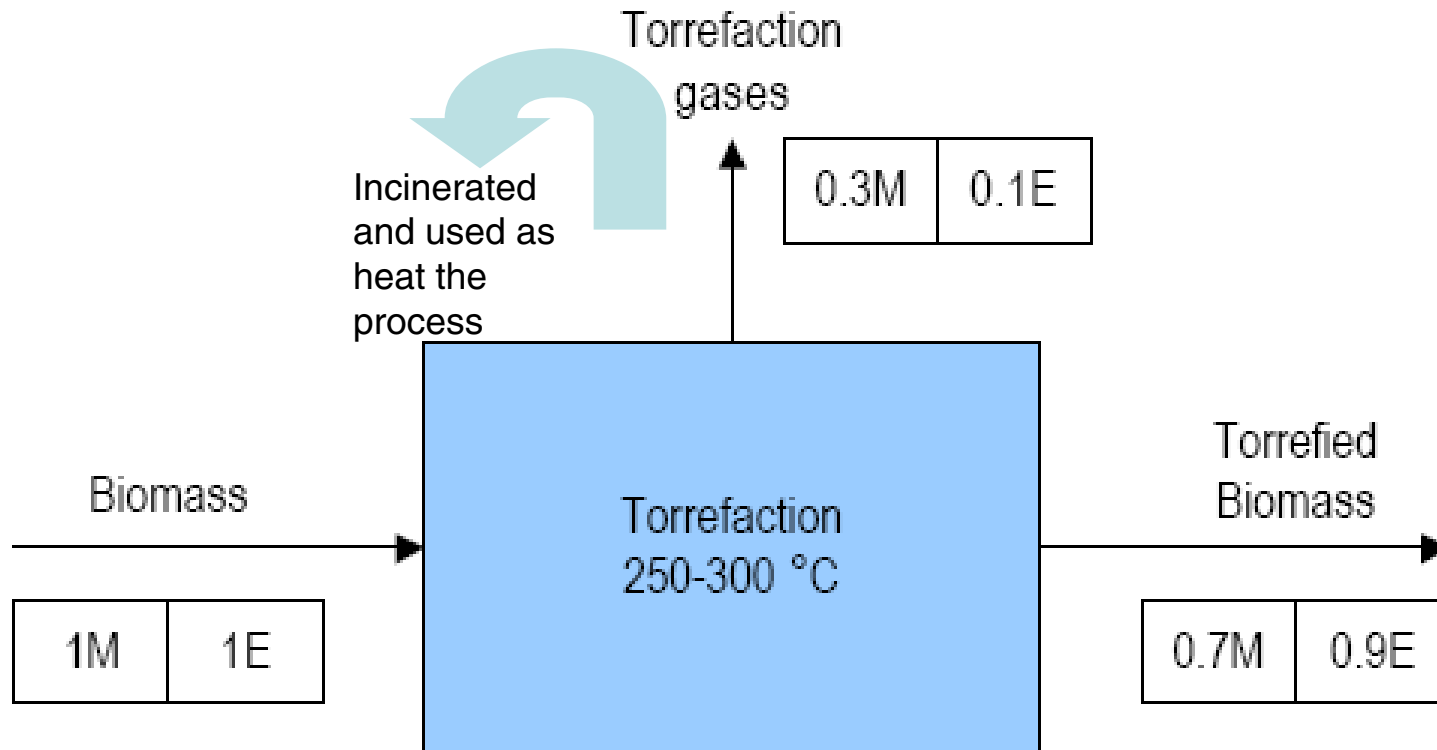


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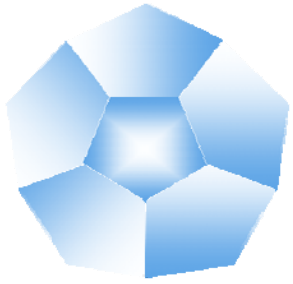
Torrefraction

mass and energy balances in general

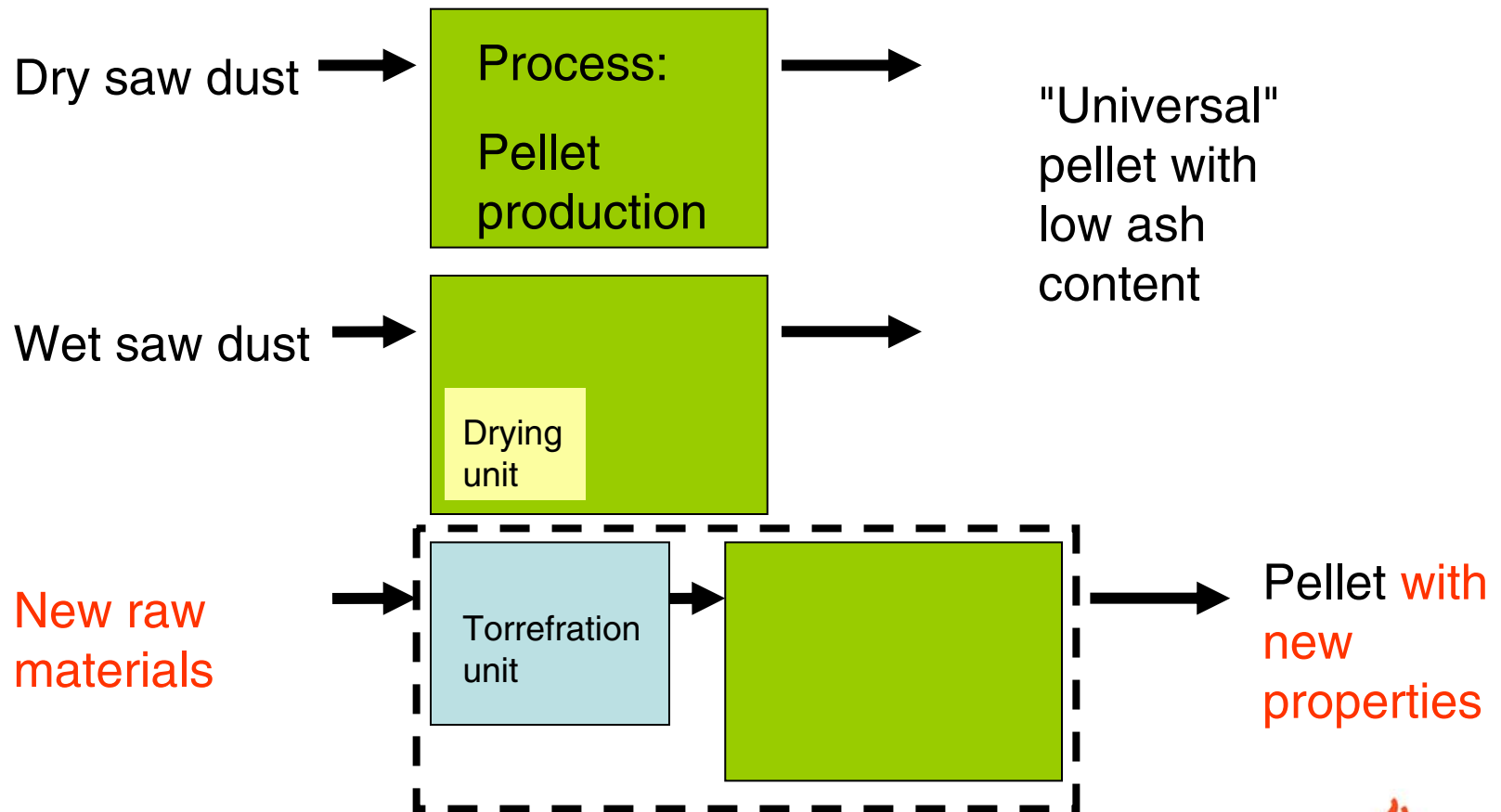


From: Bergman P.C.A. (2005): Combined torrefraction and pelletisation. The TOP process





Pellet production "process"



How does this new process (or sub-process) affect sustainability?



Material flow and energy balances: Eforwood

saw dust (15%)

85 000 t

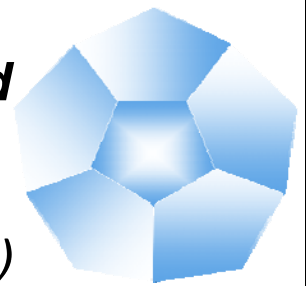
Production process (dry)

Pellet (10%)

80 000 t

el

150-200 kWh_e/t



0,36 TWh

saw dust (57%)

167 000 t

Production process (wet)

Pellet (10%)

80 000 t

el

150-200 kWh_e/t

heat

700-1000 kWh_h/t

~ 0,07 - 0,1 TWh

0,36 TWh

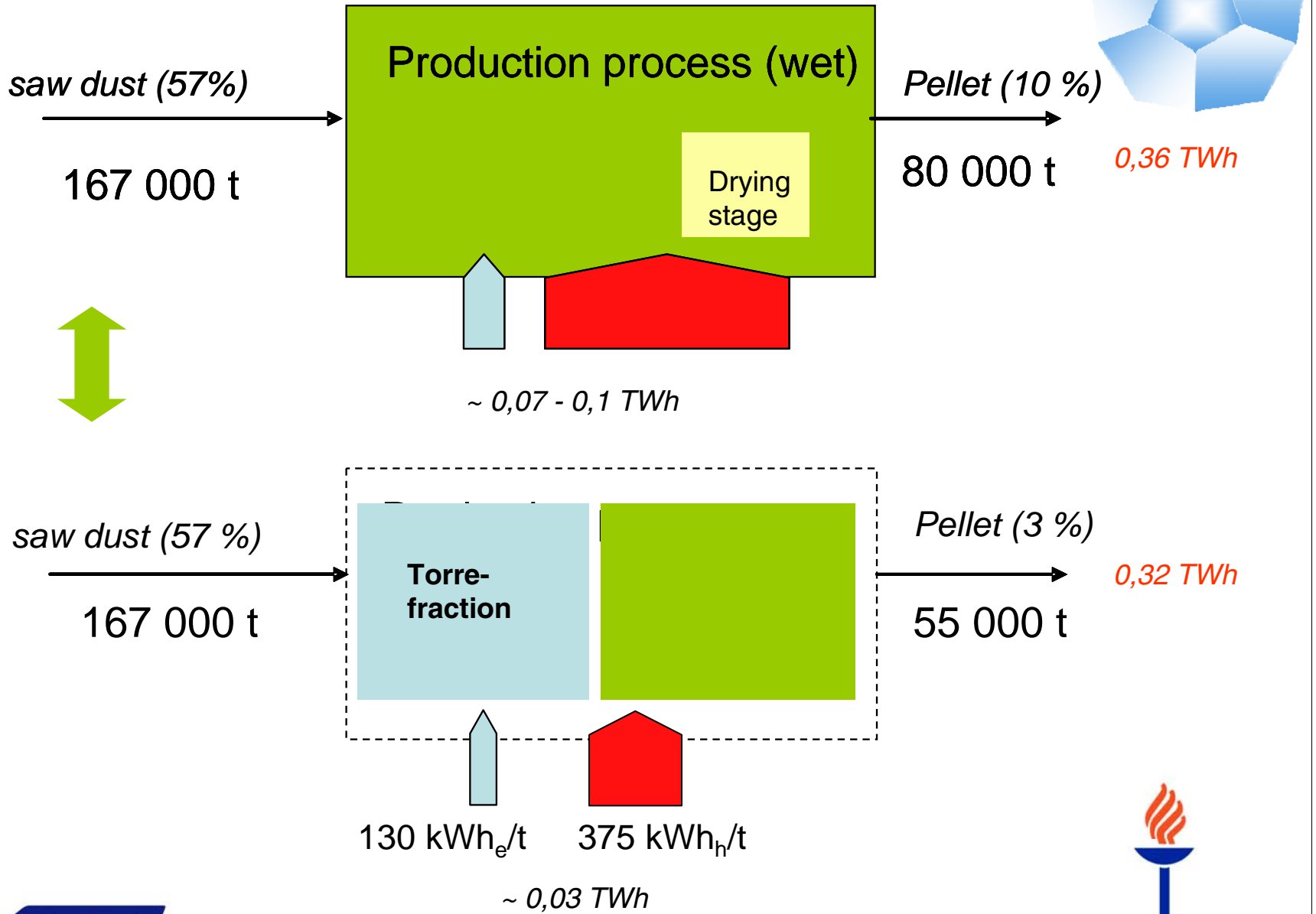
Double mass to transport!

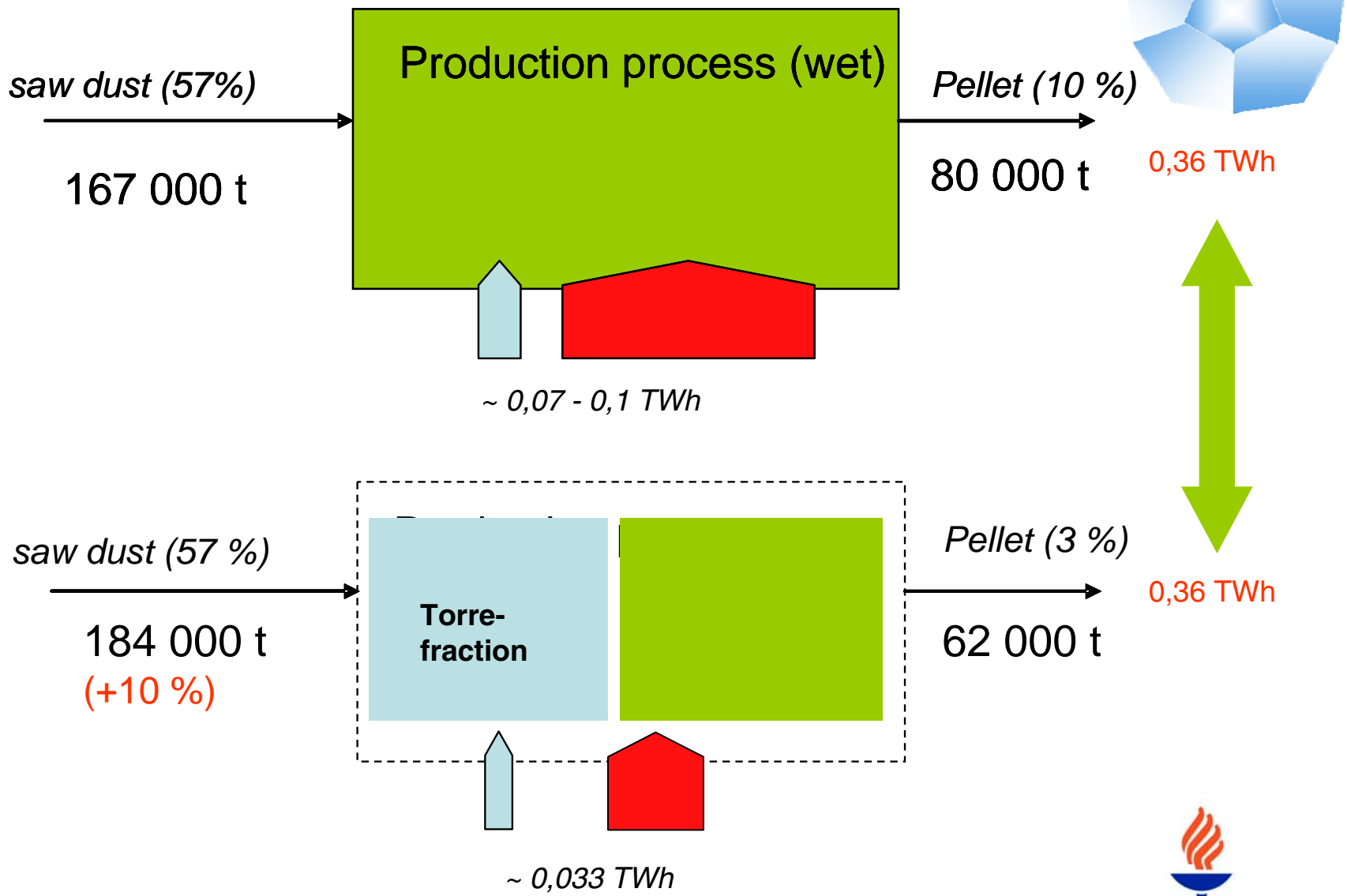
Drying stage

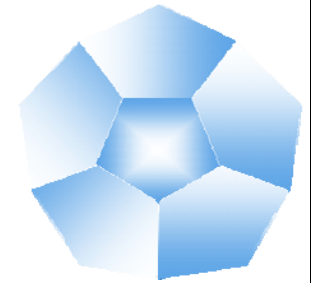


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Introducing a new process, what changes?







Traditional production or combined with torrefraction ?

This presentation focused on

- material balances
 - energy balances
- => seem to be in order!

Quality

..of raw material (more flexible)

..pellets for large scale use (substituting eg. coal)

Economy...needs probably improvements...

Focus for research approaches

- at least in Finland!



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Thank you!

The logo of the University of Jyväskylä, featuring a stylized white outline of a hand holding a flame above a bowl, with a vertical bar below it. The entire slide has a blue background with a pattern of smooth, rounded stones.

Presentation based on results
from:

- Eforwood project (2005-2009)
- OSKE project: Pellet R&D
(2009)
- literature

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