The Role of Woody Biomass in Bioenergy Business in Russia and the World

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Agenda

- Indufor
- Local and Global Wood based Fuels
- Conclusions
Indufor – Quick Facts

- Independent international consulting company based in Finland, New Zealand, Australia and the US with over 35 years of experience in the field of forestry, forest industry and bioenergy
- Provide world class advisory services to a wide range of private and public sector clients
- More than 300 clients in over 800 projects in 5 continents
Indufor – Forest Industry & Bio Solutions

Biomass sourcing and wood supply plans
- Site suitability for forest plantation and biomass species and varieties
- Potential and realistic supply availability in biomass supply baskets
- Developing supply models and assessing associated cost structures

Business strategies
- Pre-feasibility/feasibility studies
- Business plans
- Market supply, demand and trade assessments – market entry solutions
- End use segment and client identification studies

Due Diligence and M&A
- Purchaser and vendor due diligence
- Valuations
- Mergers and acquisitions

Process Improvements
- Technology assessments
- Operational improvement analysis

Industry benchmarking
- Industry segment productivity assessments
- Single plant benchmarking studies
Indufor – Russia

- In Russia since late 1980s
- Both strategic and operational projects.
- Services cover all strategically important issues for the industry:
  - Forest management
  - Forest inventories
  - Wood supply and procurement
  - Investment advice and manufacturing processes
  - Sales and marketing
  - Logistics.
Local and Global Wood based Fuels
Local and Global Wood Based Fuels

The consumption of different wood based fuels is connected with their transportability and the spread of the geographical market area. Changes in the demand for global market products, mainly industrial pellets, may have far-reaching consequences for regions producing biomass.

### Local products

- Wood based fuels with low value adding:
  - Harvesting residues (forest chips)
  - Processing residues (chips and sawdust)
  - Firewood

- All above products have strong dependence on the wood supply streams of local forest industry operations
- Low energy content per volume
- Short economical transportation distance

### Global products

- Wood based fuels with high(er) value adding:
  - Wood pellets
  - Torrefied/black pellets
  - Liquid biofuels

- Production and use are less dependant on the forest industry
- Better energy value per unit of volume
- Long transportation distances and better stocking capabilities

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Local
Local Production – Available Harvesting Residue Volumes

Biological potential is the maximum theoretical volume of harvesting residues available. This volume differs significantly between wood species and age structure of the forest.

Source: Metla

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Local Production – Available Harvesting Residue Volumes

In reality, the economic harvesting residue potential is significantly lower than the theoretical/biological potential.

**Technical potential**
- Technical potential indicates the share of logging residues from the biological potential that can be realistically extracted from the site.
- Depending on the harvesting and forwarding method, part of removable material will be rejected due to small particle size and part of residues fall off during handling and loading.
- Also lease holders willingness to sell can restrict the available volume

**Economic potential**
- The economic potential is the share of the technical potential which is economically profitable in given conditions.
- Economic potential depends on the other hand from the sourcing cost of biomass and on the other hand the paying capability of the bioenergy plant.

![Graph showing theoretical, technical, and economic potential for Location 1 and Location 2](image-url)
Local Production – Harvesting Residue Processing

Decentralized processing solutions dominate globally. Centralized processing solutions are effective when a large volume of biomass is closely available to the processing location.

<table>
<thead>
<tr>
<th>Supply Chain</th>
<th>In-field chipping</th>
<th>Roadside chipping</th>
<th>Terminal chipping</th>
<th>Mill-site chipping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply chain</td>
<td>Decentralized</td>
<td>Decentralized</td>
<td>Centralized</td>
<td>Centralized</td>
</tr>
<tr>
<td>Cost</td>
<td>Low investment cost</td>
<td>Low to medium investment cost</td>
<td>High investment cost</td>
<td>High investment cost</td>
</tr>
<tr>
<td>Efficiency</td>
<td>Inefficient chipping</td>
<td>Cost efficient method for longer transport distances</td>
<td>Cost efficient method for large volumes in small areas</td>
<td>Cost efficient method for large volumes within short transport distance</td>
</tr>
<tr>
<td>Transport distance</td>
<td>&lt; 150 km</td>
<td>&lt; 150 km</td>
<td>Chips &lt; 150 km</td>
<td>&lt; 50 km</td>
</tr>
</tbody>
</table>
Local Production – Transportation of Biomass

The required space is the restricting factor when transporting harvesting residues whereas weight is typically the restricting factor. Logging residues are the main wood raw material in global CHP production.

Note: All loads have the same solid content.
Local Production – CHP – Optimal Processing Location

South African example – Harvesting residue transportation is economical only in short distances.

![Graph showing cost versus lead distance for Logging Residues and Chips]

**Breakeven Distance:** 8.2 km

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Local Production – CHP – Biomass Types and Transport Distances

Southern African example – Harvesting residues viable option and available very close to the planned plant location.
Local Production – CHP – Unwanted Roundwood in Siberia, Russia
Local Production – CHP – Biomass Cost Curves in South Africa

*Harvesting residues are cost effective wood fuel type – cheaper than firewood in this example.*

![Cost Curves Graph](image-url)
Local Production – CHP – Biomass Cost Curves in South Africa

_Harvesting residues are cost effective wood fuel type – All targeted volume can be found within 100 km radius._

Cost (Chipped at Millgate), ZAR/MWh

- Firewood
- Logging residues within 50-80 km
- Chips
- Logging residues within 30 km
- Logging residues within 15 km
- Bark
- Weighted average

Cumulative Volume, MWh

0 100 000 200 000 300 000 400 000
Global
Global Business – Wood based Biomass in Energy Production in EU

In Europe, wood raw material is a scarce resource due to high competition. Increase of the wood based energy production will be largely dependent on imported wood biomass.

- In Europe, wood raw material is a scarce resource due to high competition.
- About 2/3 of the wood energy use is connected with the processes of the forest industry.
- Supply of residues from the wood processing industry (sawmills) is not going to increase drastically due to stagnant total production.
- Thus, increase of the wood based energy production will be largely based on imported wood biomass.

Use of wood based biomass in energy production in the EU

- Fire wood: 35%
- Forest chips: 15%
- Industrial pellets: 6%
- Pellets - individual houses: 7%
- Pellets - heat and electricity: 7%
- Recycled wood: 6%
- Bark: 3%

Total: 722 TWh

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Global Business – Transportation of Biomass

Economically feasible transportation distance is typically less than 100 km, except pellets.

- **Chips**: 100 km
- **Pellets**: 500 – 700 km, 2 000 – 3 000 km, 15 000 km
Global Business – Wood Pellets – Supply and Demand

EU comprises nearly half of the global pellet production and app. 75% of consumption. North America and Asia form nearly 20% of the whole market. Pellet markets have been steadily growing in Japan and South Korea.
The competitiveness of both European energy producers as well as North American pellet exporters has decreased due to currency developments – pellet producer prices have decreased and consumer prices have increased.

Production and consumption of wood pellets in the EU

Prices (CIF) for North American imported pellets in Belgium and Holland
Global Business – Liquid Biofuel

The primary driver of producing biofuels is to displace liquid fossil fuels which is largely driven by political decisions. Only a few wood based liquid biofuel plants exist in commercial scale.

- The primary driver of producing biofuels is to displace liquid fossil fuels
- The biofuels are substituting the fossil fuels thus the market price reference is the fossil oil prices.
- So far only few pyrolysis oil, bioethanol mills based on lignocellulosic (woody) feedstock are operating commercially.
- Biorefinery concepts based on lignocellulosic feedstocks will require more time to become technically mature and competitive against fossil fuels production.

![Brent Crude Global Market Price Graph](image)
Global Business – Liquid Biofuel – Russian Market

*Russian domestic market is only at its development phase and production will be export driven.*

- Russia is developing regulatory norms and standards for bioenergy and biofuels.
- The bioenergy and biofuel targets by 2020 are:
  - 10% share in motor oil
  - 10% share in generation of thermal power
  - 20% share of solid biofuels in the European market
  - 5% share of the world market of motor biofuels and its components.
- The Russian targets by 2020, 10% share in motor oil and 5% share in the global biofuel market, would be about 1,500,000 toe oil and about USD 7 billion market share.
- However, biomass and biogas facilities will not get financial support from Russian Federation by 2020 as the technology is not considered yet commercial, which makes challenging to reach BIO 2020 targets.
Global Business – Liquid Biofuel – European Market

HFO is considered a near term opportunity based on the expected pyrolysis oil quality, whereas LFO could be replaced in the medium term (5+ years).

**Consumption of HFO in selected European countries**

- Italy: 1,000 tonnes/a
- Finland
- Sweden
- Portugal
- UK
- Denmark
- Norway
- Netherlands

**HFO Market Price in selected European countries**

- Sweden
- Portugal
- Denmark
- United Kingdom
- Finland

**EUR/t**
Global Business – Liquid Biofuel – Dumped Residues outside Mill in Russia
Global Business – Liquid Biofuel – Raw Material Mix in Russia

Planned wood biomass composition for a pyrolysis oil plant.

- 90,000 m³/a mill: About 50% of raw material is roundwood and the rest industrial residues.
- 350,000 m³/a mill: Ca. 85% roundwood and 15% industrial residues. Ca. 60% of roundwood is pulpwood and the rest low quality roundwood.
Global Business – Liquid Biofuel – Mill Gate Cost in Russia

Processing residues from close by sawmills would be enough for a smaller pyrolysis oil mill and would dominate also the raw material mix for the bigger mill size. However, various roundwood assortments needed also.

![Graph showing the cost of roundwood, industrial residues, and ex-mill/roadside price for different volumes of wood.](image)

- **Roundwood**
- **Industrial residues**
- **Ex-mill/Roadside price**

- W. Avg. 90,000 m³
- W. Avg. 350,000 m³

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Key messages
Conclusion

- Knowledge and understanding of a realistic wood biomass situation has the utmost importance – have to be done before machinery selection etc.
- Correct mill size has to be considered carefully. Wood cost increases with mill size and other cost savings become marginal once a certain size has been passed.
- Transportability of different wood fuel types varies significantly
  - Harvesting residues – local
  - Pellets and liquid biofuels – global
- Increase in the wood based energy production in the EU will be largely dependent on imported wood biomass
- EU targets for liquid biofuels in transportation create demand in medium/long term
Local Production – CHP – Raw Material Types and Suitability/Availability

Strong dependence of the wood raw material streams of the local forest industry operations. Logging residues are the main wood raw material in global CHP production.

LISÄÄ KUVIA
Global Xxx – Pellets – Raw Material
Euroopassa ja Venäjällä lähes exclusively processing residues (from sawmills), Amerikassa myös from roundwood. Ja muutama kuva alle? POIS!

• POIS