

Business models in forest-based bioenergy production – “Show me the money”

Mr. Jyrki Raitila
VTT, Finland
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Business from technology

VTT - NEW TECHNOLOGY WITH SCIENCE-BASED INNOVATIONS

VTT IS:

- One of the biggest research organizations in Northern Europe
- An essential part of the Finnish innovation system

VTT HAS:

- Multidisciplinary R&D covering different fields of technology
- Clients and partners: industrial and business enterprises, organisations, universities and research institutes
- Turnover: 225 M€ (2005)
- Staff: 2 720 (2005)

VTT CREATES:

- Value added: New technology and science-based innovations in collaboration with domestic and foreign partners



Forest-based bioenergy business

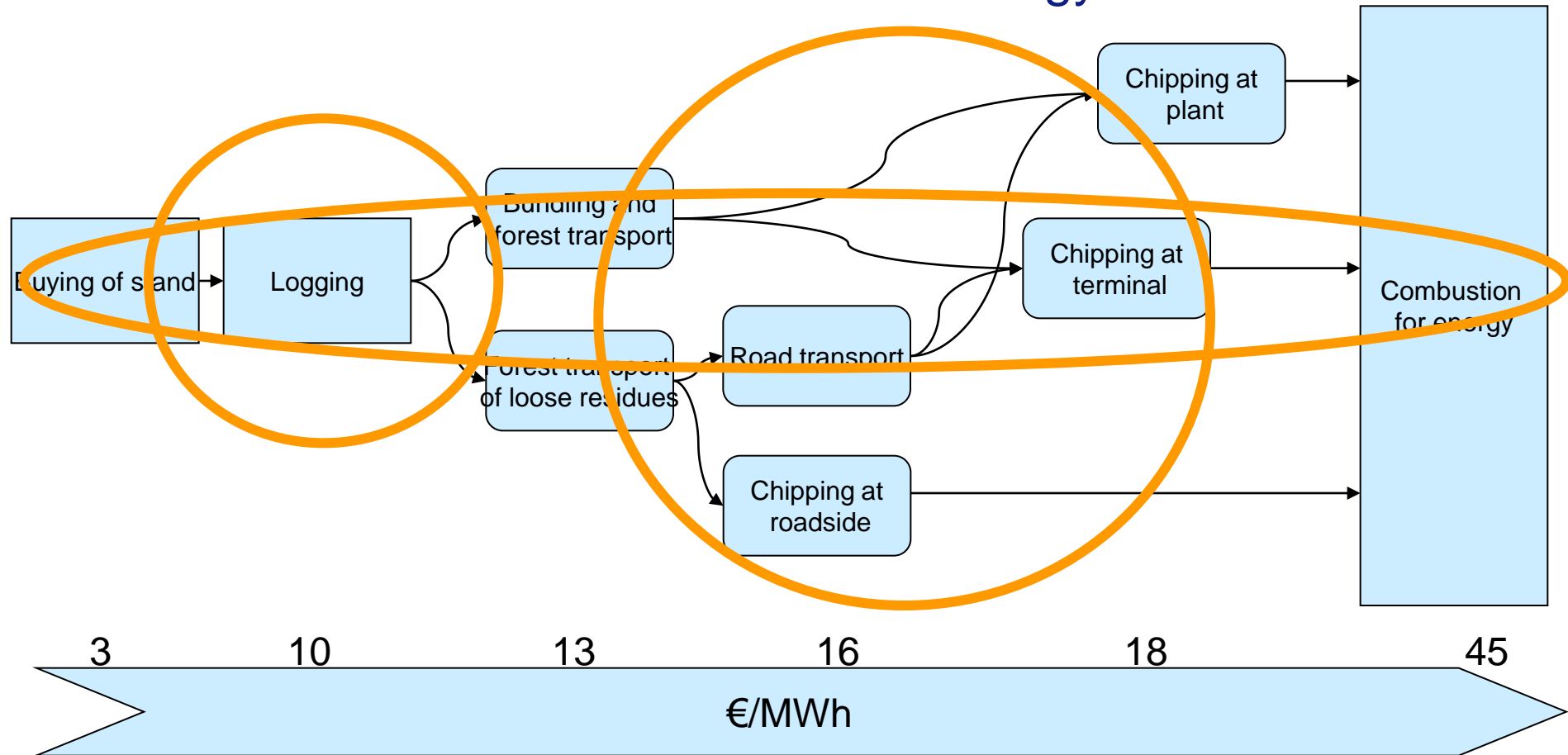
BUSINESS

- Primary production
- Manufacturing
- Resale
- Service
- Financing
- Real estate business
- Transport
- Information business



Source: Sikanen 2009, University of Joensuu

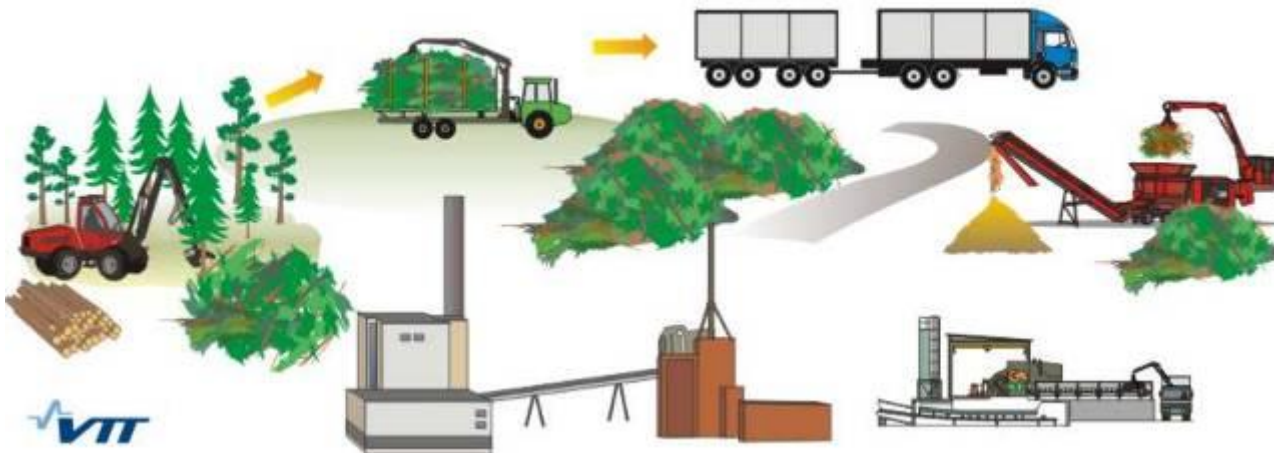
Value chain in the forest energy business



In each business model it is important to consider which part(s) of the value chain one wants to deal with.

Typical forest fuel supply chains in Finland (1)

Comminution at end-user facilities
Logging residues, mobile or stationary crusher



Logging residues

- Loose residues transported to plant
- Crushing at plant
- Efficient over short distances (<30 km)



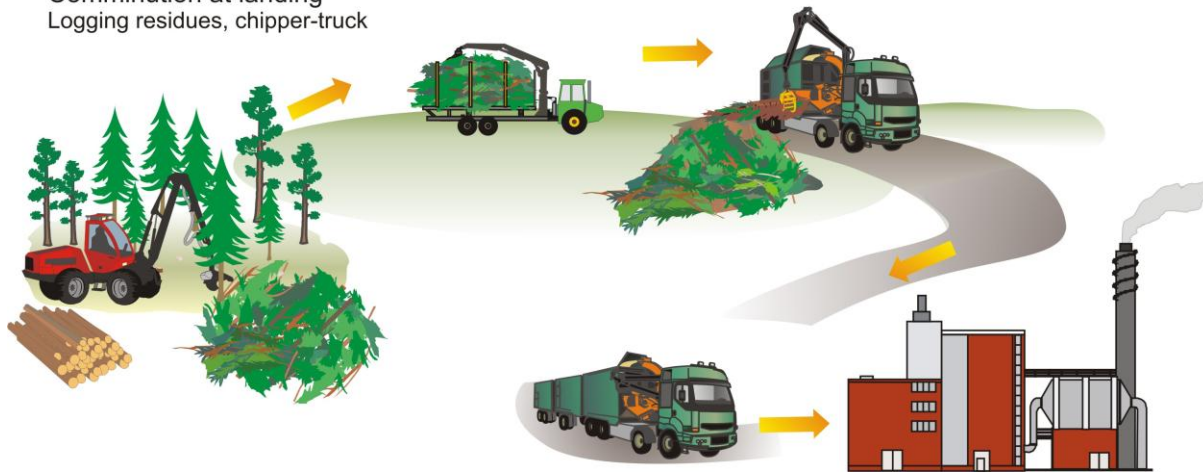
Forest haulage with a forwarder



Road transport with a full trailer truck;
low payload (15-25 ton)

Supply chains (2)

Comminution at landing
Logging residues, chipper-truck



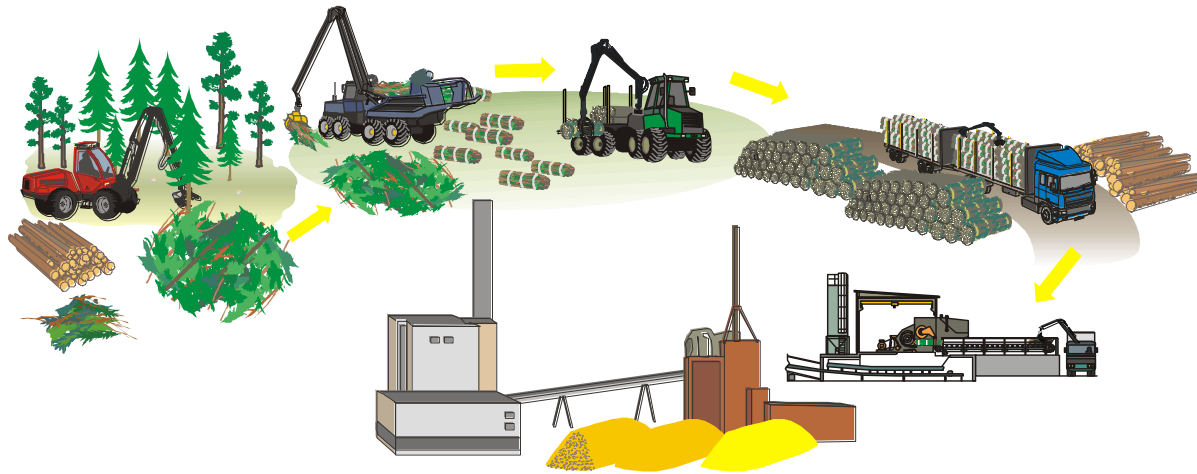
Chipping with a large mobile drum chipper

Logging residues

- Seasoned and chipped with mobile chippers at landing
- Chips transported to plant
- The best method in most situations

Supply chains (3)

Comminution at plant



Logging residues; bundling method

- Logging residues are first bundled with a bundler in order to increase the energy density of the load in long-distance transportation

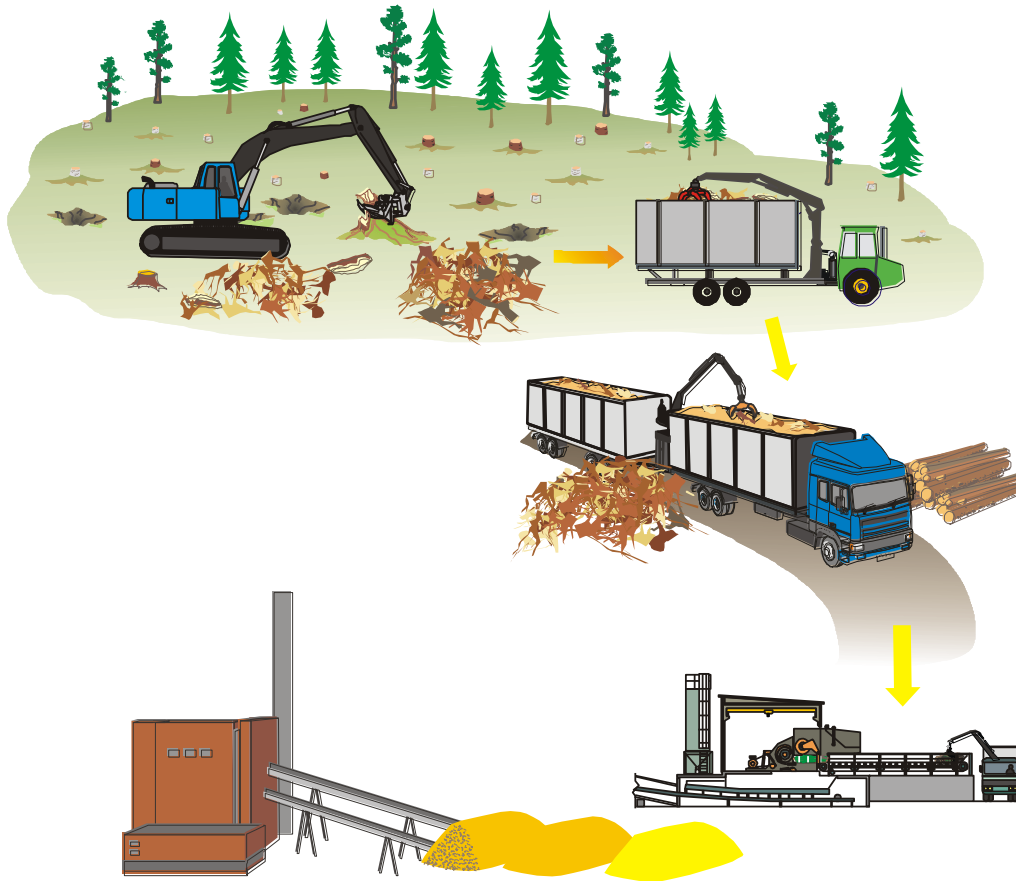


Bundler mounted on a forwarder



Road transport with a log truck

Supply chains (4)



Ketju-5-Kanto-Juuripuu.cdr/EAA/1.04

Stump extraction

- In spruce-dominant sites
- 100 MWh/ha
- Stumps seasoned for over a year, first on site and then at landing



Excavator fitted with a special bucket

Supply chains (5)

**Small trees from thinning**

- Pre-commercial and first thinnings; 30-50 MWh/ha
- Small trees are normally used at heating plants
- Forest machines smaller



Small harvester with an accumulating felling head



Chipping with a tractor chipper

Examples of forest energy business models in Finland (1)

CHIPPING AND CRUSHING/GRINDING

- Companies are specialized in using terminal-sized machines
- Based on contract work
- Transport often provided
- Biomurskaus Oy (Ltd.)



CHIPPING AND TRANSPORT

- Companies are specialized in chipping and transporting of chips
- Customers are heating plants and organizations supplying fuel for plants
- www.kotimaisetenergiat.fi



Examples of forest energy business models in Finland (2)

(BUYING) + HARVESTING + CHIPPING + TRANSPORT

- Specialized in harvesting, chipping and transporting energy wood
- Companies give advice to forest owners on the producing of wood chips of good quality and trade wood
- Add value through the sorting of energy wood
- www.kmeoy.fi

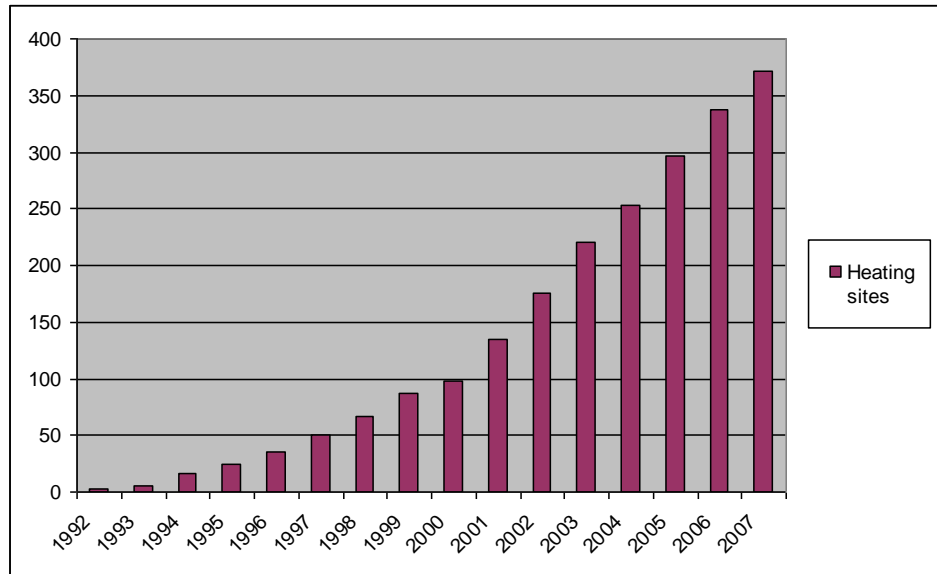
Examples of forest energy business models in Finland (3)

- **(BUYING) + HARVESTING + CHIPPING + TRANSPORT + PRODUCTION AND SUPPLY OF HEAT**
- Turnkey basis = management of the whole value chain
- Customer only pays for heat, not involved in the chain
- <http://www.jns.fi/energiaosuuskunnat/en.html>

Heating entrepreneurship (1)

- Definition and description
 - A single entrepreneur (e.g. farmer), a limited liability company, a co-operative, or an entrepreneur consortium which supplies heat for a customer
 - The entrepreneur operates the heating plant and earns an income based on the amount of heat produced
 - The heating plant is owned by the entrepreneur, municipality, or some other company
 - The enterprise operates locally and uses local wood (or peat)
 - Fuel usually comes from the forest of the entrepreneur and other local forest owners, or/and from the wood processing industry
- ESCO – Energy Service Company

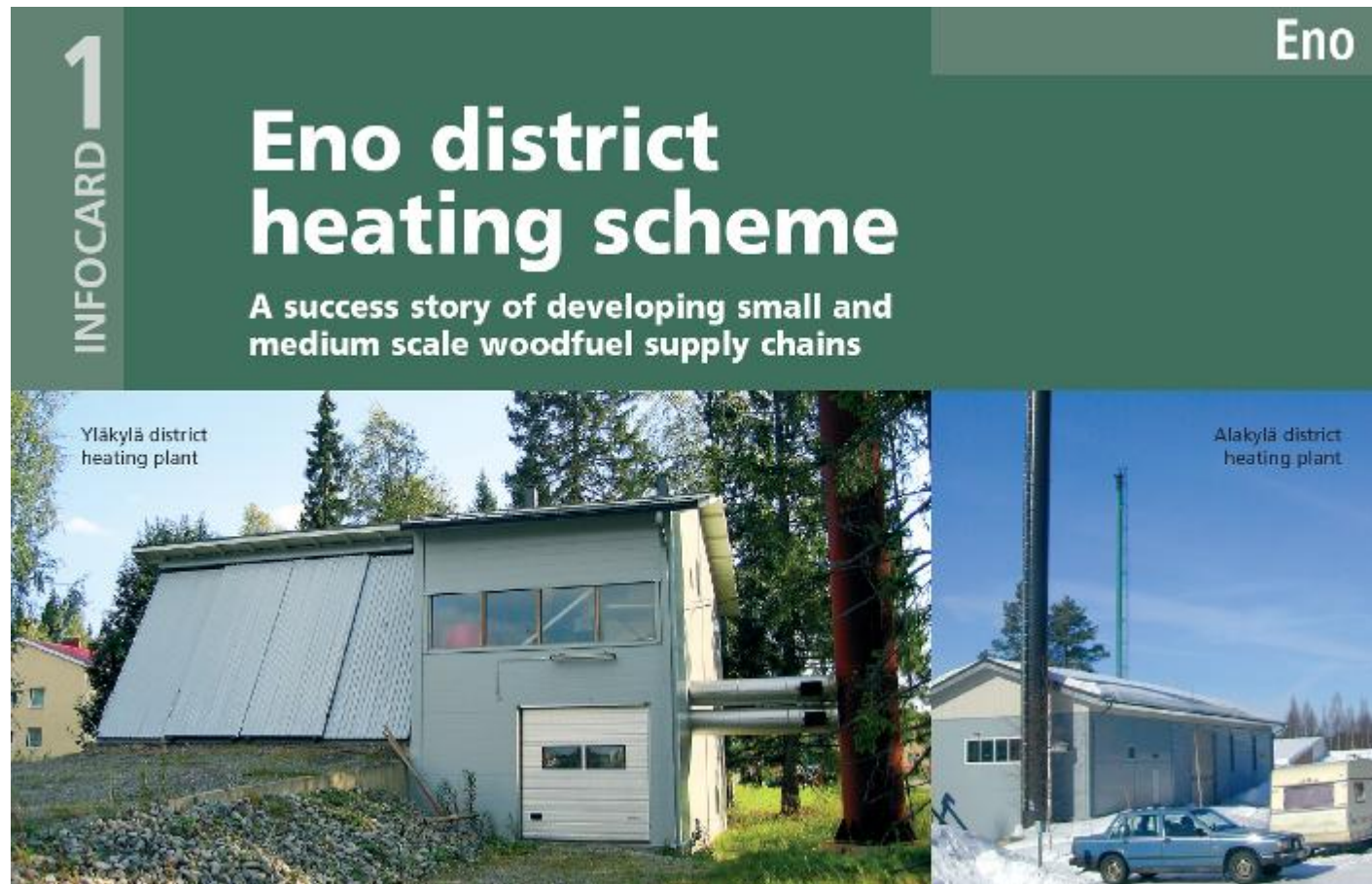
Heating entrepreneurship (2)



- The total number of heating sites managed by heating enterprises

Type of enterprise	Number of heating plants	Total output, MW	Average output, MW
Entrepreneur	149	58,8	0,39
Group of entrepreneurs	40	11,2	0,28
Co-operative	82	54,3	0,62
Limited company	99	68,4	0,69
Other	2	1,5	0,75
Total	372	194,2	0,52

Heating entrepreneurship – a success story



Source: Sikanen 2009, University of Joensuu

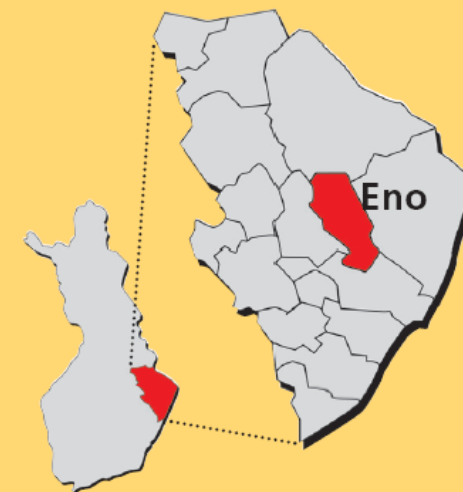
In 1997, the municipal council of Eno, included a paragraph about energywood utilisation in its natural resource strategy.

That decision has since been put into practice and has led to the establishment of three heating plants based on wood chips and the Eno Energy Cooperative. As a result carbon dioxide emissions were reduced by 3.2 million kilos annually.

Benefits:

- Heat produced using wood energy (33e/MWh) is remarkably cheaper for consumers compared to oil (51e/MWh, January 2006)
- Wood energy heating centers replace over 1 million liters of light oil
- About 700 000 euros (January 2006) were saved by the local economy
- The switching to local energy sources has created jobs for over 20 persons, totally 7–10 person-workyear.
- A local energy source brings safety and independence in times of a possible energy crisis.

Municipality of Eno



Eno is located in the heart of North Karelia, in the province of Eastern Finland, situated 35 kilometers from Joensuu.

Eno has 7.000 inhabitants and its area covers 1 088.63 km², of which 939.33 km² is land and 3 000 km² forests.

Although Eno is a small municipality, two population centers – the actual village of Eno and Uimaharju which are 16 kilometers from each other, can be

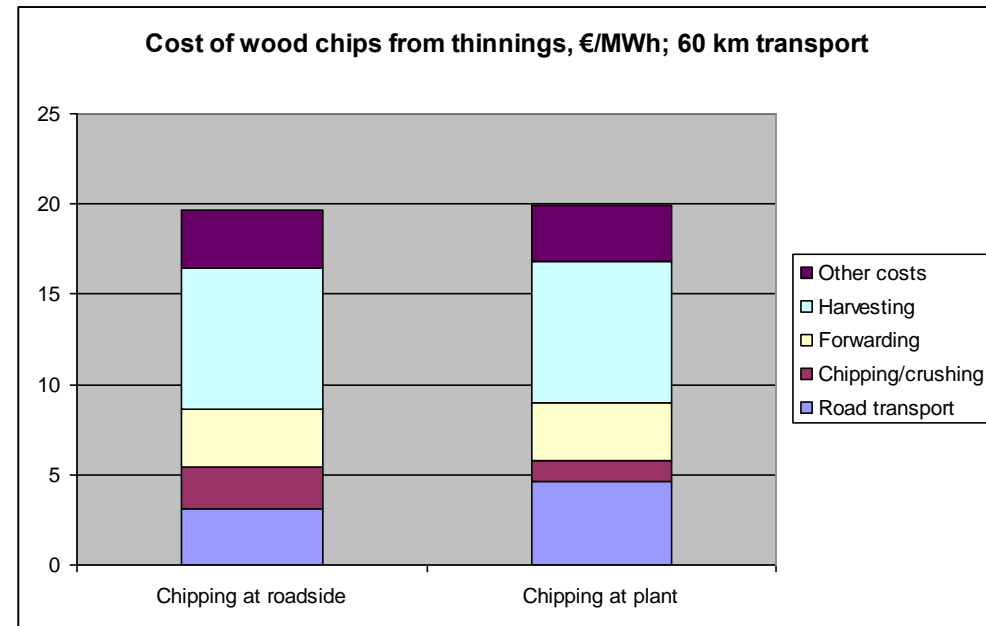
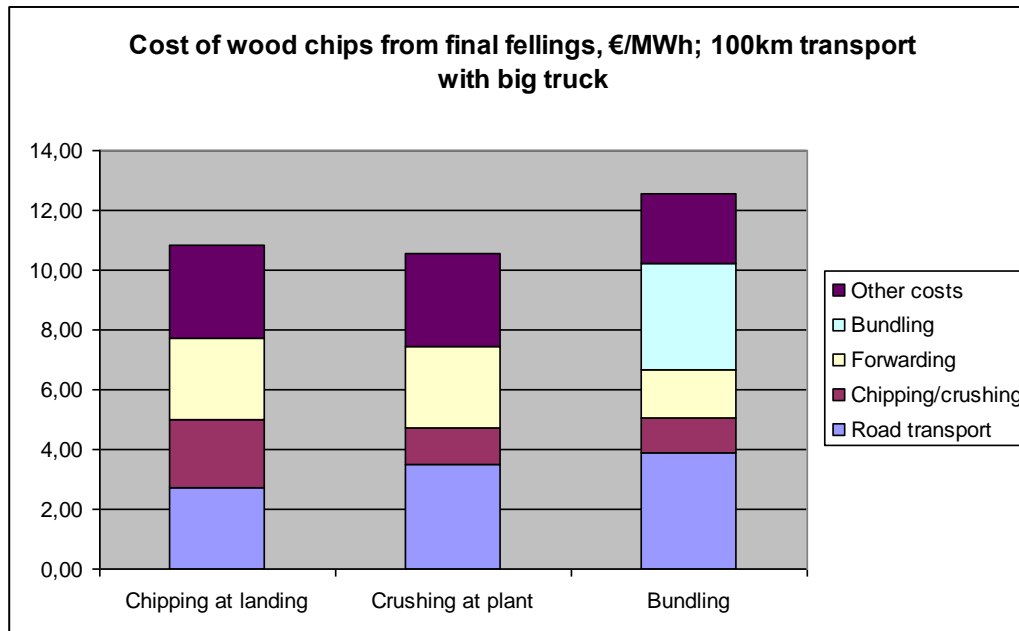


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Forest fuel procurement business

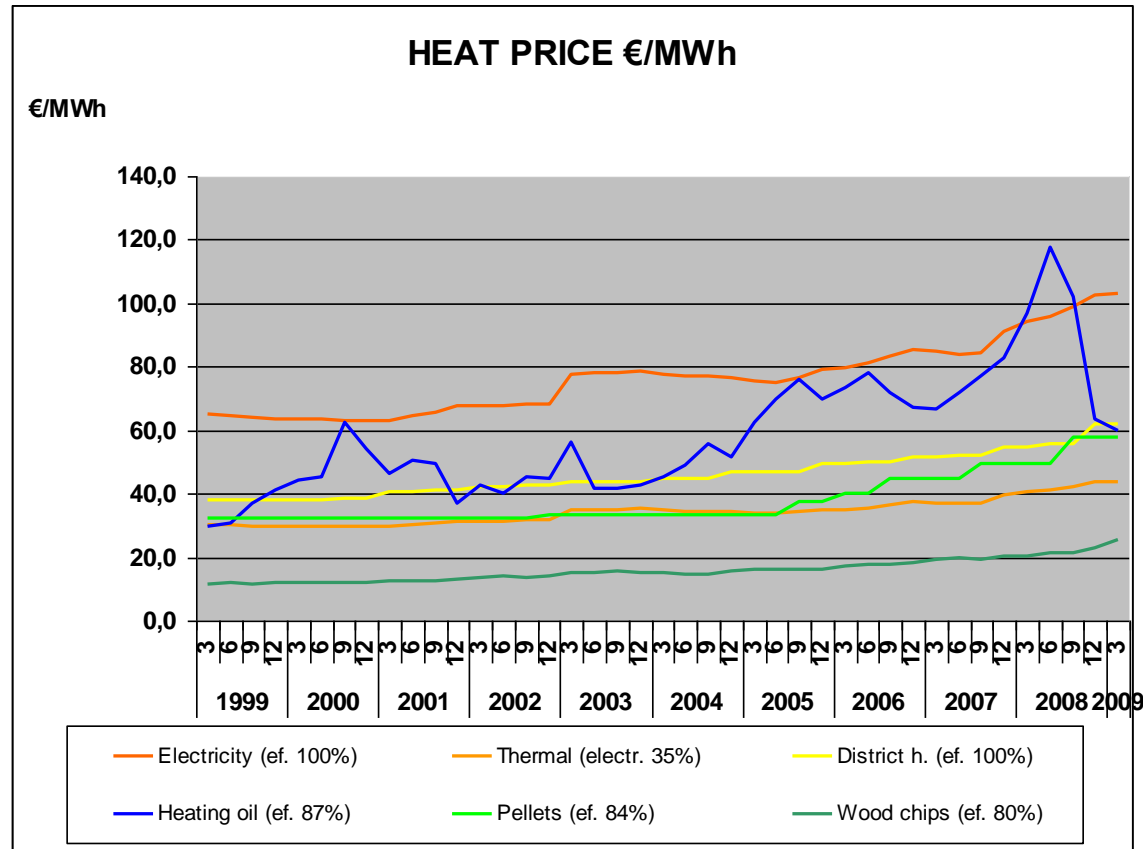
- Typical for large forest companies, e.g. Vapo, L&T Biowatti, UPM-Kymmene, Storaenso
- Use subcontractors at all stages of procurement
 - Investments in own machines to be avoided (if possible)
- Use the diverse expertise of a large company, for example in organization and contracting
- Wood fuel flows directed effectively to financially sound companies (= energy producers), depending on the market situation
- Can compete effectively in larger markets
- Requires effective management of storage sites as well as co-operation with subcontractors

Is forest fuel affordable – show me the money?



Examples of forest fuel procurement costs from Northwest Russia, calculated by VTT

Heat prices in Finland



Efficiency of different heating devices has been taken into account.

Investment costs have been excluded.

Conclusions

- Subcontracting model
 - Low investments; minimizing invested capital
 - Narrow margins require high volumes
 - Requires effective organization and contracting
- Heating entrepreneurship - 'Whole chain' model
 - Most or all parts of the supply chain managed by the same enterprise (e.g. co-operatives)
 - Requires large investments and long term commitment – no instant 'jack pots'
 - Freedom to organize roles among the owners
 - Value added by putting own expertise and efforts (labor) into the business
- Recent market development has proved both models to be profitable if they are done in a professional way



VTT creates business from technology

