TECHNOECOMICS OF BIOENERGY TRADE CHAINS - IEA BIOENERGY TASK 35
Task Objectives - Bioenergy Trade

- To select the economically promising chains for a detailed study.
- To carry out a comparison for selected alternatives with a rigorous method.
- Overall costs and reducing CO$_2$ emissions as criteria.
- To identify business opportunities and new concepts in bioenergy utilisation chains.
IEA Bioenergy Task 35 Participants 2002

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Elements in Assessing Biofuel Trade

- Resource supply
- Local conversion
- Long distance logistics
- Final conversion and end use
Biomass Resources Considered

- Woody biomass
  - Forest industry by-products
  - Forestry residues
  - Other wood fuels
- Agricultural by-products
  - Straw
  - Bagasse
  - Other
- Specifically grown biomass
  - Short rotation forestry
  - Grasses
Local Conversion

- Drying (used in processes below)
- Pellets
- Bio-oil
- Other liquid biofuels
  - Ethanol
  - Methanol
  - Fischer-Tropsch liquids
Transportation Logistics

- Raw biomass, pre-treated biomass, converted biomass
- Water, rail, road
Final Conversion and End-Use

- Conversion to other energy forms
  - Fischer-Tropsch liquids
  - Ethanol, Methanol
  - Bio-oil

- Power and heat
  - Stand-alone
  - Co-fire

- Transportation
## An Example of Data Collection, Resources Supply

<table>
<thead>
<tr>
<th>Context</th>
<th>Geography, system, pattern over year, typical alternative uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amounts</td>
<td>(Gross-net) + distribution (ton/km²)</td>
</tr>
<tr>
<td>Collection methods</td>
<td>Machinery (€, O&amp;M, energy use/ton)</td>
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<tr>
<td></td>
<td>Storage (time, O.M., losses)</td>
</tr>
<tr>
<td></td>
<td>Local transport (€/ton*km)</td>
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<tr>
<td></td>
<td>Local transfer (€/ton)</td>
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<td></td>
<td>Fuel properties (moisture, ash, HHV, particle size, bulk density), change over time</td>
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<tr>
<td></td>
<td>Sustainable level given above as net (+ criteria)</td>
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<tr>
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<td>Emissions: SO₂, NOₓ, Dust, VOC</td>
</tr>
</tbody>
</table>
An Example of a Biofuel Trade Chain

- Primary fuel: forestry residues (FR) available in connection to wood industry in Northern Europe
- Used industrially in Finland and Sweden (CHP and heat production)
- Utilisation of FR is increasing, and a considerable potential exists
- Conversion of FR in an integrated plant to heat and bio-oil
- Transportation of bio-oil to remote users
- Use in replacing coal (or mineral oils in the future)
Current Industrial Use of Forestry Residues

- Procurement of the forest residues is connected to timber harvesting
- Bundling of forest residues
- Forest haulage of bundles by a forwarder
- On-road transportation by log trucks
- Crushing of bales at the plant

Piling of forest residues at stand
Cost of Wood Fuels for Large Users

- Industrial by-products
- Forest residues
- Thinnings