EFORWOOD
Sustainability Impact Assessment of the Forestry-Wood Chain

Tool for Sustainability Impact Assessment (ToSIA)
1. Introducing the Concept

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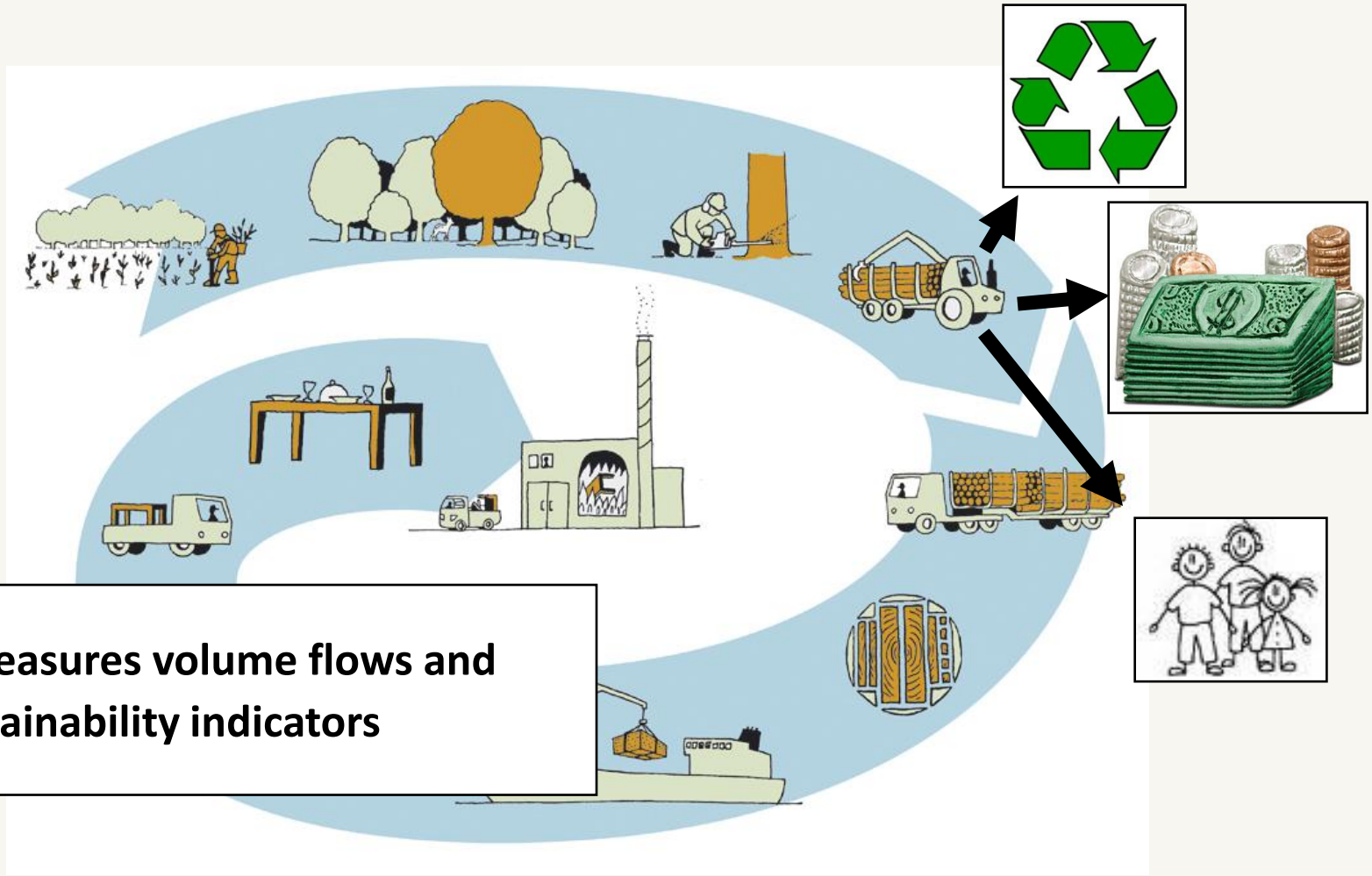
ToSIA approach to Sustainability Impact Assessment of Forest-Wood Chains

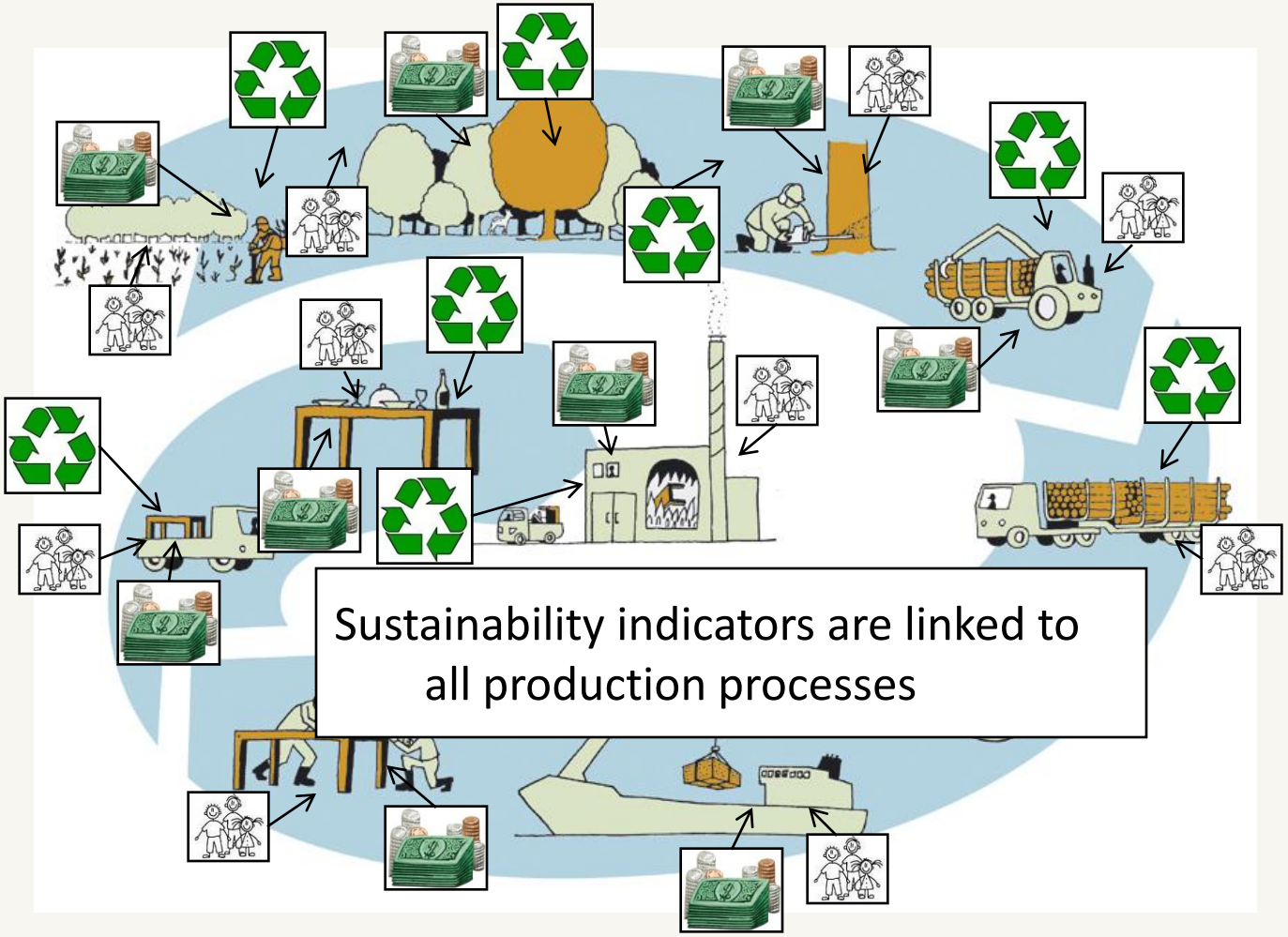


ToSIA measures volume flows and sustainability indicators

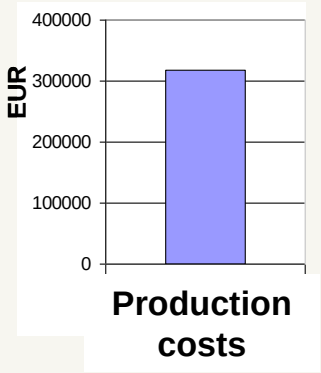
Sustainability Indicators

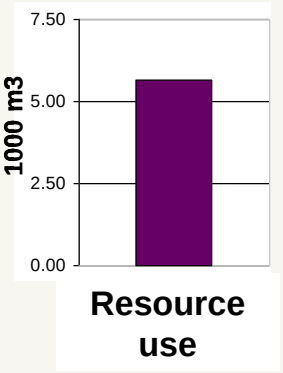
Economic	Environmental	Social
Gross value added	Energy generation and use	Employment
Production costs	Greenhouse gas emissions and carbon stocks	Wages and salaries
Resource / material use	Transport distance and freight	Occupational safety and health
Total production	Water use	Education and Training
Investment and research & development	Soil, water and air pollution	
	Generation of waste	
	Forest biodiversity	
	Forest resources	

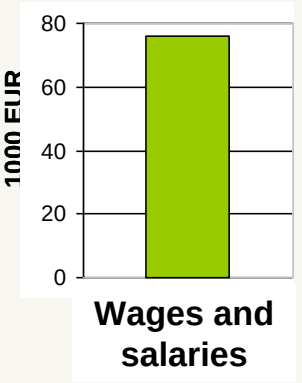
ToSIA approach to Sustainability Impact Assessment of Forest-Wood Chains

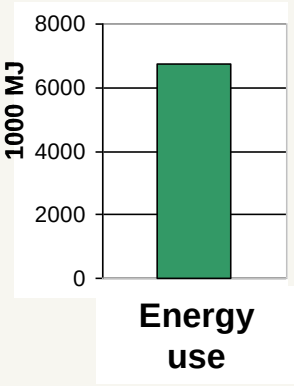


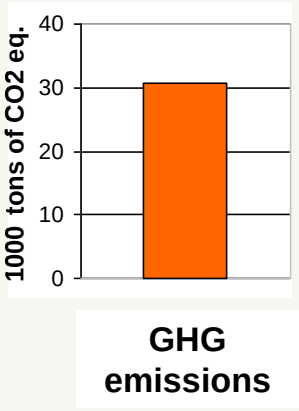
ToSIA approach... (basic principles)





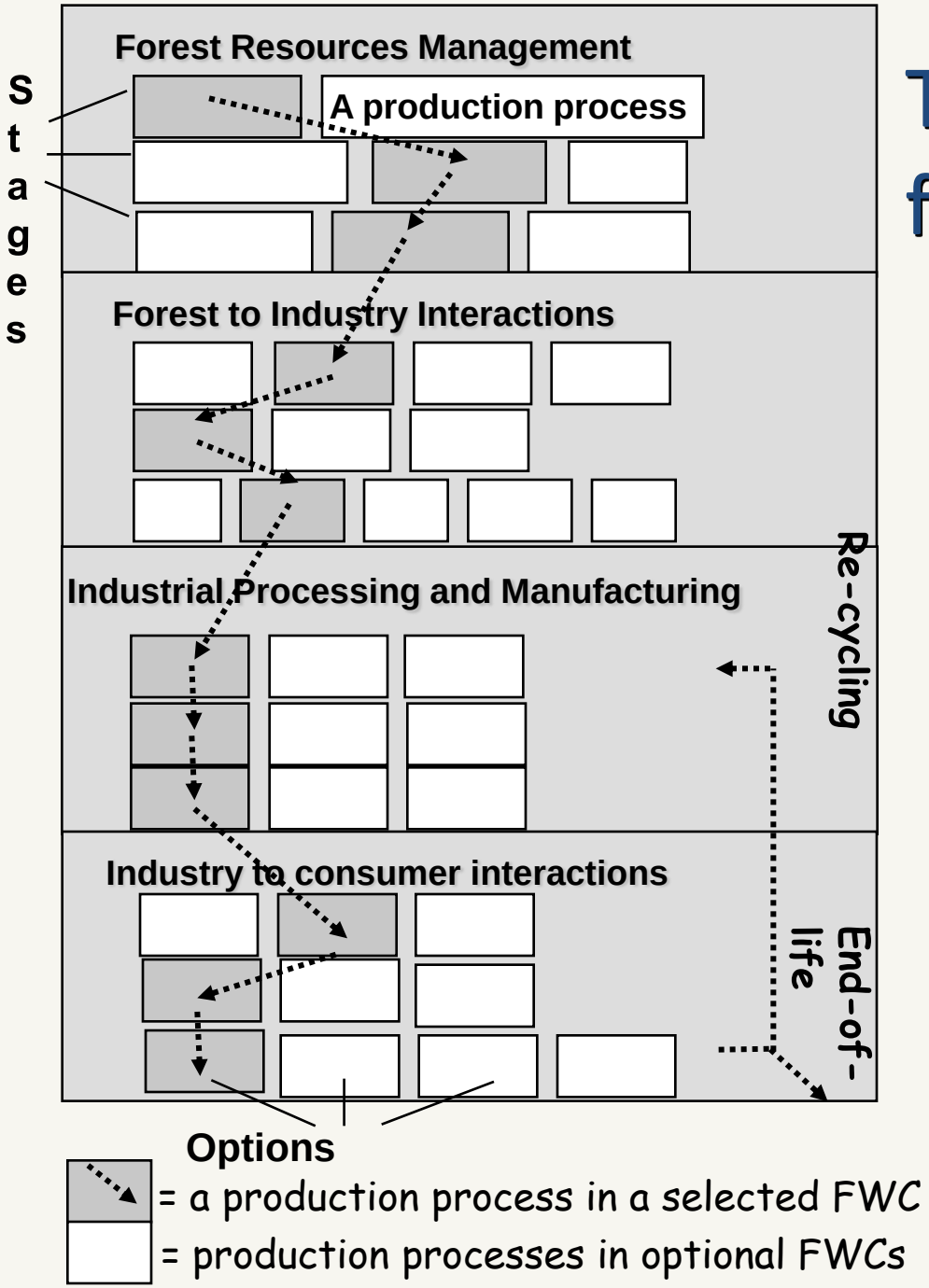






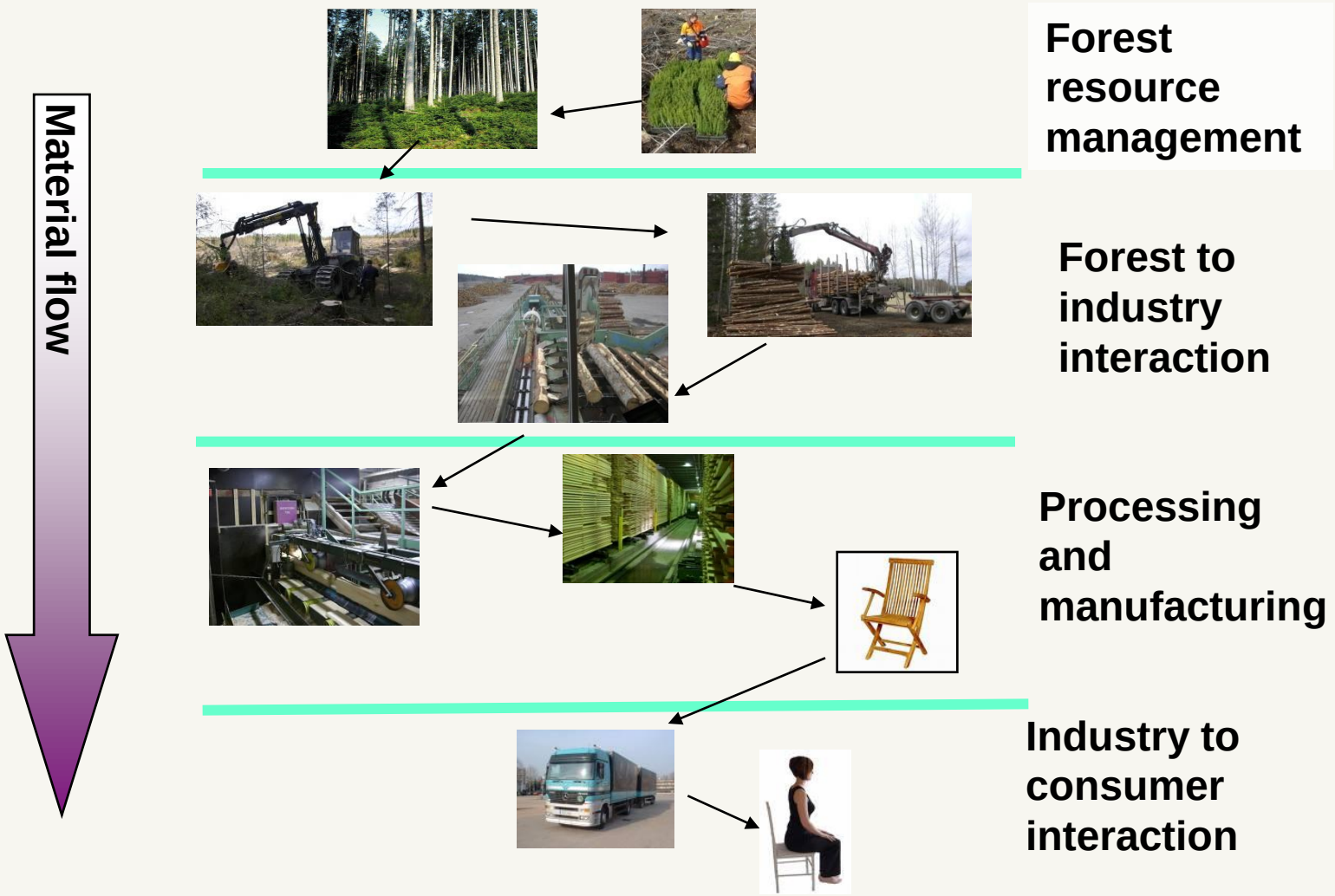
ToSIA aggregates indicator results along the FWC

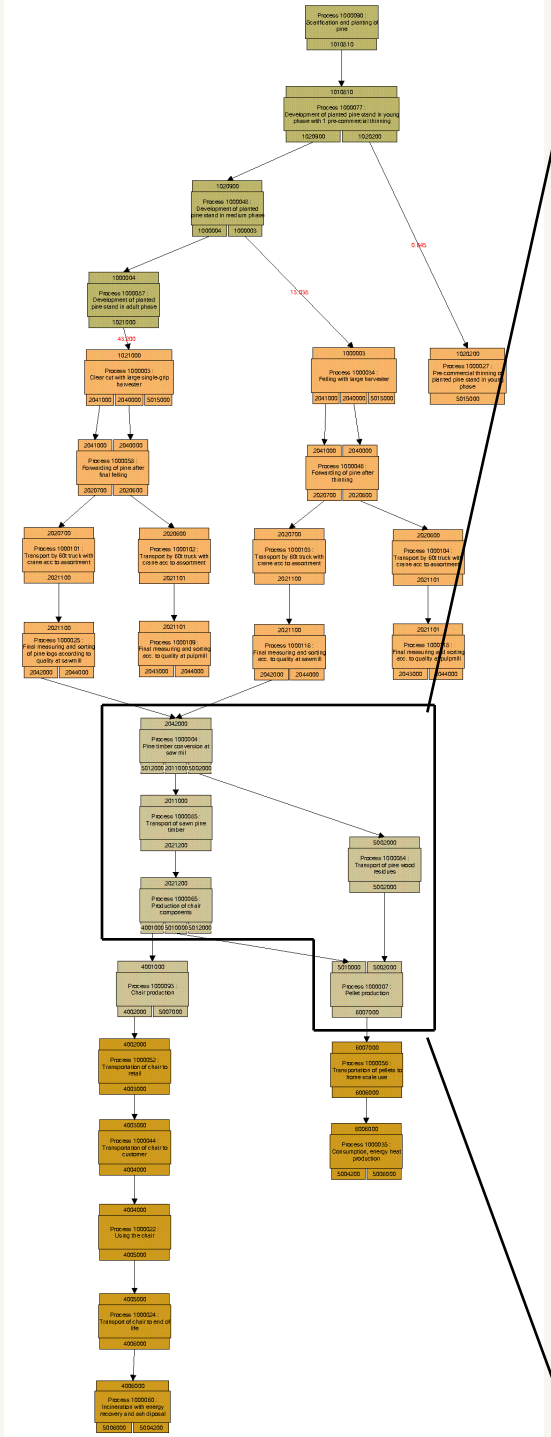
The analytical framework



FWC is a chain of processes

Defining the structure of a forest value chain





2042000

Process 1000004:
Pine timber conversion at saw mill

5012000 | 2011000 | 5002000

2011000

Process 1000085:
Transport of sawn pine timber

2021200

2021200

Process 1000065:
Production of chair components

4001000 | 5010000 | 5012000

5002000

Process 1000084:
Transport of pine wood residues

5002000

5010000 | 5002000

Process 1000007:
Pellet production

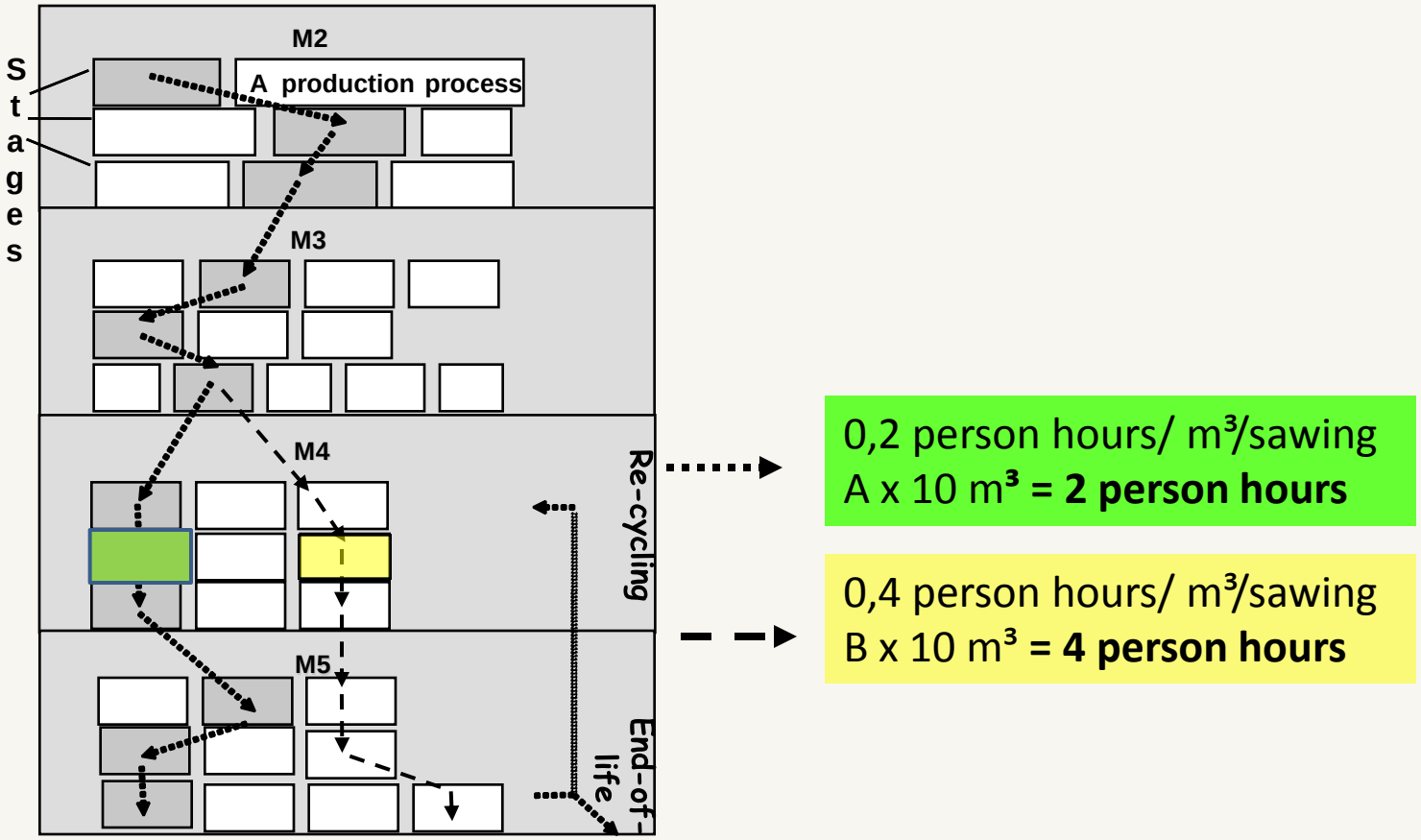
6007000

Processes

Products linking the processes

Sustainability Indicator Calculation

1. Take indicator value per unit of reference flow
2. Multiply with material flow through a process
3. = sustainability indicator value for the process

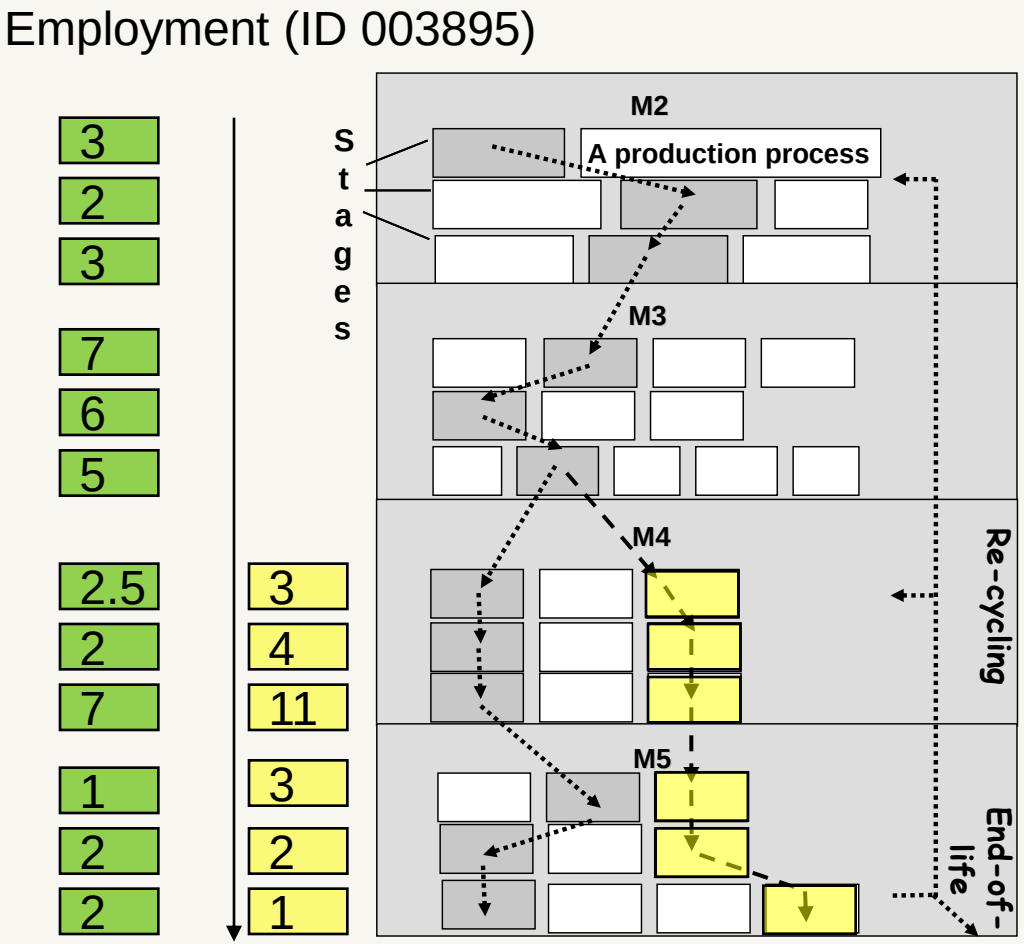


0,2 person hours/ m³/sawing
A x 10 m³ = **2 person hours**

0,4 person hours/ m³/sawing
B x 10 m³ = **4 person hours**

Aggregation of indicator results

- Identify same indicator for different processes in calculated chains
- Sum up indicators of the same ID in a calculated chain



TOTAL 42.5 person hours

50 person hours

Sustainability Impact Assessment

Impact of changing sub-chain A to sub-chain B on social indicator 'employment' =

Employment hours B – employment hours A =

50 – 42.5 = + 7.5

How to compare changes in different indicator values?

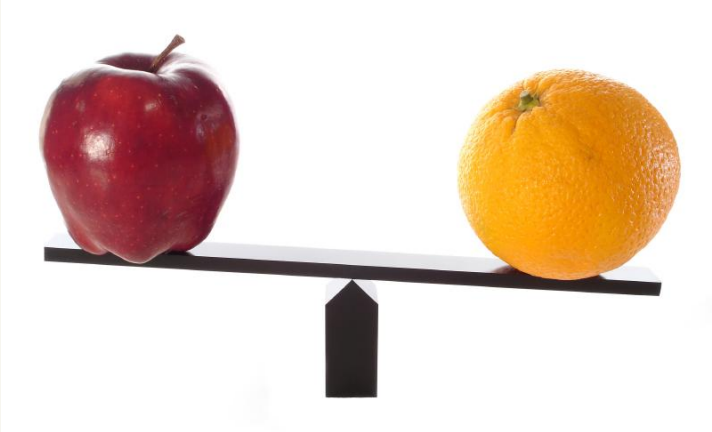
If the impact on employment is + 7,5 h but at the same time waste generation increases +2%,

is the total impact positive or negative?

Sustainability Impact Evaluation

Multi-Criteria Analysis (MCA)

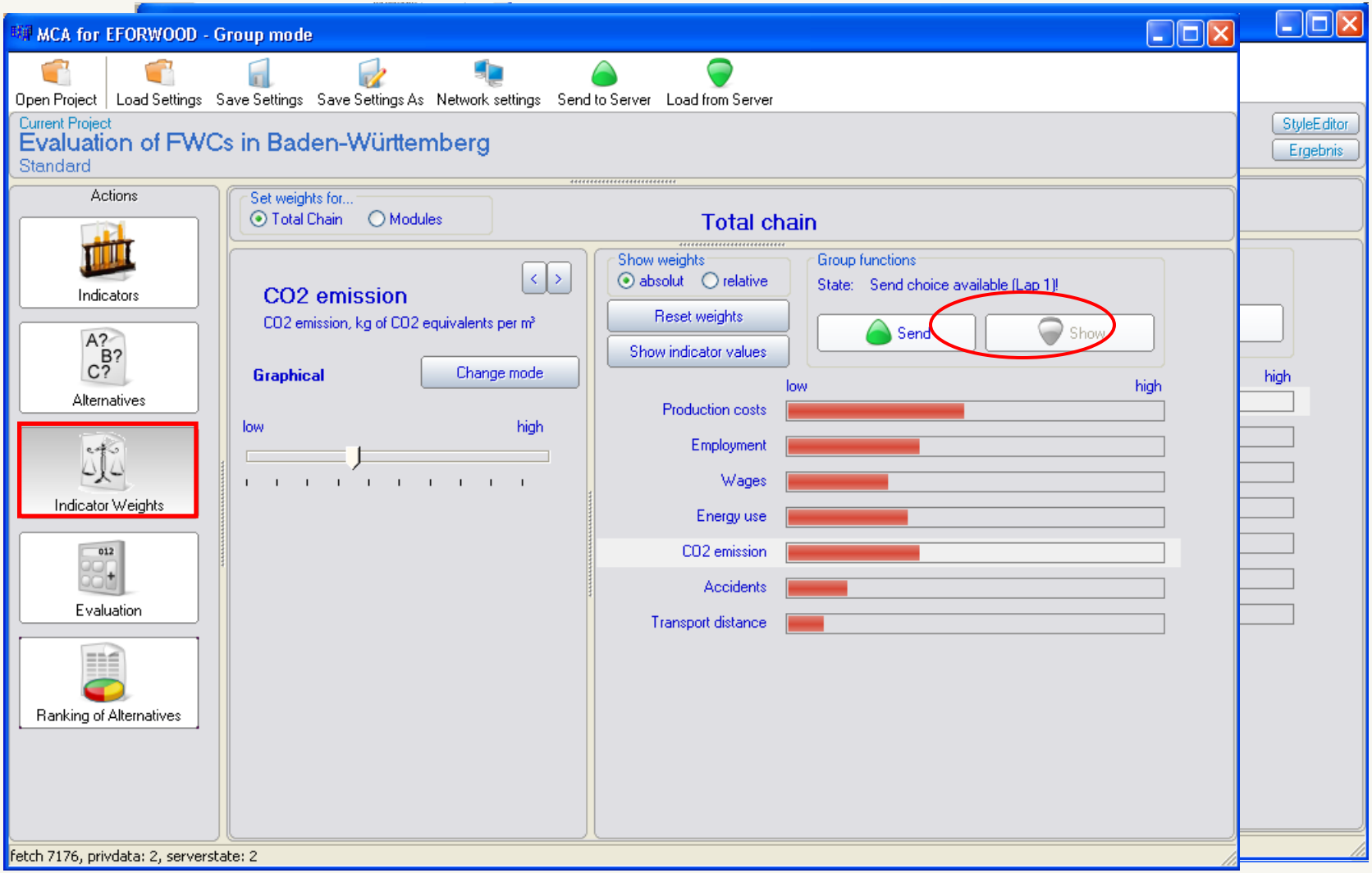
compares apples and oranges



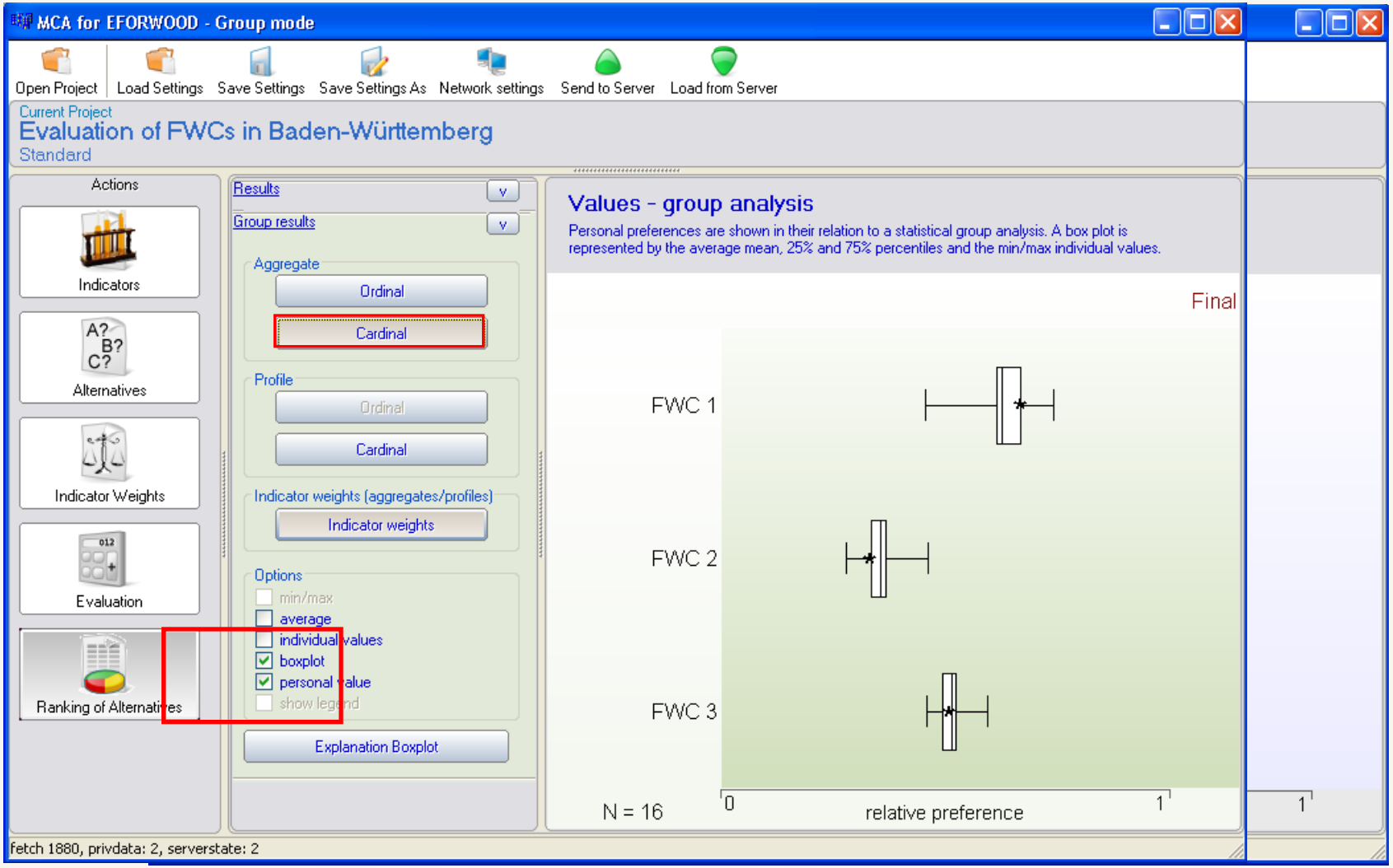
Cost-Benefit Analysis (CBA)

Converts apples and oranges into €

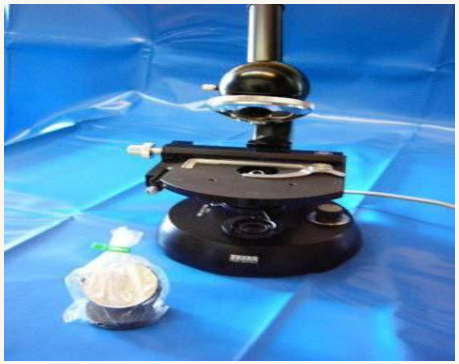
Software for Weighting of indicators



Software for Ranking of alternatives



ToSIA perspectives: How you look at things makes a lot of difference!



Different ToSIA perspectives at sustainability impact assessment

I will become a nice table...

I used to live in Northern Sweden...

...in my earlier lives I had other carreers

We grew up only 35 km from here...

I will be read in downtown London!

”forest-defined” ”product-defined” **”industry-defined”**

What can ToSIA be used for?

Questions to be answered relate to economic, social and environmental sustainability impacts of modified FWCs under the influence of, for example:

- Changes in Policy
  - forest conservation
  - increasing utilization of woody biomass for bio-energy
- Changes in Technology of the FWC
  - harvesting methods
  - transport alternatives
  - minimal-pollution technology in industrial processing

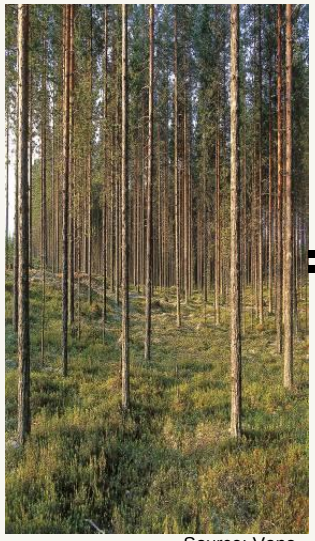
What can ToSIA be used for?

Questions to be answered relate to economic, social and environmental sustainability impacts of modified FWCs under the influence of, for example:

- Changes in Consumer Behaviour
  - increased utilization of wood materials in housing construction
  - higher recycling rates for paper and wood based products
- Changes in External Markets
  - higher energy prices
  - collapsing round wood imports from Russia

ToSIA application: comparing two different bio-energy supply chains for heating a private household

1) Production of pellets – used in single family homes
2) Chipping of biomass – used in single family home via district heating


Source: Vapo


Source: Vapo


Source: Vapo


Jouko Parviainen, Josek Oy

Source:Vapo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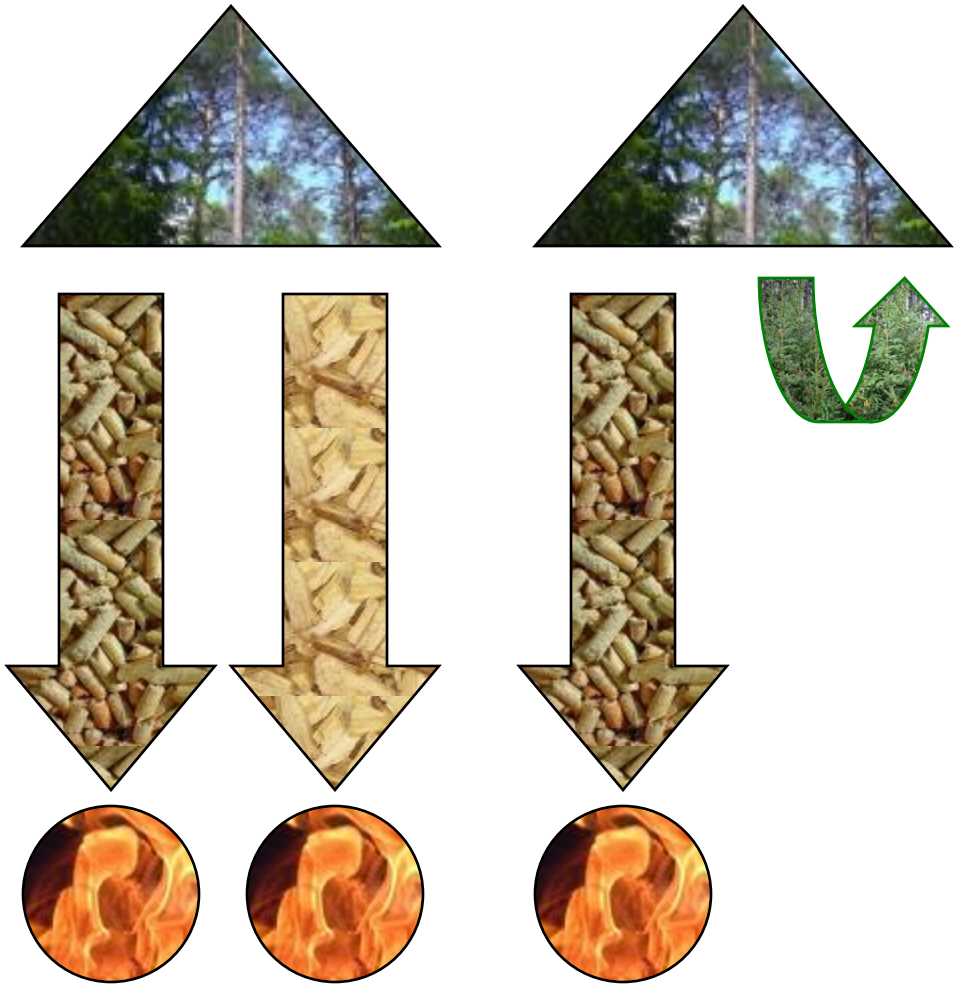
Comparison of two chains

P&C Chain

P Chain



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Indicators

Indicators		Units
1. Production costs		euro
2. Resource / Material use		m3
3. Total heat consumption		MJ
4. Employment	4.1 male	person a
	4.2 female	person a
5. Wages and Salaries	5.1 male	euro
	5.2 female	euro
6. Safety and Health	6.1 Occupational accidents non-fatal	accidents
	6.1 Occupational accidents fatal	accidents
7. Greenhouse Gas Emissions		tons CO2 eqv.
8. Maintenance of soil quality		kg
9. Transport (road)	9.1 transport distance road	tkm
	9.2 freight volume	*tons*
10. Energy	10.1 renewable energy use	MJ
	10.2 non renewable energy use	MJ
	10.3 electricity from the grid use	MJ
	10.4 generation from renewables	MJ
11. Average carbon storage in cut biomass		tons

Results of the comparison

a) effects of additional extraction of forest biomass on sustainability

Indicator		P Chain	P&C Chain	increase in %	Unit
1. Production costs		318 737	595 078	87	euro
3. Total heat consumption		5 604 318	1 6491 609	194	MJ
4. Employment		0,99	2,18	120	person a
7. Greenhouse Gas Emissions		63	126	101	tons CO2 eqv.
8. Maintenance of soil quality		0	5 382	n.a.	kg
9. Transport	9.1 transport distance	272 416	363 846	34	tkm
	9.2 freight transported	1 679	2 822	68	*tons*
10. Energy	10.1 energy use	1 942 126	2 348 295	21	MJ
	10.2 heat generation	6 404 935	20 725 555	224	MJ

Based on:

- one reference year (2007)
- a certain land area (1803 ha)

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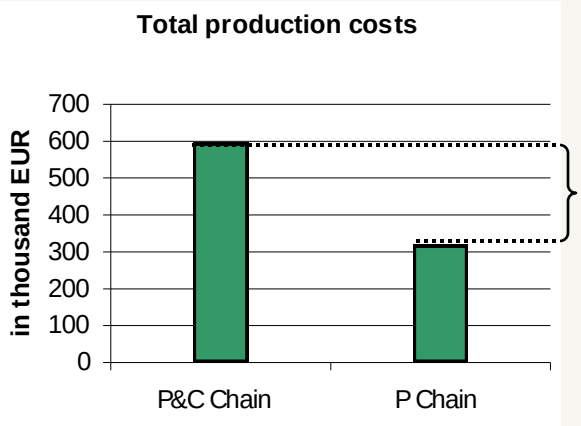
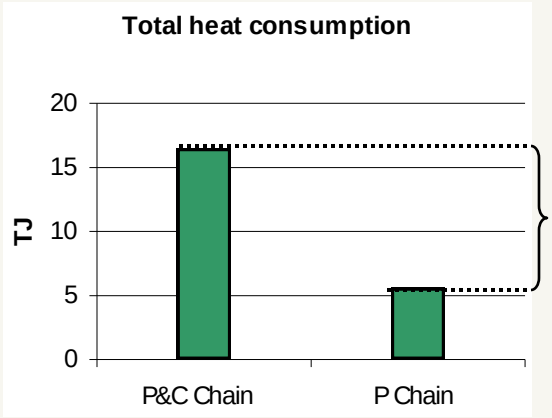
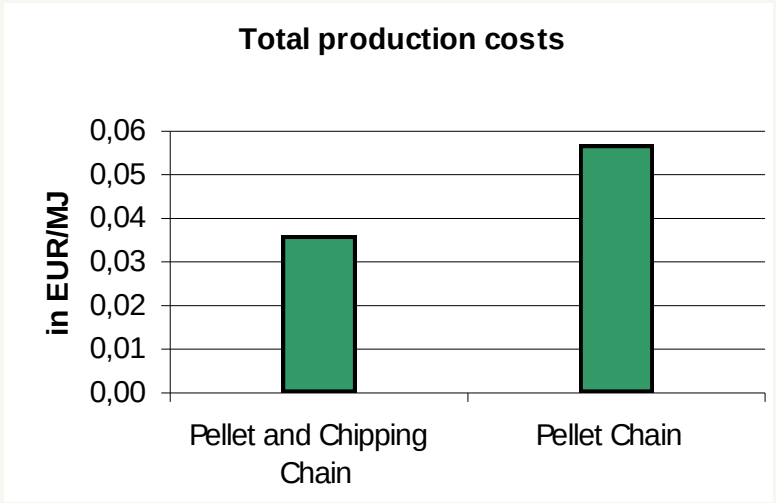
Results, production costs



+276



+10,8



Less costs per unit heat consumed in P&C Chain

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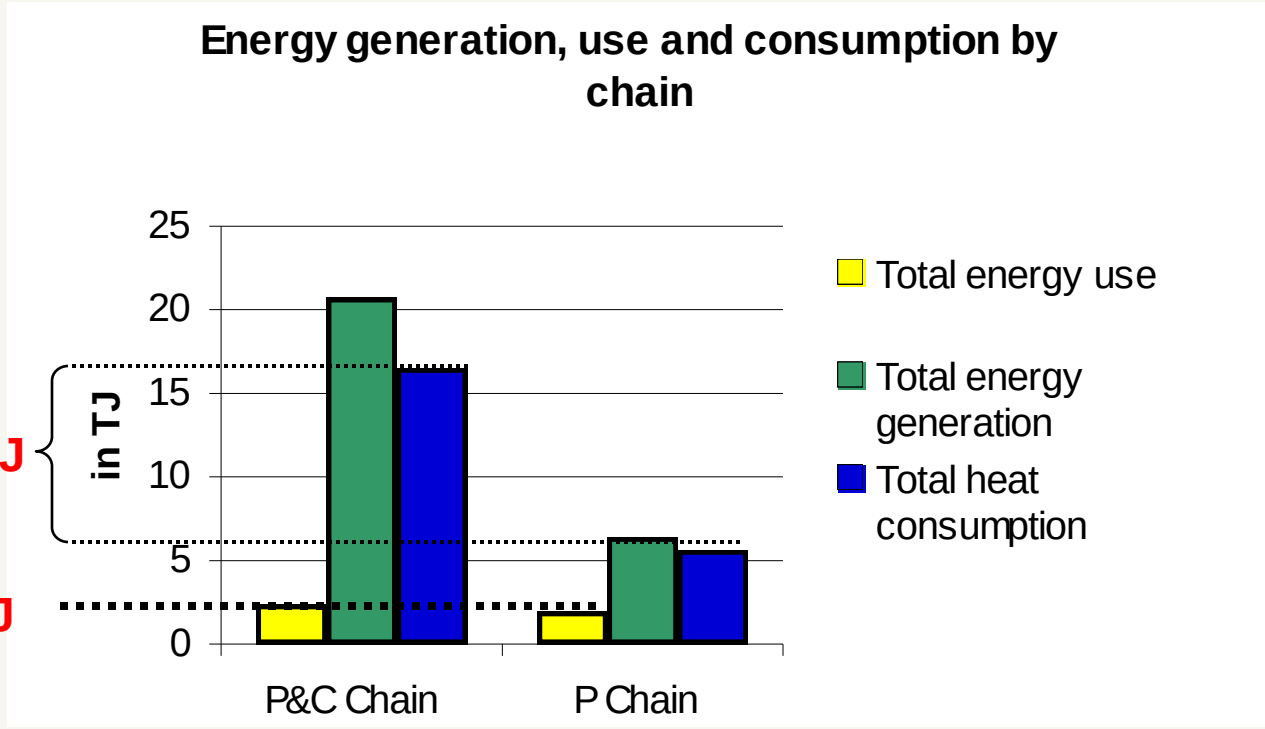
Results, energy



- **Chipping strongly increases the heat generation, > 3 times**
- **Similar energy use in both chains**
- **Pellet Chain more efficient, (0,80 vs. 0,88)**

ToSIA results

a) Pellet and Chips chain
b) Pellet chain

Indicator	P & C Chain	P Chain
GHG bal.	↑	→
Employment	↗	→
Energy bal.	↑	↓
Costs	↑	→
Soil maint.	↓↑	↑

ToSIA Concept – Questions?

Time for discussion...