Wood supply chain management for bio-energy in Europe, today and tomorrow?

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Do we speak the same language?

ENERGY UNITS AND CONVERSION FACTORS

toe = ton oil equivalent energy content
MWh = megawatt hour
GJ = giga joule

<table>
<thead>
<tr>
<th>Basic Units</th>
<th>toe</th>
<th>MWh</th>
<th>GJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>toe</td>
<td>1</td>
<td>11,63</td>
<td>41,868</td>
</tr>
<tr>
<td>MWh</td>
<td>0,08598</td>
<td>1</td>
<td>3,6</td>
</tr>
<tr>
<td>GJ</td>
<td>0,02388</td>
<td>0,2778</td>
<td>1</td>
</tr>
</tbody>
</table>
Don’t get lost in MWh…it all comes from biomass, either green or fossil!

One gigajoule (GJ) = $10^9$ joules = 0.948 million Btu = 239 million calories = 278 kWh

One metric tonne energy wood (air-dried, 35% moisture) = 3 MWh

One solid cubic meter energy wood = 2 MWh

1.3 loose cubic meter chips = 1 MWh

100 liters of oil = 1 MWh

One million cubic meters energy wood = 2 TWh

Wood biomass in Europe

EU: 27 countries : 480 million people

EU27: 147 million ha forest : 40% public vs. 60% private

EU27: 22000 million m$^3$ growing stock : 150 m$^3$/ha average growing stock

EU27: 448 million m$^3$ annual fellings
Milestones

Mar 2007:
A binding target to have 20% of the EU's overall energy consumption coming from renewables by 2020, and;
as part of the overall target, a binding minimum target for each member state to achieve at least 10% of their transport fuel consumption from biofuels

Jan 2008:
Commission presents a proposal for a directive to reach the targets set in March. Proposal forwarded to the EU Council and Parliament for approval

1st half 2009:
Target date for the adoption of the legislation

31 March 2010:
Deadline for EU states to present National Action Plans (NAPs) on renewables

Can these ambitious targets be reached?

<table>
<thead>
<tr>
<th>Member State</th>
<th>Share of renewables in 2005</th>
<th>Share required by 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>23.30%</td>
<td>34%</td>
</tr>
<tr>
<td>Belgium</td>
<td>2.20%</td>
<td>13%</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>9.40%</td>
<td>16%</td>
</tr>
<tr>
<td>Cyprus</td>
<td>2.90%</td>
<td>13%</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>6.10%</td>
<td>13%</td>
</tr>
<tr>
<td>Denmark</td>
<td>17%</td>
<td>30%</td>
</tr>
<tr>
<td>Estonia</td>
<td>18%</td>
<td>25%</td>
</tr>
<tr>
<td>Finland</td>
<td>28.50%</td>
<td>38%</td>
</tr>
<tr>
<td>France</td>
<td>10.30%</td>
<td>23%</td>
</tr>
<tr>
<td>Germany</td>
<td>5.80%</td>
<td>18%</td>
</tr>
<tr>
<td>Greece</td>
<td>6.90%</td>
<td>18%</td>
</tr>
<tr>
<td>Hungary</td>
<td>4.30%</td>
<td>13%</td>
</tr>
<tr>
<td>Ireland</td>
<td>3.10%</td>
<td>16%</td>
</tr>
<tr>
<td>Italy</td>
<td>5.20%</td>
<td>17%</td>
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<tr>
<td>Latvia</td>
<td>34.90%</td>
<td>42%</td>
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<tr>
<td>Lithuania</td>
<td>15%</td>
<td>23%</td>
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<tr>
<td>Luxembourg</td>
<td>0.90%</td>
<td>11%</td>
</tr>
<tr>
<td>Malta</td>
<td>0%</td>
<td>10%</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>2.40%</td>
<td>14%</td>
</tr>
<tr>
<td>Poland</td>
<td>7.20%</td>
<td>15%</td>
</tr>
<tr>
<td>Portugal</td>
<td>20.50%</td>
<td>31%</td>
</tr>
<tr>
<td>Romania</td>
<td>17.80%</td>
<td>24%</td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>6.70%</td>
<td>14%</td>
</tr>
<tr>
<td>Slovenia</td>
<td>16%</td>
<td>25%</td>
</tr>
<tr>
<td>Spain</td>
<td>8.70%</td>
<td>20%</td>
</tr>
<tr>
<td>Sweden</td>
<td>39.80%</td>
<td>49%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>1.30%</td>
<td>15%</td>
</tr>
</tbody>
</table>
Some means to achieve the objectives are in place already

- Governments in EU reacting to EU Directives related to renewable energy with:
  - VAT reductions or exemptions
  - green certificates
  - supply tariffs
  - investment supports
  - energy wood harvesting subsidy
  - chipping subsidy

- Companies are reacting with:
  - technological innovations and product modifications
  - increasing bio energy purchases with various means

Further stress to European forest industries due to Russians playing hard on wood resources

The Russian government is increasing their roundwood export duties of softwoods and birch logs (>15 cm in diameter) as follows:
- 10 euro/m3 by July 2007 (implemented)
- 15 euro/m3 by April 2008 (implemented)
- 50 euro/m3 by January 2009
- all tree species and assortments to 50 euro/m3 by 2011
- customes points for export clearance radically reduced 2008
- the Russian decision magnified with the EU targets on RES is intensifying the fiber buyers’ efforts to get more from the domestic sources across the Europe and several companies’ research efforts are magnified to come up with innovations
Biomass innovation chain

Power plant energy wood integrated management - ordering the biofuel via a web-based operational management tool
Information flow between the power plant and hauling contractor takes place via web. The sitemap can naturally also be sent as a paper copy, but then requires a delivery - taking longer time.

Planning and implementation of wood procurement

- Site maps have been drawn by the wood buyer using the browser, the mouse and appropriate feature marks.
- Machine operators orientate accordingly from one forest site to another.

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Planning and implementation of wood procurement

- If the contractor does not have the laptop with GPS and internet connection, he uses the mobile phone to log in into the company’s server.
- Work data is transmitted through mobile phone technology.
- Workers receive work site coordinates and instructions.
- Office controls the progress of work and plans further work steps accordingly.

1. Logging in the management application of the mobile phone

Planning and implementation of wood procurement

Using the mobile information technology

Moving in the application to position Tasks

Moving in the Tasks menu to Hauling

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Using the mobile information technology

Moving in the Hauling to indicate the location of fiber in relation to the road

Selection of appropriate sortiment of the fiber

The Hauling contractor keys in the system his own code and storage info; the number of piles, the amount (volume or weight) and the name of the job

Koordinates automatically from GPS

After the data entry, review it once more
Planning and implementation of wood procurement
Using the mobile information technology

After confirming move to Settings/Task manager and Send Task. Select the task that you want to send from the list and press “Send”

Planning and implementation of wood procurement
Using the mobile information technology

The selected data is sent to the net service using any available data link. The mobile phone acknowledges the sent data.

After the data has been sent the application can be closed and the phone used normally again.
The Contractor received the Work Order from the Power Plant - No Longer Waste Wood in our Terminology, New Wood Fiber Assortments Developed.

Wood residues are made into slash log bundles - based on harvester as prime mover

The bundler compresses the logging residue into "logs" approximately 3-metres long with a diameter of 70 cm. Their weight is between 400 and 600 kg and they are kept tight with a sisal or nylon rope. About 1/3 of the logging residue is left on the ground as fertilization. One hectare produces an average of 70 - 100 bundles (Spruce stand). One residue "slash log" contains abt 1 MWh of energy.
Wood residues are made into slash log bundles - based on truck as prime move

The Swedish Robico-built bundler. The unit compresses the logging residue into long "logs" approximately 4-5-metres long.

PROCESSING WHOLE STEMS WITH FIXTERI...

Photo: The innovator Pasi Romo / Biotukki Oy
Productivity of bundling

In normal conditions, with adequate slash volume, professional operator, correctly planned and executed harvester operations, the productivity varies between 15-25 bundles/operating hour. As any wood harvesting operation bundling productivity depends on several factors:

- Conditions (slope, soil bearing capacity, stonyness)
- Work quality (size of slash piles, orientation, cleanliness)
- Operator
- Volume (amount and type of slash)
STUMP REMOVING:
SPLITTING OF THE STUMPS INTO 3 PIECES

ASSORTMENT: STUMPS
360 m³/ha STUMPS REMOVED
Logs and bundles wait to be transported to end users

Bundles should stay in the landing for 1-1½ years to dry before taking to chipping, stumps for 2 years.

Bundles transport

By truck:
• Average distance 60 km
• max. economic 80 km
• Average distance when management control system in place: 40 km (Forest mgmnt assoc. of Hämeenlinna city in southern Finland)

By rail:
• average distance 150 km
• max. economic 200 km
Energy wood chipping is commonly done at the forest road to containers which are directly transported to the plant.

Typical chip transport distance 20-40km max. < 50 km.

Energy wood chipping at the power plant.
Essential role of wood management control systems in:

A. **Network management**
   - Work assignments, confirmation of work completions, receiving up-to-date reports etc.

B. **Feedback and information channel to farmers and forest owners**
   - BAT-practise, benchmarking, guidance, extension etc.

C. **Support of various biomaterials**
   - E.g. straw, chips, stumps, green forest residues etc.
   - Interfaces to other data processing systems of involved partners/companies
   - Personal ledger, statement of costs, logistics and other softwares etc.

Management control systems are needed for optimal mixture of biomass assortments, both for yard operations and for burning process.
Benefits of management control systems

To buyer of bioenergy
• Is able to update contract and other information directly from the field
• Is able to follow-up state of contracts by different filters (completing, unfinished, key-contracts etc.)
• Is able to compare a needforecast of production to yieldforecasts etc.

To production planning
• Total situation of storages can be seen at one view on WMS (Web Map Service)
• Storage statements can be monitored according to the rate of harvesting
• Up-to-date information and requirements of transportation can be controlled

Benefits of management control systems, cont.

To farmer/forest owner
• Gets useful information how to improve his cultivation methods via the service
• Is able to record quantity, quality and location of piles and storages to the service
• Is able to correct and update yield forecasts to the service
• Gets transportation date from the service
• Is able to check his own contract information

To truck driver
• Gets precise driving-instructions how to get to the storages cost-effectively
• Is able to record load information to application via GPRS, SMS or any data communication method
Benefits of management control systems, cont.

To power plant

- Enables different business models
  - management of own biomaterial procurement networks or use of brokers and enterpreneuer networks
  - management of moisture of biomass (under construction)
- Delivery safety improves
- Planning of transportations gets easier
  - opportunity to direct machinery rapidly to the correct targets
  - facilities just on time deliveries
- Management of moisture content
  - Enables to monitor and control the state of biomaterial storages in the field (quality, volume, energy content etc.)
  - Price difference (Finnish cost level) of a single truck load of chips is easily 500 €!
- Enables reporting to the authorities, security offices etc.
- Interfaces to own softwares (SAP etc.)
- Communication improves between players

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BIOENERGY PRODUCTION CHAIN - TERMINAL CHIPPING OF WHOLE TREES

BIOENERGY PRODUCTION CHAIN - CHIPPING WHOLE TREES AT THE ENERGY PLANT
BIOENERGY PRODUCTION CHAIN - CHIPPING SLASH AT THE TERMINAL

BIOENERGY PRODUCTION CHAIN - CHIPPING SLASH BUNDLES AT THE ENERGY PLANT
BIOENERGY PRODUCTION CHAIN - CHIPPING STUMPS AT THE TERMINAL

BIOENERGY PRODUCTION CHAIN - CHIPPING STUMPS AT THE ENERGY PLANT
Bioenergy needs create opportunities for innovations in harvesting, transport and operations controls

CURRENT TRENDS - DRIVEN BY COUNTRIES ADAPTING TO RES POLICIES

- New technology developed and old technology improved and adapted continuously for all phases of bioenergy harvesting and transport

- Most commonly road side chipping follows thinning and cleaning operations (small sized stems) and also chipping of the logging residues is more commonly done at the road side

- Most stumps are crushed at the place of use (energy plants)

- Terminal chipping is the most common method for stout, (decayed) whole tree chip production

- New management control tools, technology innovations and best practises will be used increasingly in the procurement chain
The future of developing bioenergy harvesting and transport is a technological challenge: “How are we going to meet all the objectives without jeopardizing the primary forest business?”

I hope that my presentation has given insights of solutions already now available, and that could at the same time be future for your operations!