Science, Technology & Society

Natuurwetenschap & Samenleving

Large Scale International Bio-energy Trade

- Perspectives, Possibilities and Criteria; introduction to a workshop -

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- Rationale
- Potential of biomass for energy and key factors.
- Possibilities for international bio-energy trade.
- Performance of biotrade chains (energy, costs and GHG-balances).
- Criteria for sustainable bio-energy trade.
- Key questions.

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Rationale for international bio-energy trade.

- Potential regional surpluses of biomass versus regional demand.
- Economic arguments
- GHG mitigation impacts
- Pricing policy & market development
- Sustainable development schemes (?)
- ...

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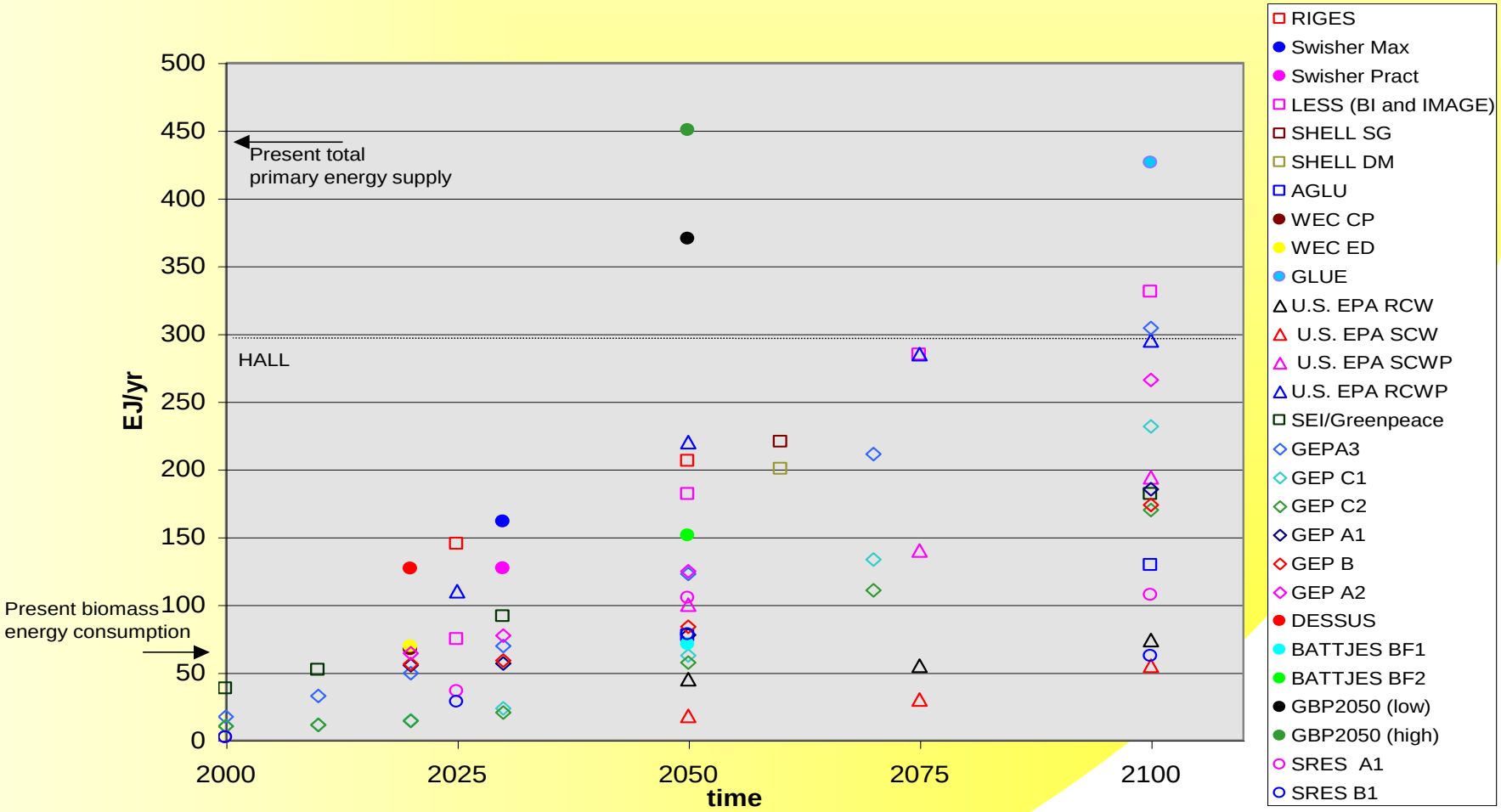
Bio-energy potentials on a global scale (17 studies)



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Global land surface and main land use categories

Land use category	(Gha)	Remarks
Agriculture	1,5	Includes grassland for intensive cattle farming
Pastures/grassland	3,5	More extensively managed
Forest	4,0	Includes natural – production forest
Inproductive	4,2	Includes (semi-)deserts, mountainous terrain and built-on areas.
Total	**13,2**	**Global land-surface (excludes large ice sheets).**

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otential spread in the global demand for food (2050)

	Current situation	Vegetarian diet, low population growth	Average diet, average population growth	Protein rich diet, high population growth
Global population (billion)	5.9	7.7	9.4	11.3
Diet (dry kg graaneq./person* per day	2.6	1.3	2.3	4.2
Total demand for food (Gton graineq.)	5.650	3.670	8.240	17.310

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Potential global land surplus (in Gha) for a world population of 9.4 billion people for different 'average diets' and 'agricultural systems' on a fixed land area of 5 Gha.

Global food production system	**Vegetarian diet**	**Average diet**	**Protein rich diet**
HEI	4.00	3.16	1.88
LEI	2.17	0.64	0.00

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Overview of the global potential bio-energy supply on the long term for a number of categories

I:	Energy farming better quality land:	0 – 870 (140-430) EJ
II:	(Re-)forestation marginal lands:	(0) / 60-150 EJ
III:	Bio-materials:	**minus** (0) 40-150 EJ
IV:	Agricultural residues:	approx. 15 EJ
V:	Forest Residues:	(0) 14-110 EJ
VI:	Dung:	(0) 5-54 EJ
VII:	Organic wastes:	5-50 (++) EJ
Total:		**40 – 1100 (200 – 700) EJ**

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Essentials of future global biomass availability...

- Major contribution of bio-energy to global energy supply possible.
- But; major (uncertain) transitions required to exploit this potential.
- Improved food production systems & rate of deployment in DC's.
- Use of marginal/degraded land & use of biomaterials.
- (Net) biomass supply per region strongly determined by local factors; large differences between regions.

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Possible ‘biotrade chains’

Exporter	Transport/transfer/storage	Importer
Biomass production	‘raw’ biomass	Full conversion
Biomass production & pre-treatment	Pre-treated (pellets, bales, bio-oil) biomass	(partial) conversion
Biomass production & conversion	Fuels (H2, MeOH, EtOH, HC’s)	End-use
Production and conversion	Electricity transport	End-use
Biomass production	‘conversion along the way’	End-use

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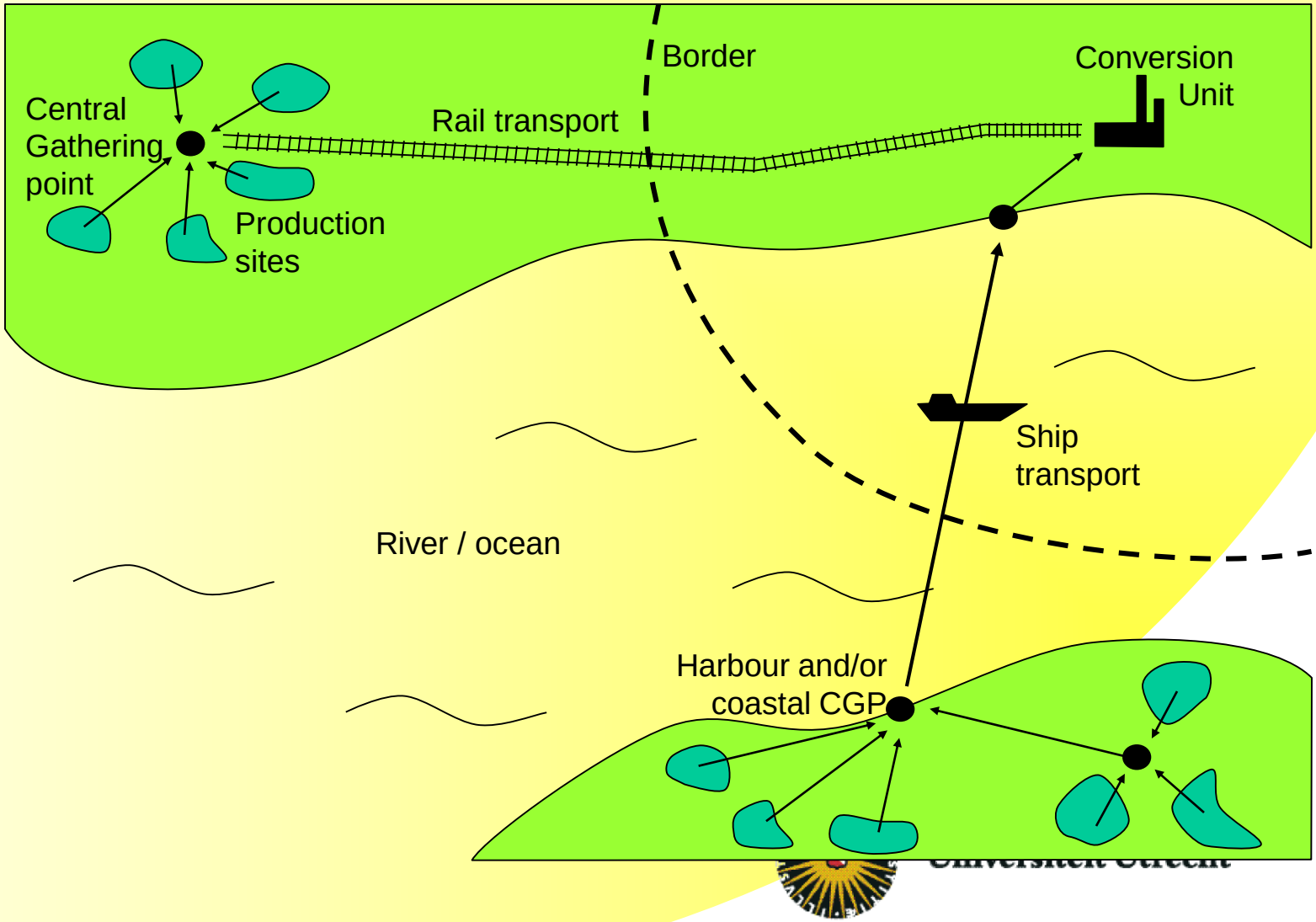
Logistics


Central
Gathering
point
Production
sites
Rail transport
Border
Conversion
Unit
Ship
transport
River / ocean
Harbour and/or
coastal CGP

Performance of biotrade chains; energy ratio's

* Export of forest residues from Baltic region to NL:
~ inland transport, transfer, 1500 km, smaller vessel size
overall 5% of energy content of the biomass is needed

* Export of (cultivated) wood from Latin America to NL:
~ inland transport, transfer, 10.000 km, large vessel size
overall 10% of the energy content of the biomass is needed

(same order of magnitude as coal, oil and natural gas)

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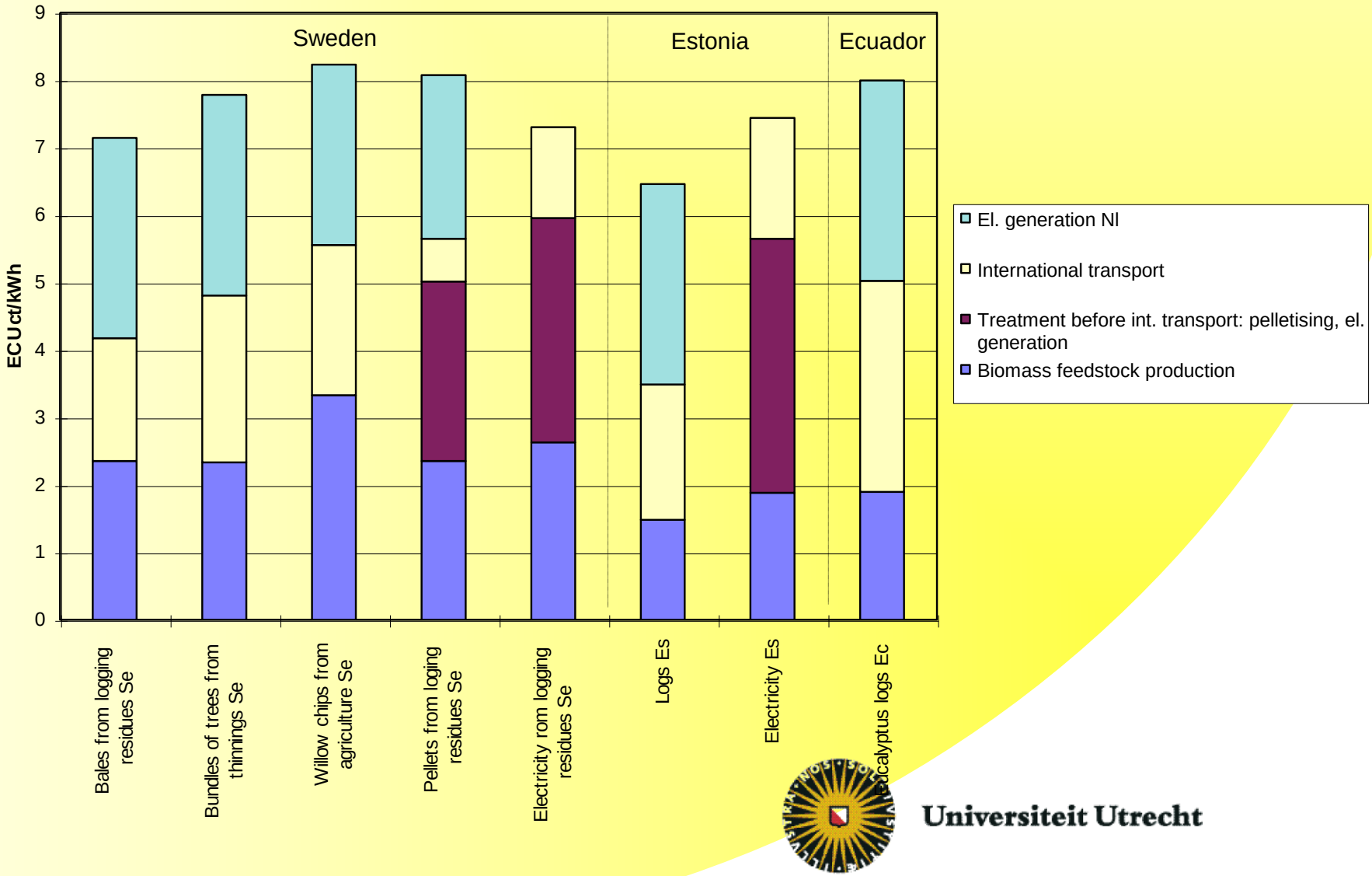
Examples: Costs for the bio-electricity chains Sweden, Baltics, Ecuador -> Netherlands (€ ct/kWh)



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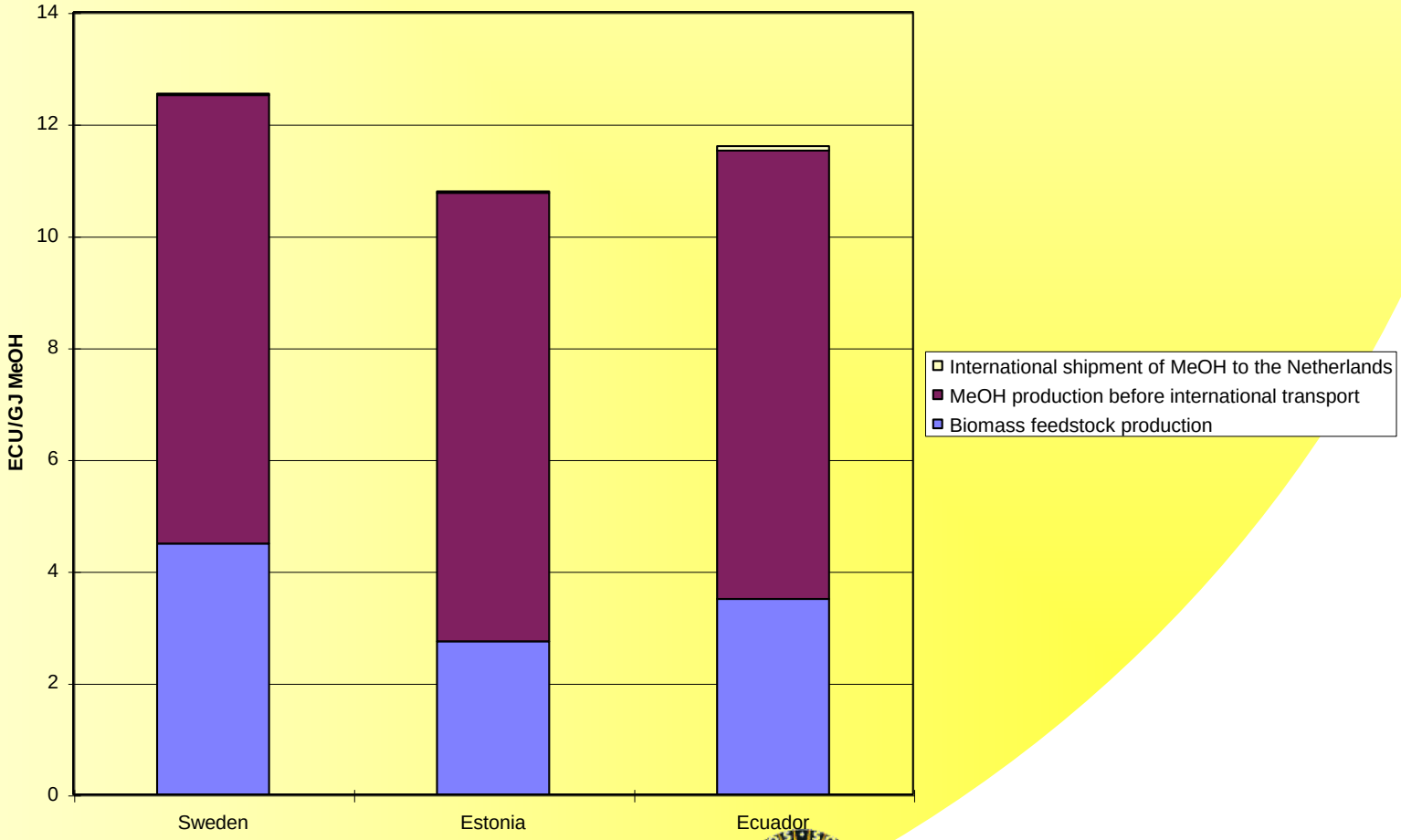
Example: Breakdown of costs of imported MeOH from three countries to the Netherlands



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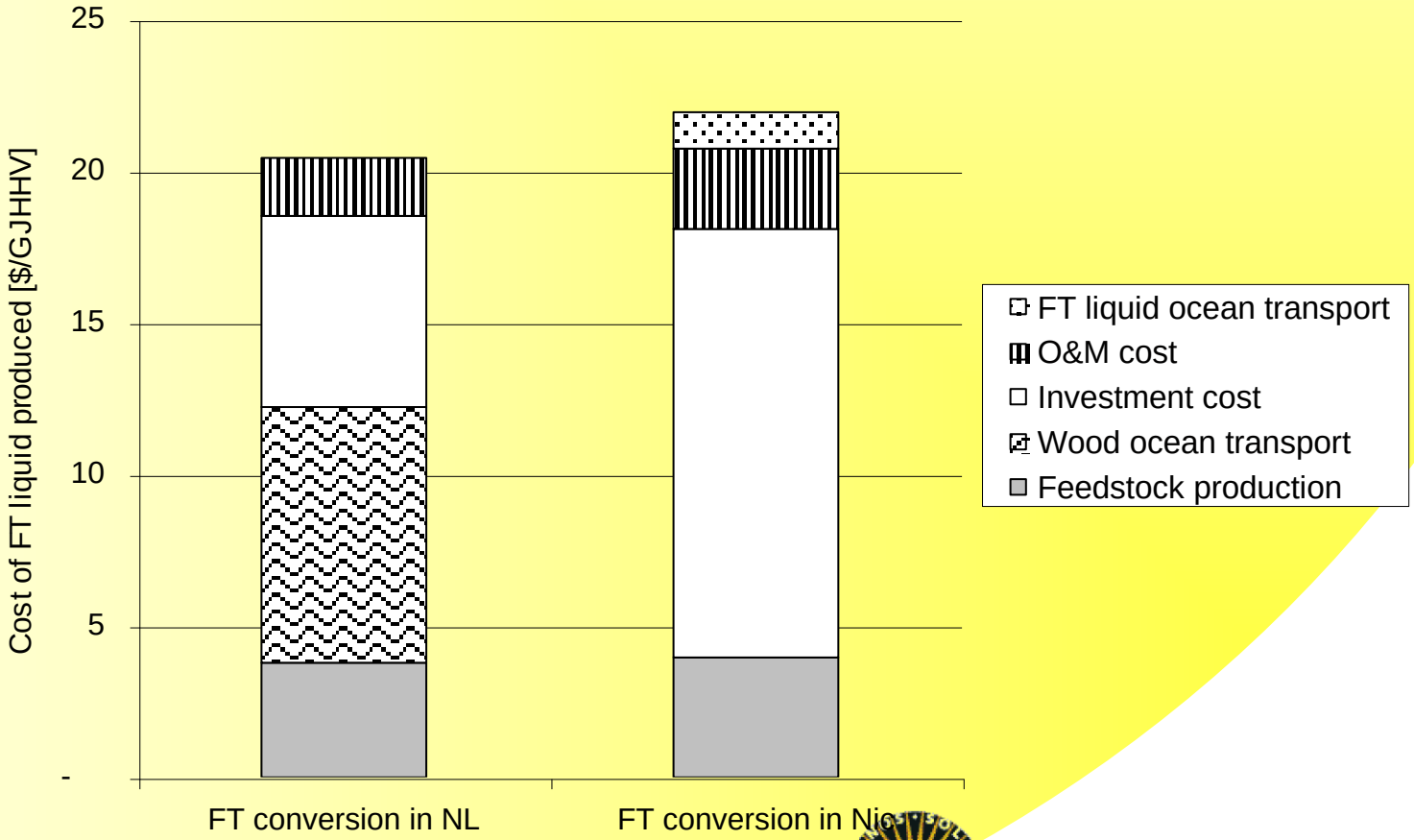
Example: Estimated cost of bio-Fischer Tropsch fuels from Nicaraguan eucalyptus for use in the Netherlands.



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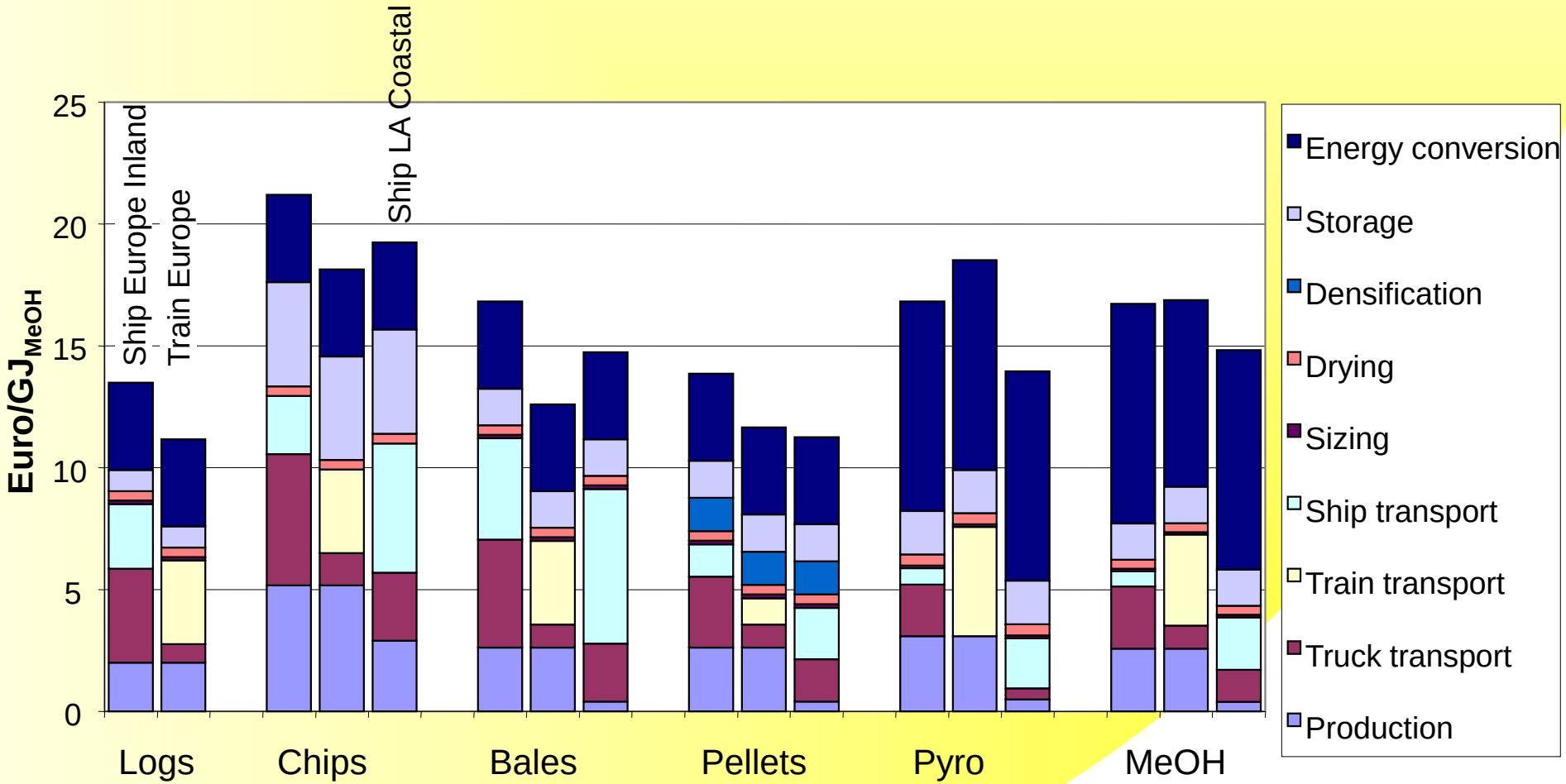
Bio-methanol from EE and Latin America



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GHG accounting...

GHG emission mitigation strongly influenced by reference situations and type of (energy) use replaced.

Conventional electricity production:

~800 g CO2/kWh (coal) ~ 0 g CO2/kWh (hydro.)

Bio-electricity production:

typical ~ 20% efficiency for small scale facilities, up to 40% for co-combustion in coal plants.

Fuels, materials, dynamics over time,...

Which party obtains the carbon credits?

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Short term & long term; key considerations

- International biomass trade can create stable markets
- And may contribute to development in exporting regions.
- Use of underutilized resources on shorter term.
- Building infrastructure on short term to contribute to increasing biomass production on the long term.
- Trade may help developing bio-energy potential.
- Biomass potentials influenced by a variety of economic, ecological and social factors; availability not guaranteed.
- (Potential) impacts are diverse; can both be positive and negative, depending on schemes pursued.

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Key questions & criteria

•What is an optimal use of resources (land, biomass)
• Which chains are optimal from environmental (GHG in particular) point of view?
•Does bio-energy import and trade meet a broad set of sustainability criteria (ecological, social, economic)?
• How can short term actions contribute to long term viability of the bio-energy (trade) option?

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Key questions

- GHG mitigation effects (export versus indigenous utilization; different utilisation options).
- Ecologically sound: soil quality, nutrient balances, biodiversity, water resources...
- Fair distribution of (economic) benefits among (local) actors involved.
- Is a long term, sustainable supply of biomass resources guaranteed?
- Implementation schemes and strategies?
- Legal issues and certification?
- (…)

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