Forest-based Bioeconomy Outlook
Agents' Day 2017 of Finnish Sawmills Association
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- Finnish wood resources and harvesting
- Wood consumption in Finland
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Indufor in a nutshell
Indufor in a nutshell

- 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 natural resources
- 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.
Scope of services

World class services to wide range of Clients: forest industry companies and associations, forest and land owners, and primary producers’ associations, investors and investment banks, development banks and others.

- Due diligence of forestry investments
- Valuation of forestry assets and financial modelling
- Sustainability solutions
- Investment advisory and strategy
- Wood supply studies
- Strategic industry advisory
- Benchmarking & process improvements
- Climate change consulting
- Development consulting
- Project and program evaluation
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
Finnish wood resources & harvesting
Average annual increment of growing stock and drain

Annual industrial roundwood removals have been fluctuating between 40 and 60 million m\(^3\) during the past 20 years. Over this period the annual growth has been significantly higher than harvesting volumes.
Sustainable annual harvesting vs. consumption of industrial wood

Current harvesting volumes do not fully realize the potential of Finnish forests and theoretically there are significant volumes being underutilized. In addition, ca. 9 million m³ of wood are imported annually, mainly from Russia.
Sustainable annual harvesting level vs. consumption of sawlogs

Current harvesting volumes especially of pine sawlogs is below harvesting potential. Recently Finland has been relying on domestic resources and imports have been marginal.
Sustainable annual harvesting level vs. consumption of pulpwood

Similar to sawlogs, particularly coniferous pulpwood is harvested below theoretical potential. However, some 6.5 million m³ of pulpwood, particularly birch, is imported mainly from Russia.
Wood import by species and type

Birch pulpwood accounts for half of the imported volumes, followed by wood chips, designated for pulp production. Due to high export tariffs for sawlogs in Russia, only minor volumes of sawlogs are currently imported to Finland.

<table>
<thead>
<tr>
<th>Species</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birch pulpwood</td>
<td>53%</td>
</tr>
<tr>
<td>Wood chips</td>
<td>28%</td>
</tr>
<tr>
<td>Spruce pulpwood</td>
<td>6%</td>
</tr>
<tr>
<td>Pine pulpwood</td>
<td>4%</td>
</tr>
<tr>
<td>Other hardwood pulpwood</td>
<td>3%</td>
</tr>
<tr>
<td>Pine sawlogs</td>
<td>3%</td>
</tr>
<tr>
<td>Spruce sawlogs</td>
<td>2%</td>
</tr>
<tr>
<td>Birch sawlogs</td>
<td>1%</td>
</tr>
<tr>
<td>Total, 2015 – 9 million m³</td>
<td></td>
</tr>
</tbody>
</table>
In the Southern regions, where most of the production facilities are located, almost all the available wood resources are being processed recently and there is high competition on the raw material market.

In Northern Finland the utilization rate is lower, but the distances are longer and accessibility is poorer.
Wood consumption is the highest in the Southern part of Finland.

Industrial roundwood removals are not sufficient for satisfying the demand in several regions.
Wood consumption in Finland
Wood flows in Finland

*Industrial processing dominates even use in energy production has increased.*

Forest

- Annual growth: 106
- Annual removals: 79
- Annual harvesting: 65
- Industrial roundwood: 64

P&P industry

- Roundwood & wood chips exports: 1
- Roundwood: 7
- Import sawdust & chips: 3
- Recycled fiber: 650,000 t

Wood products

- Sawdust & wood chips: 37
- Harvesting residues and drain: 5
- Increment of growing stock: 26
- Forest chips: 9
- Energy wood: 9

Recycled fiber

- Imports: 650,000 t

Wood consumption of the Finnish forest industries

Almost 60% of the wood consumption originates from P&P industries, whereas 35% is consumed by sawmills, mainly of medium and large size. The rest of the demand is created by birch plywood producers. In addition, 9 million m³ of wood is used for energy generation annually.

Total, 2015 – 64 million m³

Source: LUKE
Sawnwood and P&P production in Finland

Sawnwood production has not reached pre-crisis level of 2007. Currently, pine and spruce sawnwood account for equal share. Pulp production is still recovering from significant drop in 2009, accompanied by paper making capacity shrinkage. Sawmilling industry generates annually around 3 million m³ of wood chips, suitable for pulp production.
Raw material composition in P&P industries in Finland

More than half of the domestic raw material is comprised of coniferous pulpwood, whereas hardwood pulpwood accounts for 20%. Also, one fourth originated from wood industries processing residues and waste wood. Almost 9 million $m^3$ were imported, represented mainly by hardwood pulpwood and wood chips.
Future investments
Future investments
7 million m³/a increase in coniferous pulpwood and sawlog use in 2015-2017 and possible further increase of 10 million m³ in 2018-2020 and 5 million m³ thereafter.

<table>
<thead>
<tr>
<th>Company</th>
<th>Location / product</th>
<th>Investment, EUR million</th>
<th>Increase in wood use</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2015-2017</td>
<td></td>
<td>Current use 2 300 000 m³/a birch and coniferous pulpwood.</td>
<td></td>
</tr>
<tr>
<td>Metsä Group</td>
<td>Äänekoski 1 300 000 t/a pulp and other bioproducts</td>
<td>1 200</td>
<td>4 000 000 m³/a coniferous pulpwood.</td>
<td>Q3 2017</td>
</tr>
<tr>
<td>UPM</td>
<td>Kymi 170 000 t/a pulp increase</td>
<td>98</td>
<td>600 000 m³/a coniferous and birch pulpwood.</td>
<td>Q4 2017</td>
</tr>
<tr>
<td>Kotamills</td>
<td>Conversion from paper to packaging materials</td>
<td>170</td>
<td>200 000 m³/a of coniferous and birch pulpwood.</td>
<td>Q3 2016</td>
</tr>
<tr>
<td>Stora Enso</td>
<td>Varkaus 100 000 m³/a</td>
<td>43</td>
<td>250 000 m³/a coniferous sawlogs</td>
<td>Q2 2016</td>
</tr>
<tr>
<td>UPM</td>
<td>Varkaus 310 000 t/a pulp (+390 000 t/a kraftliner)</td>
<td>110</td>
<td>1 100 000 m³/a more coniferous pulpwood. 800 000 m³/a reduction in birch pulpwood.</td>
<td>Q4 2015</td>
</tr>
<tr>
<td>Keitele</td>
<td>Kemijärvi Lappl Timber 150 000 m³/a sawnwood / glulam</td>
<td>32</td>
<td>300 000 m³/a coniferous sawlogs.</td>
<td>Q1 2015</td>
</tr>
<tr>
<td></td>
<td>2018-2020</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boreal Bioref</td>
<td>Kemijärvi 400 000 t/a pulp and other bioproducts</td>
<td>750</td>
<td>ca. 2 200 000 m³/a coniferous pulpwood and chips</td>
<td>2019-2020</td>
</tr>
<tr>
<td>Kaidi</td>
<td>Kemi biofuel refinery 200 000 t/a biofuels</td>
<td>900</td>
<td>2 800 000 m³/a pulpwood, energy wood, wood residues</td>
<td>2019</td>
</tr>
<tr>
<td>Finnpulp</td>
<td>Kuopio 1 100 000 t/a pulp and other bioproducts</td>
<td>1 400</td>
<td>ca. 6 000 000 m³/a coniferous pulpwood.</td>
<td>2019</td>
</tr>
</tbody>
</table>

Other announced investment plans

<table>
<thead>
<tr>
<th>Company</th>
<th>Project Description</th>
<th>Investment</th>
<th>Increase in wood use</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Savonlinna biorefinery</td>
<td>Savonlinna 50 million liters of liquid biofuels</td>
<td>n.a.</td>
<td>n.a.</td>
<td>Announced Q3 2016</td>
</tr>
<tr>
<td>Kaicell Fibres</td>
<td>Kajaani or Paltamo 400 000-460 000 t/a pulp</td>
<td>n.a.</td>
<td>ca. 2 500 000 m³/a pulpwood.</td>
<td>Announced Q2 2015</td>
</tr>
<tr>
<td>Haapajärvi biorefinery</td>
<td>Haapajärvi, softwood kraft pulp, 400 000 t/a</td>
<td>500</td>
<td>ca. 2 million m³/a coniferous pulpwood</td>
<td>Announced Q2 2016</td>
</tr>
<tr>
<td>St1 Cellunolix®</td>
<td>Pietarsaari</td>
<td>n.a.</td>
<td>n.a.</td>
<td>Announced Q4 2016</td>
</tr>
</tbody>
</table>
Future investments

*Greenfield plans focused in central and north. Chinese involvement in more than one project.*

- Wood consumption will be increasing in the Northern and Central part of Finland.
- In 2015-2017 wood consumption is to increase by 7 million m$^3$, mainly represented by coniferous pulpwood.
- If all announced projects are completed, that will result into annual wood consumption growth of over 20 million m$^3$ by 2022.
- This would result in a significant additional supply of coniferous sawlogs and birch veneer logs in the domestic market.
**Future investments – Most significant projects**

**Äänekoski** is the only project under construction. Chinese CAMCE strongly involved in Kemijärvi project.

**Metsä** Äänekoski

- First next-generation bioproduct mill in the world
- Up in operation in Q3, 2017
- 1,2 billion € investment
- 1,3 million tons of pulp
- Bioproducts (tall oil, turpentine, lignin products, bioelectricity and wood fuel)
- 4.5 million m³ of coniferous pulpwood
- 2 million m³ of birch pulpwood
- Up to 2 500 jobs generated
- Annual impact of more than EUR 0.5 billion on Finland’s GDP

**Boreal Bioref**

- Develops biorefinery in Kemijärvi
- Up in operation in 2020. No investment decision yet
- EUR 780 million investment (letter of intent with CAMC Engineering signed in 2016)
- 400 000 t of pulp (dissolving pulp, long fibre market pulp)
- Bioproducts (microcrystalline cellulose, MCC C5- and C6 sugars, pine oil and turpentine, bioenergy, soil improvement substances)
- 2.3 million m³ of coniferous, mainly pine, pulpwood and chips from nearby sawmill
- Location close to Keitele group sawmill and glue laminated timber mill

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Future investments – Most significant projects

Chinese Kaidi involved in Kemi project. Finnpulp plan closest to the Äänekoski project which is under construction already.

**Kaidi**

- Second generation biorefinery
- Up in operation in 2019; investment decision to be done in 2017
- 900 million € investment carried out by Chinese Kaidi
- 225 000 metric t of biofuels (75% - renewable diesel, 25% - renewable gasoline)
- 2.8 million m³ of wood biomass (energy wood, harvesting residues and other brown side streams from sawmilling)

**Finnpulp**

- World's largest softwood pulp mill
- 1.4 billion € investment. No major investors announced yet. No investment decision
- 1.2 million tons of coniferous pulp
- 1 TWh of electricity and 65 000 t of tall oil
Future investments – Most significant projects

*Kaicell and Haapajärvi are 200 km from each other with no public information of investors.*

**Kaicell**
- Up in operation in 2020
- No investment decision yet
- Production capacity 450 000 t of coniferous sulphate pulp
- 2.5 million m$^3$ of coniferous pulpwood from Kainuu region

**Haapajärvi**
- Announced in April 2016
- Up in operation in 2020
- No investment decision yet
- Production capacity 400 000 t of coniferous kraft pulp
- Wood consumption of 2 million m$^3$/a (coniferous pulpwood)
Wood consumption growth in Finland

Significant number of investments is being planned and to be completed by 2022. Largest wood consumption growth originates in P&P sector. However, sawnwood output is required to increase to get the required fiber for these investments.
Wood consumption increase per region

Most of pulpwood consumption increase is for coniferous pulpwood.
Wood use would increase above local increment in central Finland.

- Boreal bioref in Kemijärvi and Kaidi in Kemi, both consuming pulpwood. Greenfield sawmill by Keitele.
- Kaicell, consuming pulpwood.
- Finnpulp, consuming pulpwood and expansion of Stora Enso’s Varkaus mill, both pulpwood and sawlogs.
- Äänikoski, consuming coniferous pulpwood.
- UPM’s Kymi and Kaukas pulpmills expansions, Kotkamill’s paper machine conversion; all pulpwood.

Most of pulpwood consumption increase is for coniferous pulpwood. Wood use would increase above local increment in central Finland.
Conclusions & implications for the sawmilling industry
Outlook for Finnish sawnwood industry
Announced P&P investments will significantly increase the demand for pulpwood and pulp chips. All investment plans are close to existing sawmills.
Outlook for Finnish sawnwood industry

Sawnwood production is expected to set new record level but the production growth can most likely be met by the existing sawmills.

- It can be expected that future investments in P&P sector will lead to increased sawlog availability on domestic market.
- Estimates of annual production growth have varied between 1.5 and 3 million m$^3$ – both levels would mean new national record production.
- Regardless of the eventual output increase, the whole production volume can most likely be produced by the existing sawmills through minor investment and/or debottlenecking as well as adding shifts in production.
Outlook for Finnish sawnwood industry

Finnish annual domestic market has been fluctuating between 3 and 4 Mm³ lately, whereas exports have been growing steadily since 2009 reaching almost 9 Mm³ in 2016. In case annual sawnwood output growth exceeds 1.5 Mm³, exports become more and more vital. Emerging markets would be of significant importance to absorb the new volumes.
Home takeaways

- There is a significant gap between the sustainable annual harvesting level and the actual drain
  - regional differences
  - supply-demand balance varies between wood species and assortments
  - economically available supply smaller than theoretical

- P&P industries account for almost 60% of the overall wood consumption
  - over three quarters is round pulpwood, and one quarter chips

- Numerous greenfield and capacity expansion investment announcements
  - P&P and bioeconomy represents a clear majority
  - Foreign ownership – especially Chinese
  - Unrealistic to expect all investment plans to materialize

- New P&P / bioeconomy investments require remarkable volumes of pulpwood as well as processing residues
  - Forest owners need to be able to sell their logs as well which require higher output from the sawmills
  - Domestic market can’t alone absorb the expected volume increase