Chapter

Business Models Covering the Entire Wood Heat Supply Chain

5

5.1. Case Studies from Austria: Development and Management of Wood Heat Business

5.1.1. Associative Forest Management Communities (AFMC)

5.1.1.1. Austrian Forest Communities

The structure of Austrian Forest Communities, abbreviated as FC (German: Waldverband – WV), is shown in the Figure 53. The Forest Communities are special organisations acting under the roof of the Austrian (and provincial) Chamber of Agriculture, which is a special interest group for the agricultural holdings in Austria. Several other forestry organisations are associated with or connected to the Forest Community, such as educational institutes, communication platforms, the Austrian biomass association, which represents the entire biomass sector in Austria as well as the Forest Wood Paper Board, the central platform for the coordination of the several wood supply and demand organisations. The Forest Community is interconnected with the certification body Programme for the Endorsement of Forest Certification (PEFC), which also means that all wood marketed by the Forest Community must be certified under the PEFC scheme. Finally, the Forest Community is also linked with the Confederation of European Forest Owners (*CEPF*).

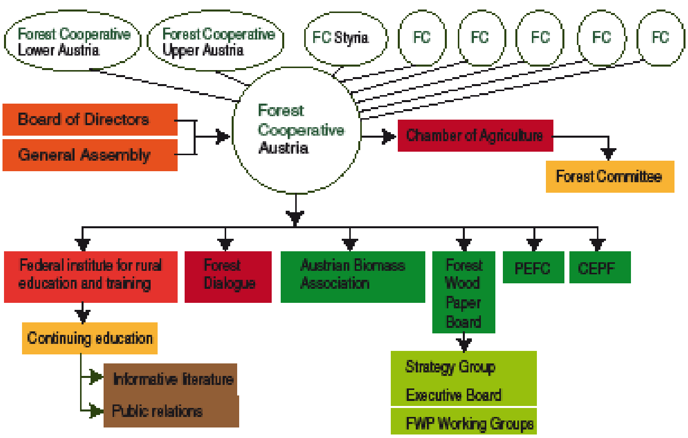


Figure 53. Structure of Austrian Forest Community (Hierner 2010)

5.1.1.2. Provincial Forest Communities

The Austrian Forest Community is organised into eight provincial Forest Communities, one for each provincial state of Austria (excepting Vienna). These organisations were founded between 1969, for the Austrian province Salzburg, and the year 2000, for the province of Lower Austria. All 296 local Associative Forest Management Communities (AFMCs) in Austria are organised under the umbrella of the provincial Forest Cooperative (www.waldverband-noe.at).

Around 47% of the total land area of Austria is forest, which corresponds to 3.96 million ha forest land in Austria. Out of this area, 873,000 ha are managed under the Forest Communities (Figure 54). 82% of the Austrian forest area is privately owned by 170,000 forest owners in total; 58,000 private forest owners are organised in Forest Communities. These figures show that even in Austria there is still potential to organise more forest owners into communities and associations, especially with the increasing demand of wood in the panel and paper industry and the bioenergy sector.

Corresponding to the large number of forest owners, most own small areas of forest land, as shown in Figure 55. As a result, 98% of forest owners can be categorised as owning “small-scale forest holdings” (<200 ha).

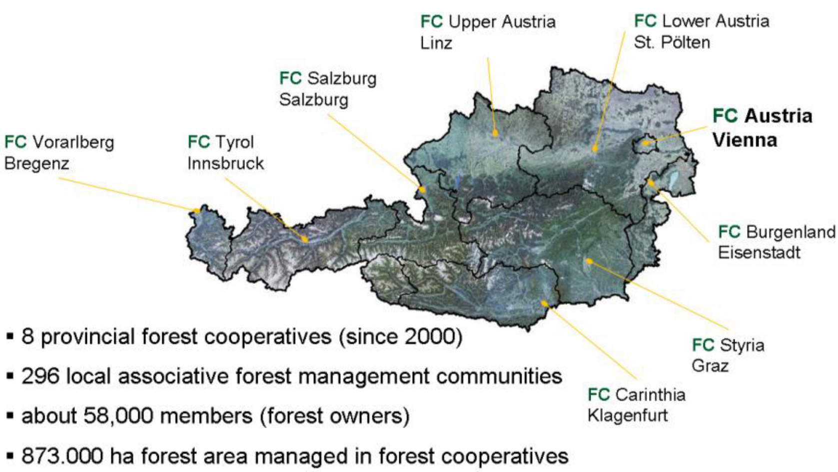


Figure 54. Provincial Forest Communities in Austria (Höbarth 2010)

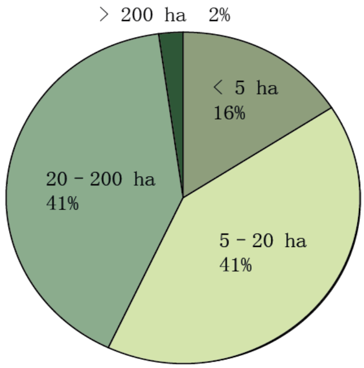


Figure 55. Size of forest areas according to the share of forest owners holding these areas (Höbarth 2010)

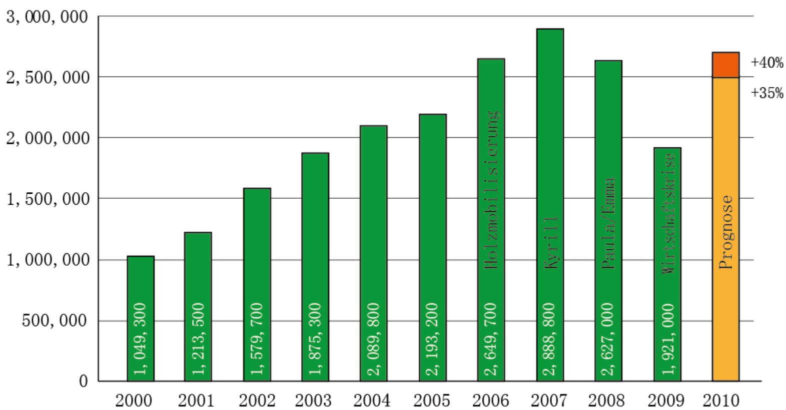


Figure 56. Collaborative wood supply through Forest Communities in Austria, in solid m³. (Waldverband Österreich 2010 in: Höbarth 2010; influencing factors: 2006 more wood mobilisation, 2007 and 2008 more fellings due to Kyrill storm and Paula/Emma storms, 2009: Economic crisis, 2010: prognosis)

The amount of wood supplied through the Forest Communities has increased since 2000, mainly due to the mobilisation of more forest owners organised in Forest Communities (Figure 56). A peak of wood supply was reached in 2007, when the Kyrill storm caused forest damage which resulted in more fellings. Fellings through Forest Communities also decreased in 2009 because of the global economic crisis. For 2010 again an increase of wood supply was forecast.

5.1.1.3. Associative Forest Management Communities (AFMCs)

All provinces in Austria (excluding Vienna) have a provincial Forest Community, each consisting of a different number of Associative Forest Management Communities. The reasons for the individual development of AFMCs are different and can involve:

- Historic reasons: cooperation and networks are traditionally strong in certain communities, e.g. in terms of agricultural associations
- Geographic reasons: e.g. cooperation and mutual support in communities along a valley
- Shared interests: collective purchasing and sales in order to benefit from economies of scale
- Number and area of forest owners in a region

Table 12. Federal provinces and number of associative forest management communities (AFMCs) status 2005

State Province in Austria	Number of AFMCs
Burgenland	5
Carinthia (7 regions)	44
Lower Austria (5 regions)	68
Upper Austria	73
Salzburg (5 regions)	20
Styria	80
Tyrol	2
Vorarlberg	2
Total	294

The Lower Austrian Forest Community consists of 68 associative forest management communities with 6,500 members who are responsible for 244,000 ha of forest. This provincial Forest Community represents their forest owner members in negotiations with the wood and paper industry. Today all local AFMCs are organised within the 8 provincial Forest Communities which together constitute the Austrian Forest Community. The several Forest Communities cooperate among each other, i.e. in wood marketing issues, negotiating with the wood industry etc. As a legal association, applications for governmental or EU support are easier to undertake.

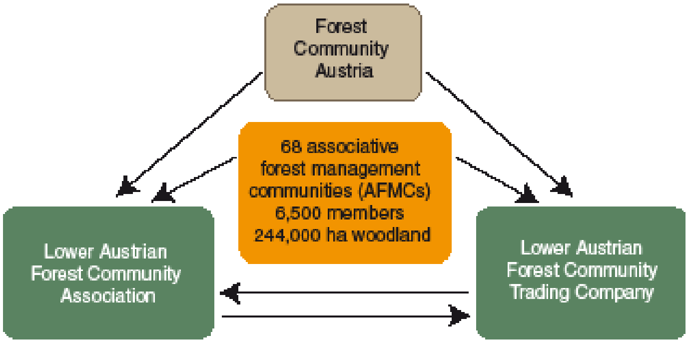


Figure 57. Responsibility structure of the Forest Community in Lower Austria (BIOENERGY2020+)

5.1.1.4. Example AFMC-Gaming

The associative forest management community AFMC Gaming was established in 1996 and now forms one of the 68 Lower Austrian Provincial Forest Councils. Four private forest owners initiated the formation of AFMC Gaming by organising a meeting to which all forest owners in the district were invited. The model was of great interest for the forest owners. As a result of this event, AFMC Gaming was established with 20 forest owners. During the following years new members expanded the membership to 45 owners.

AFMC Gaming was a pioneer, established prior to the formation of the Lower Austrian Forest Community, which was formed four years later. The original objective of AFMC Gaming was to coordinate the application and management of structural development funds in order to develop projects for the management of their forests and the utilisation of the wood. AFMCs were often initiated with the objective of taking up a stronger position against the saw mills and thus jointly negotiating fair prices for supplied wood.

Due to the rising number of biomass heat plants since the mid-1990s, AFMC Gaming now provides an increasing amount of wood as fuel to heat plants, as well the supply of timber to the wood industry. Today the objectives and services of the AFMC Gaming are:

- the trading of wood and wood chips (wood fuel)
- preferring contracts over several years
- supply the district Gaming heating plant with wood chips
- shared use of machinery
- support in fields of forest cultivation
- provide training for the members
- public relations

Characteristics of the Gaming 2005 heating plant, which is the main AFMC customer for wood chips:

- Type of customers: restaurant, hotel, monastery, Gaming and some private flats
- Connected load: 800 kW
- Net length: 300 m
- Annual heat demand: 1.1 MWh
- Investment costs: € 230,000
- Annual wood chip demand: 2,000 bulk cubic metre, soft wood (beech)
- Wood chip price level € 14–24 (depending soft / hard wood and moisture content)

Figure 58. Team of AFMC-Gaming (AFMC-Gaming)

The community members are not owners of the district heating plant; they are only responsible for the wood fuel supply. The members of AFMC Gaming provide 80% of the used wood fuel, and 20% is provided from private foresters who have other contracts with the members.

5.1.1.5. Profitability of AFMC-Gaming

An associative forest management community does not make profit from the organisation. The benefit for the members is in reaching better prices for their wood products (log wood, spit log (firewood) wood, wood chips) through collective bargaining. The AFMCs strive for long-term contracts with their consumers and with partners such as machinery service or transport companies.

5.1.1.6. Organisation and Handling of Current Businesses within AFMCs

The typical organisation of AFMCs is described based on the articles of association of the AFMC Stockenboi in Carinthia. These articles are also the basis for several other AFMCs in Austria. The main bodies of the AFMC are displayed in Figure 59.

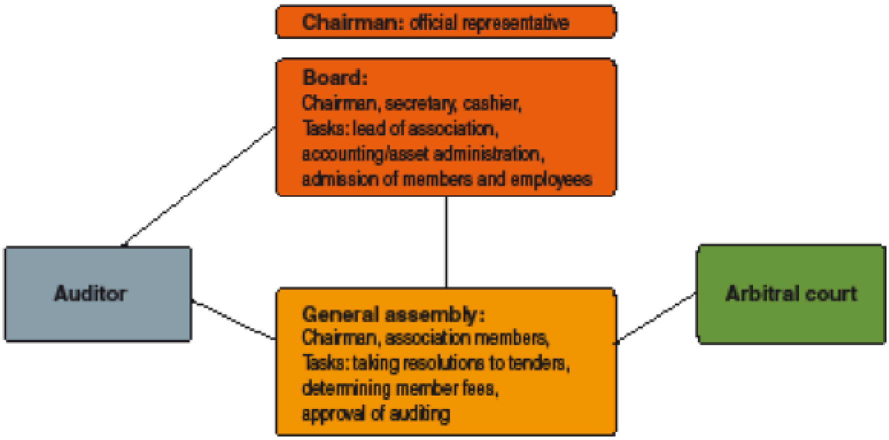


Figure 59. Main bodies of the Associative Forest Management Community (WWG Stockenboi 2010)

At least once a year, all members (forest owners) meet in the general assembly to discuss and agree about the continuous activities of the AFMC, tenders, the management of forest land etc. The general assembly is chaired by the chairman, who takes over the lead of the AFMC. The chairman is also responsible for the financial administration, the current business and transactions, and represents the AFMC and negotiates with business partners (wood consumers). The auditors of the AFMC are responsible for controlling current businesses and supervising the orderly accounting and utilisation of resources according to the articles of association. The arbitral court is set up in order to arbitrate all kind of potential disputes arising from the AFMC´s activities.

The general activities of the AFMC are discussed and decided upon during the general assembly, to which all members are invited. In this way, the members decide, for instance, the thinning or management of a certain forest area within the community and how to manage these actions, e.g. contracting a harvesting and machinery service or harvesting the forest land themselves in a group of forest owners, ordering transport etc. The chairman is in charge of finding consumers for the harvested wood (saw mills, biomass heat plant operators etc.) and negotiating fair prices for the supplied wood. Usually, the wood harvested in a certain forest area is proportionally valued according to the area and quality of wood owned by the individual forest owners.

The members of an AFMC are obliged by the Forest Community to market their wood (see § 7 in the articles of association). In the case of a forest owner who wants to fell wood for their own need, agreement is made with the chairman of the AFMC. A recent advance in the structure of AFMCs is the organisation of regional marketing units (a group of AFMCs) under the lead of a full-time manager. This structure is considered to optimise the regional marketing of wood in certain areas.

Other activities initiated by the provincial Forest Communities include special services for forest owners living remotely from their forest lands (full service for forest owners). Forest Communities also offer youth work in order to get young people (forest owners) interested in their woodland and/or to acquire future staff for the management of AFMCs.

5.1.1.7. Strengths and Weaknesses

The total forest land organised under the eight provincial Austrian Forest Communities altogether represents the biggest share of forest ownership in Austria, alongside the forest land of the Austrian Federal Forest Company (ÖBf) and a couple of owners of large forest areas. The same proportion of state owned forest land, and forest land organised by associative forest management communities can be found in the local provinces. This is why the Forest Communities are an important price negotiator with the timber and sawmilling industry. Due to its large number of members the AFMC is represented in each region and subregion. Information is presented informally and published in regular member newsletters, so that all members are well informed. Member fees (15–25 €) and payments from timber sales (≈0.5 €/m³) are used to finance the organisation.

Excellent education and best practice from professional foresters are shared with all members in practical sessions, such as field trips, excursions, chain saw training etc. (Figure 60).

The AFMC organises market interventions, such as in cases of high timber availability resulting from storms or pest infestations or in periods of low prices. The arrangements can involve extraordinary negotiations with wood customers or the preparation of bulk volume. Bulk volume allow long storage periods. In this case, timber is often humidified in order to prohibit bark beetles or other insects. Before final use of the timber, it has to be dried again. The moisture content is comparable to freshly harvested wood. This method is quite common in case of big storms, or to store huge volumes of wood (see Figure 61).

Figure 60. Examples of excursions and training (Hierner)

Figure 61. Example of bulk storage area, green timber (Hierner 2010)

The success of AFMC depends on several factors like private individuals' motivation, educational levels of members and the engagement of the head of the AFMC.

5.2. Applicability of Models from Austria – Contracts and Economy

5.2.1. Bioenergie NÖ Ltd. (Niederösterreich)

5.2.1.1. Description Bioenergie NÖ

The community Bioenergie NÖ Ltd. (http://www.agrarplus.at/projekte.energie.benoe.php) was estab-lished in August 2003 by the Agricultural Chamber of Lower Austria and "Agrar Plus", which is an organisation for the development of agricultural business. In contrast to a limited liability company, the profit of the Cooperative Ltd. will be divided amongst the cooperative members in equal shares.

The Bioenergie NÖ community now implements and operates small scale biomass heat plants in Lower Austria (see Figure 62). The cooperative enables the quick establishment of a profitable heating plant, essential for local governments and residential communities. The community members are farmers or foresters, who have to pay a membership fee of 600 €. Bioenergy NÖ has limited liability and works at cost. A critical success factor for the community has been a strong relationship with the Forest Communities and responsibility for the accountancy and costing functions.

Economic success is guaranteed by the following:

- Working at cost
- Structured accounting plan
- Specified quality standards
- Sensitivity analysis of markets
- Controlling of whole process

Characteristics of heat plants under Bioenergie NÖ:

- Members: 330
- Number of biomass plants developed: 50
- Number of customers: 339
- Connected load: 9,410 kW
- Net length: 8,930 m
- Annual heat demand: 12,000 MWh
- Investment costs: 6,755,570,-€
- Annual wood chip demand: 22,000 bulk cubic metre

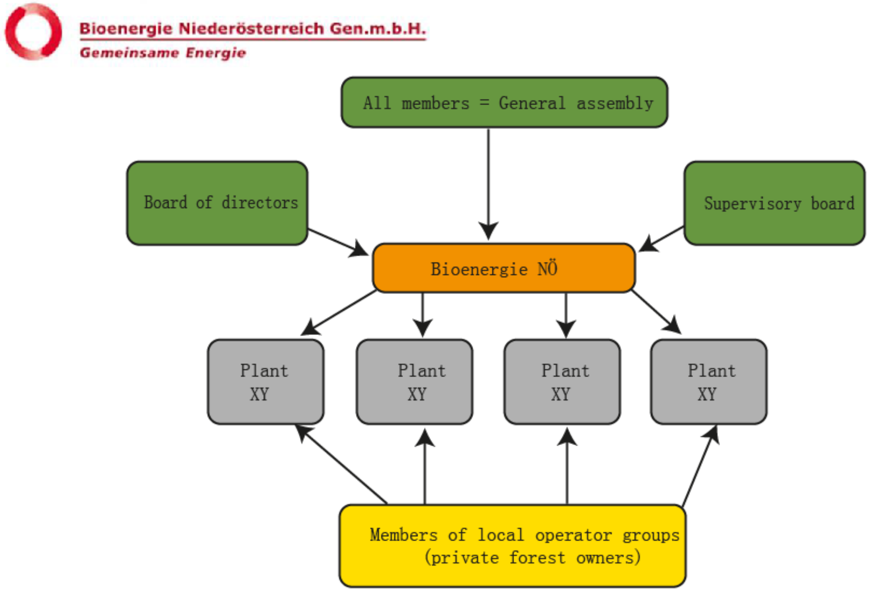


Figure 62. Organisational chart of Bioenergie NÖ (modified from Bioenergie NÖ)

The community members are the owners of the Bioenergie NÖ and form self-sufficient ‘communities’ to operate heat plants up to 1 MW, and are responsible for the daily operation of the heat plant. Bioenergie NÖ wants to be a professional and reliable partner for housing developers and municipalities. Key projects are biomass heat supply to large residential buildings, children’s nurseries, schools, community centres and civic centres with heat networks.

5.2.1.2. EXAMPLE – Heat Plant Hofstetten Grünau

Project Inception

Figure 63. Wood chip storage and furnace of heat plant Hofstetten-Grünau (BIOENERGY2020+)

In November 2009 the 500th heat plant in Lower Austria was developed by Bioenergie NÖ and was put into operation in the Hofstetten–Grünau municipality, which has about 2,500 inhabitants. The initiator of this project was a member of the local farmer association, Mr Patscheider. He wanted to build a heat plant because the old oil boiler of the municipality centre had to be replaced. Mr Patscheider approached the municipality and Bioenergie NÖ for help.

During the implementation phase some problems were overcome such as difficulty finding members for the coop which would operate the heat plant. This problem was addressed with the support of the associative forest management community (AFMC), which called special meetings to mobilise members to supply wood chips. Now a community with 30 members operates the heat plant and is responsible for the forest fuel supply. The second challenge was the site selection. There were problems with potential neighbours, who were afraid of particulate emission and noise. These problems were solved with the help of personal meetings and information sessions, which overcame the concerns of the residents. The whole implementation phase from the initial idea to commissioning the heat plant lasted about three years. Due to the support of the Bioenergie NÖ there were no problems regarding financing and funding.

Description of the procurement chain

The biomass suppliers are responsible for the forest work related to harvesting, chipping and transportation. Every year approximately 1,200 bulk m^3 of wood are transported to the heat plant, Hofstetten-Grünau. The delivery schedule is arranged by telephone, with delivery carried out by agricultural vehicles and dump trailers, or trucks. The heat plant has a shed, which is designed for the storage of 300 bulk m^3 of wood chips.

Profitability

The investment costs amounted to € 580,000, and the payback period was around 13 years. A subsidy for 30% of investment costs (fund for rural development) was obtained. The private forest owners receive € 21 / bulk cubic metre of their wood chips. The production and transport costs range between € 10–15 / bulk cubic metre depending on the location.

Strengths and Weaknesses

Bioenergie NÖ is responsible for the profitability of the heat plant. Members benefit from the low individual risk and exchange of experience in operating a heat plant. With the support of the Associative Forest Management Community (AFMC) the quality of wood chips and security of supply is guaranteed. While the community members of Bioenergie NÖ do not directly bear the risk for their individual heat, the potential risk of unprofitable heat plants is distributed to all community members.

5.2.2. Biomass Logistic and Trade Centres

Under the initiative of the EU project "Biomass Logistic and Trade Centres" (http://nuke.biomasstradecentres.eu) the Forest Community Styria and the

Styrian Chamber of Agriculture, developed a concept for the realisation of biomass centres, which sell wood biomass for energy use and accelerate the regional added value of this product. The EU project finished in October 2010: the project coordinator was AIEL – the Italian Agriforestry Energy Association (IT), and the Forest Community Styria was project partner.

The project's main idea was creating and/or enforcing a business with optimum logistics and trading organisation where different biomass fuels (e.g. logs, wood chips, pellet), of a guaranteed quality were marketed. The priority was the establishment of biomass logistic and trade centres as reliable suppliers of wood biomass and heat. The quality of the biomass fuel was ensured through standardised controls. Uniform market images with a strong brand identity promised a high recognition value to the customers, providing continuity and security, which is the responsibility of the Forest Community Styria and the Styrian Chamber of Agriculture. Until then, the business concept of biomass logistic and trade centres had been unique in Styria.

Several groups of farmers are willing to start biomass logistics and trade centres in other provinces of Austria. A crucial motivation is the availability of supporting funds, such as LEADER funding.

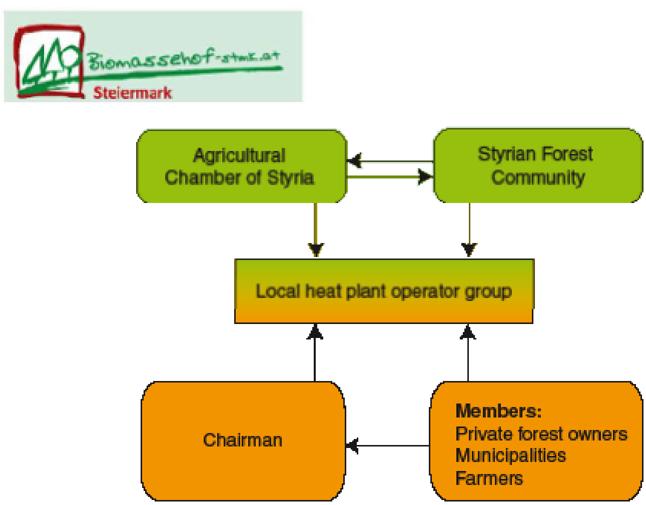


Figure 64. Organisational chart of biomass logistic and trade centres

5.2.2.1. Description of Biomass Logistic and Trade Centres

Figure 65. Biomass logistic and trade centre in Waldstein Styria (Waldverband Steiermark) (http://www.biomassehof-stmk.at/)

The central premises of biomass logistic and trade centres are:

- Increase security of biomass supply with a collective rural marketing channel for biomass fuels and energy services (e.g. wood energy harvesting contracting)
- Mobilise more biomass for energy purposes (wood chips, wood logs, pellets)
- Involve farmers and forest owners directly in the bioenergy market as operators of biomass trade centres ("Petrol station for biofuels")
- Guarantee high quality of biomass fuels
- Customers: private households, operators of wood energy contracting and district heating systems, business enterprises (hotels etc.)

These criteria must be met:

- The operators are members of the Forest Community (Waldverband)
- The operator group must consist of at least 10 forest owners
- Minimum quantity stored: 500 m^3 energy wood or the caloric equivalent of 1 million kWh energy
- Minimum requirements: storeroom, weighbridge, price depends on weight and moisture, additional storage area for the raw material

- Biomass centres are offering: energy wood, woodchips, log wood and pellets from regional forests
- Importation of raw material from other countries is not allowed

As well as these specific criteria, national laws and regulations have to be observed. In Austria, operators need a business license for the establishment of a Biomass logistics and trade centre. It has to comply with the Forest Act and the Soil, Water and Nature Conservation Act. Depending on the location of the centre, other regulations also have to be considered, such as the Traffic Act.

Table 13. Characteristics of three biomass logistics and trade centres in Styria (Waldverband Steiermark)

Date opened	May 2007	April 2008	October 2009
Raw material supply	60 members; 2,200 hectares	13 members; 3,000 hectares	50 members; 3,000 hectares
Sales volumes	7,000 loose m^3 of wood chips 400 stacked m^3 of split logs	14,000 loose m^3 of wood chips 800 stacked m^3 of split logs	14,000 loose m^3 of wood chips 800 stacked m^3 of split logs
Product range	Wood chips, split logs	Wood chips, split logs	Wood chips, split logs, pellets planned in future
Heating oil substitution per heating season	0.6 million litres	1.2 million litres	1.2 million litres
Greenhouse gas production per heating season	1,887 t CO_2	3,775 t CO_2	3,775 t CO_2
Target group	Heating plants, hotel and restaurant trade, private customers	Heating plants, hotel and restaurant trade, private customers	Heating plants, hotel and restaurant trade, private customers
Service	Delivery and pick-up	Delivery and pick-up	Delivery and pick-up

Checklist for the implementation of a biomass logistics and trade centre (Source: Waldverband Steiermark):

- Where is the raw material from?

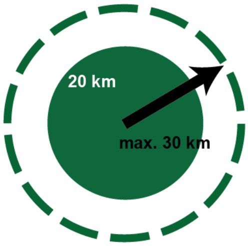
The potential suppliers should be within a maximum radius of 30km from the centre. Check whether there are enough potential suppliers in this radius.

- Who are the customers?

Check whether there are enough potential customers, such as biomass district heating plants, CHP-plants based on biomass or private households and business enterprises, in the radius of 30km. How high is the heat demand?

- Which site requirements must be met?

Information about the regulatory framework is required, e.g. solid and groundwater protection, emission and noise protection.



5.2.2.2. Biomass Trade Centre Pölstal

Project inception

The Biomass centre in Pölstal was established in April 2008. The community, which operates the biomass centre consists of eleven private forest owners, the Pölstal municipality and a cattle breeding cooperation. The reasons for establishing a biomass centre in Pölstal was the wish of the municipality for a self-sustaining energy supply and the wish of the private forest owners to sell their wood locally. The implementation was supported by the Forest Community Styria, who started the initiative and contacted forest owners. Agents of the Forest Community Styria instructed the community members about BLTC operation.

In addition to the 11 community members as biomass suppliers, there is a fixed delivery contract with the local AFMC, which is composed of 100 members, and guarantees supply. The catchment area for supply is a maximum of 30 km. Initially there was some scepticism about the high investment costs (about 600,000 €), but this was offset by private forest owners generating higher profits due to the direct sale of heat, and regional subsidies (30% of the investment costs) also helped the biomass centre Pölstal to open.

Description of the procurement chain

The biomass suppliers are responsible for forestry work related to harvesting, chipping and transportation. Every year about 8,000 solid m³ of wood are transported to the biomass centre in Pölstal. The delivery is concentrated in winter and spring; and the delivery schedule is arranged by telephone. The delivery is carried out mainly in agricultural vehicles and dump trailers, sometimes by truck. The biomass centre has a hall which is designed for the storage of 6,000 m³ of wood chips, as well as an external storage with an area of 20,000 m².

Figure 66. Biomass logistics and trade centre in Pölstal Styria (Waldverband Steiermark)

5.3. Case Studies from Finland: Development and Management of the Wood Heat Business

5.3.1. Case–VakkaLämpö Co-operative, Toivakka, Central-Finland

Background

A local district wood heating system in Toivakka, a small rural town with 2,400 inhabitants, was initiated by the municipality. Increasing oil prices made the municipal government look for cheaper possibilities to heat their own buildings and provide heat for people living in the town centre. Having plenty of forest owners and forest resources in Toivakka it was natural to opt for wood heating. The municipality made all the required investments to build a new heating system, including the boiler and control devices, the boiler house and a connection to an existing distribution network in 2002. At that time there was an oil fired boiler in the school building, which heated the municipality's facilities, such as the town hall, church hall and one terraced house. Once the wood fired boiler started its operation the old oil fired systems remained as backup systems.

The 700kW wood chip boiler was supplied by Tulostekniikka Oy (Ltd.) in 2002. The investment costs were 380,000 €. 20% investment support was received from TE-centre (currently Ely Centre, the Centre for Economic Development, Transport and the Environment). Some direct support for building the boiler house was also obtained from the company Suur-Savon Sähkö.

The running and maintenance of the plant was put out to tender and the operating and maintenance of the plant was then outsourced to a local, recently founded co-operative, VakkaLämpö, that also provides wood chips. This co-operative consists of three farmers and a forest management association. The municipality originally made a three year contract with the co-operative. VakkaLämpö has remained as the plant operator after following the tendering processes. In the coming years a private kindergarten and school facility enlargement will join the wood heated district heat network.

Fuel procurement

The Toivakka heating plant uses wood chips made from small wood from clearings and thinnings. Oil is used only during servicing of the main boiler and as a back-up fuel if problems occur with the feeding or combustion of wood.

As stated above, a local co-operative is in charge of wood fuel supply. In practice the local forest management association (Mhy Päijänne) provides 80% of all wood chips through their normal logging chains. In Finland forest management association usually have a twofold role, on one hand they give advice and practical help to forest owners about how to manage their forest well, and on the other they help in timber and other wood sales and organise logging if requested. Forest management associations are mainly funded by the government but they also make money on organising wood sales for forest owners.

The remaining 20% of wood chips are produced by farmers. The vast majority of wood fuel comes from mechanised supply chains, illustrated in a case study of Ekowatti. Whole trees are stored at a road side at least over one summer and then chipped on location with a mobile chipper. A sample of each chip load is taken and the moisture content of chips measured on delivery of the wood chips. The provider is paid based on the energy content of the chips (€/MWh).

Figure 67. Small tree chipping with disc chipper (Kesla) at a road side (VTT)

Figure 68. Toivakka heating plant, 0.7 MW (Jyrki Raitila)

Heating plant

Investment by an initiative of the municipality took place in 2002, to decrease the costs of heating municipal buildings. The existing distribution network was connected to the new plant with a new 400 m outlet.

The plant operates unmanned and is highly automated. Fuzzy logic is used to control the operations and combustion of the boiler. In case of disturbance, fuzzy logic uses the original settings and sends a message to the controlling computer and to the mobile phone of the operator. Combustion is controlled by an oxygen sensor. Wood chips are conveyed to the grate using blade dischargers and screws.

Facts

Table 14. Technical details of Toivakka Heating plant

Boiler output	700 kW
Fuel	Wood chips 95% and heating oil 5%
Heated building volume	40,000 m^3
Heat production	2,500–4,000 MWh
Investment costs	380,000 €
Operation started	2002

Benefits of the cooperative model

The cooperative model offers a good baseline for an easy business foundation and simple contract arrangement between Vakkalämpö and Toivakka municipality. Because the initial plant investment was made by the municipality, the contract for heat supply is rather simple. A new contract is agreed for plant operation and heat supply each year between the municipality and the co-operative. Vakkalämpö is paid according to the amount of energy (MWh) supplied to the municipality. Vakkalämpö's fuel suppliers are paid according to the energy content of the supplied wood fuel (€/MWh). In addition, members of the co-operative receive a separate payment for running the plant (paid by the hour). Wood fuel supply chains are mostly in the hands of trained professionals (Päijänne MHY). The whole wood fuel harvesting chains integrated into the round wood supply using the same machines and operators as for other timber assortments (http://www.woodheatsolutions.eu, www.afo.eu.com).

5.3.2. Case–Joutsan Ekowatti Oy (Ltd.), Joutsa, Central-Finland

Background

Joutsan Ekowatti Oy (Ltd.) was established in 2004, driven by a need for a new heating system with a cheaper and predictable fuel price compared to light heating oil. The enterprise was initiated by a small door and window frame manufacturer (Puusepänliike Tamminen) who, on the one hand needed a heat source, and on the other had wood residues for a wood fired heating plant.

Suitable business partners were soon found through previous contacts: a forest service company, a real estate management company and an accounting company. Expertise for all necessary operations for running the heating plant was found in the companies involved. There are no paid staff for the heating plant because most of the time it is automated.

Figure 69. Joutsan Ekowatti plant (Jyrki Raitila)

Fuel Procurement

The vast majority of wood fuels are procured by Metsäpirkka Ky, one of the owners of the heating company. Metsäpirkka is a forest service company offering services to forest owners from afforestation to logging. Their main emphasis is on manual logging and the tending of young forests, so wood fuel from pre-commercial thinnings is easily at hand. Wood residues from the door and window frame factory are also used in the heating plant.

Typical supply chains for wood chips from small trees are illustrated in Figure 70. Metsäpirkka employs about 30 timberjacks involved in manual logging and other forest operations, e.g. afforestation. During spring, summer and autumn (no snow cover) the number of lumberjacks is increased to 100. Manual felling methods are mostly used in seedling and young forest tending. A chainsaw with felling frame is a suitable option for small wood felling and bunching. In addition to normal energy wood harvesting Metsäpirkka specialises in challenging sites, where machines are not wanted and "softer" forest treatments are requested.

In order to reduce costs and increase the productivity of small wood harvesting, many different mechanised felling methods have been introduced.

The general trend in small wood felling is that several trees are processed simultaneously by using accumulative felling heads. It is possible to use these felling heads with many different base machines, including farm tractors, excavators and harvesters.

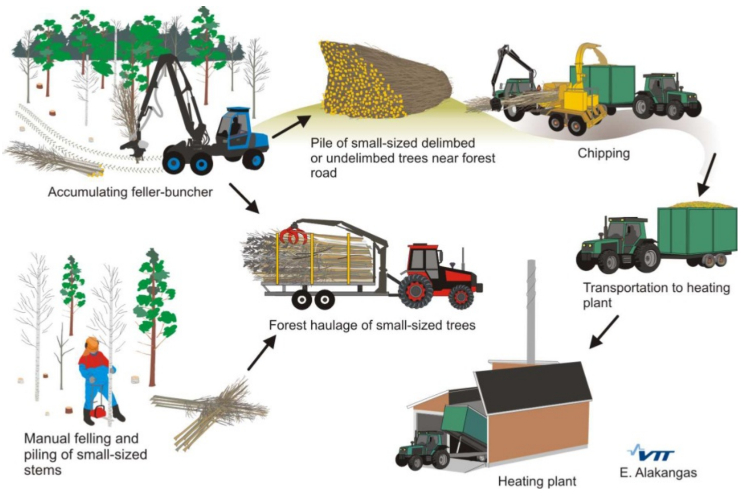


Figure 70. Wood chip supply chains for heat entrepreneurs (VTT)

Whole trees are stored at a road side at least over one summer and then chipped there with a mobile chipper. A sample of each chip load is taken and the moisture content of chips measured on the delivery of the wood chips. The provider is paid based on the energy content of the chips (e/MWh).

Heating plant

The wood chip boiler of Ekowatti in the Joutsa industrial park has a capacity of 1 MW thermal. The whole system, including the boiler, controlling devices, screws and boiler house, was delivered by Tulostekniikka Oy. The plant operates unmanned and is highly automated. Fuzzy logic is used to control the operation and combustion of the boiler. In case of disturbance, fuzzy logic uses the original settings and sends a message to the controlling computer and to the mobile phone of the operator. Combustion is controlled by an oxygen sensor. Wood chips are conveyed to the grate using blade dischargers and screws.

Facts

Table 15. Technical details of Ekowatti Heating plant

Boiler output	1 MW
Fuel	Wood chips 95% (80% from forest, 15% from wood residues), 5% light heating oil
Heated building volume	25,000 m^3
Heat production	4,000 MWh
Investment costs	500,000 €
Operation started	2004

Benefits of the limited company model

As a limited company Ekovatti can make its own decisions and is not tied to municipal decision making. The core advantage of Ekowatti is that its owners have an extremely good mix of different skills and expertise within the company consortia (fuel supplier, bookkeeping company and a company producing a by products for fuel). The quality of management and reliability of fuel availability is good because the fuel supply chains are in the hands of one of the owners (a professional in forestry).

The fact that the company owns its heat installation requires a long term contract with their customers. In Ekowatti's case all customers are located in an industrial area. This has kept the heat distribution network costs at a reasonable level.

Fuel suppliers (mostly Metsäpirkka) are paid according to the energy content of the supplied fuel (€/MWh). The company gains payments from the customers through a one-time connection fee, monthly basic fee and for used energy. The boiler technology selected by the company represents proven and reliable technology (http://www.woodheatsolutions.eu, www.afo.eu.com).

5.4. Contracts and Economy of Biomass Heating Business in Finland

5.4.1. Contracts

Contracts between the heat producer and client

Once the need for a heat plant has been identified, the heat producer and the client can start negotiating the heat supply contract. To make the contract as comprehensive as possible, it should include at least the following (Solmio et al. 2006):

- Amount of heat produced
- Price of heat and pricing basis
- Start date of heat delivery
- Measuring the amount of delivered heat
- Ownership of the heating equipment and measuring devices, their maintenance and repair
- Securing the heat supply
- Commencement and duration of the contract
- Termination of the contract and compensation

By including the above mentioned items in the contract, possible dispute situations will be easier and cheaper to resolve. Good practice is to think of all the things that can go wrong in the heat supply chain, and include negotiation and solution methods for worst case situations. In heat supply cases these "what if?" situations can include the malfunctioning of the heat plant, insufficient raw material deliveries, etc.

The contract between the heat producer and the client commits the heat producer to supplying a certain amount of heat to a certain place for a certain time, and commits the client to buying the heat supplied by the producer. A basic heat supply contract agrees on these issues as clearly as possible, leaving as little room for interpretation as possible. It is usual that the need for heat may vary during the duration of the contract, especially in a long term contract, so this should also be taken into account. In order to avoid financial loss in acquiring substituting energy, the start date of heat supply should be stated in the contract as well as the sanctions if not followed. Delays in the construction of the heat plant may cause the heat supply to be delayed, if the schedule has been made too tight, or if the raw material acquisition has not been planned sufficiently or the weather conditions do not allow for harvests to take place. The start date of the heat supply should be planned so that the plant will be finished, test run and the receiving inspection completed (Solmio et al 2006).

Heat is normally measured at the premises of the client by the units given in contract or by heat exchange, which is the border where the ownership of the pipes changes. Inevitably there will be some deviations in the heat measurement equipment, and the allowable deviation should be stated in the contract. If the heat meter is not functioning properly, the invoicing will be mismatched to the overall heat supply, causing losses to one or both of the parties (Solmio et al. 2006).

Example of an index-linked price for heat energy:

X = Z*(A%*An/Ao + B%*Bn-Bo), where:
X = New energy price, €/MWh
Z = Price paid by the buyer in the previous contract year, €/MWh
A%, B% = Weight of each fuel in the price
An = Average price of wood chips in the current year, €/MWh
Ao = Average price of wood chips in the previous year, €/MWh
Bn = Average price of heating oil in the current year, €/MWh
Bo = Average price of heating oil in the previous year, €/MWh

Fictional parties have agreed to produce heat to a fictional municipality in 12/2006.

The price has been decided as index-linked to the price of wood chips (50%) and light fuel oil (50%) published in the Energy Report published by the Ministry of Trade and Industry.

The price for energy was set as 40€/MWh (excl. VAT) when commencing the heat delivery.

Prices at the time (2/2007) the contract was made (VAT 0%):
Wood chips 12.87 €/MWh, and
Light heating oil 64.96€/MWh

In December 2008 the prices were (VAT 0%):
Wood chips 13.14 €/MWh, and
Light heating oil 67.77 €/MWh

The new price is calculated as
40 €/MWh * (0.50*13.14/12,87 + 0.50*67.77/64.96) = 41.20 €/MWh
And total price for energy sold would be 50.26 €/MWh (including 22% VAT).

Figure 71. Example of calculating the redemption price for the heat plant (Saramäki 2007)

If all the heat produced in the heat plant is sold to one building only, it is possible to invoice the heat based on the total heat produced in the plant. In most cases, the heat is sold to many buildings, although the client is the same. If the heat is sold to separate buildings, the heat may be invoiced according to the heat delivered to the client, and verified from the heat measuring device. Heat is generally invoiced monthly and the normal basis for pricing is MWh. The formula for calculating the MWh should be included in the contract. Prices can be based on a connection fee, a fixed annual or monthly fee and the price paid for each MWh of heat. The fixed fee is meant to partly cover the investment costs of building the heat plant. If the client owns and builds the heat plant, then of course the fixed fee is not necessary. The price of heat can be defined in a number of ways. One way is to link the price of heat to the price of alternative fuels, such as heavy fuel oil, light fuel oil, and wood chips. This way price changes in those fuels will affect the price of heat produced in a pre-determined manner (Solmio et al 2006).

The heat plant itself can be owned by the heat producer or the client, and this determines responsibility for its maintenance and repair. In usual cases, the owner of any plant is responsible for the operability of the plant and its equipment, and the operator of the heat plant is responsible for its maintenance and repair, as well as ash removal and cleaning the surroundings of the plant. The disposal of ash should be agreed on in the contract. If the heat plant is run by a cooperative, it is most likely that the cooperative members will dispose of ashes as fertilizers in their own forests. However, local regulations must be adhered to (Saramäki 2007).

When heating bigger estates or a number of estates, and when the heat producing unit is not physically attached to the building to be heated, heat distribution networks must be constructed. If the heating unit is attached to the building, no network is necessary and the heat distribution pipes can be directly connected to the building. Building such networks requires licensing and extensive earth moving as well as professionals to build them.

The ownership and construction responsibility of the network should be stated clearly in the contract. Extra costs for maintaining the network may also arise later, if chemicals or water need to be added to the network or if there are leakages in the network which need to be repaired (Saramäki 2007).

Contracts are generally drawn up for several years. Shorter contracts, from two to five years, are made if the client maintains ownership of the heat plant. This way the client will have the option of changing the heat producer after the contract period has ended. If the heat producer owns the heat plant, a longer contract could be justified and the investment costs are higher. Longer contracts allow the investor to repay possible loans taken out for the construction of the heat plant. In a good contract there will be clauses allowing the parties to continue their contract after the contract period, but also clauses stating when the contract can be cancelled by either of the parties. If the heat producer owns the heat plant, it is appropriate to state a redemption price for the plant in the case the contract is cancelled. Cancelling the contract should always be done in writing (Saramäki 2007).

An example of calculating the redemption price for a heat plant:

A = (B – C) – [{D*(B – C)}*E], where

A = Redemption price of heat plant

B = Investment costs of the construction of the heat plant

C = Investment subsidies granted to the heat plant

D = Annual depreciation-% of plant, for example 7%= 0.07

E = Age of the heat plant at time of redemption in years

The redemption price shall exceed 0€.

Figure 72. Example of an index-linked price for heat energy (Modified from Saramäki 2007, p. 92)

In case there are disagreements between the heat producer and the client, contractual penalties can be included. The penalties will be employed if either of the parties seriously breaches the terms of the contract. A protocol for resolving disagreements over the contract should be stated in the contract.

Contracts between entrepreneurs and forest owners

Cooperative members need to have a clear understanding of each member's obligations and rights. When forming a cooperative, in addition to the statutory forms, a Member Agreement should be written and signed by the members. The Member Agreement can include guidelines for day-today operations performed by the cooperative, and the scheduling of work. In a heat producing cooperative, the Member Agreement should include the following (Solmio et al 2005):

- Dividing the heat delivery and plant monitoring shifts between the cooperative members
- Quantitative division of raw material deliveries and scheduling
- Arrangements for substituting personnel to ensure heat supply
- Maintenance and repair of joint equipment and dividing the costs between the cooperative members
- Division of earned profit

In heating enterprises and plants run by, for example, a group of entrepreneurs, obligations and tasks are usually divided depending on the role of each partner. However, to avoid disagreements these obligations should be put in writing.

Even if the heat producer is a cooperative, it may buy raw material from external sources. When the heat is produced by a single entrepreneur or a group of entrepreneurs, raw material is often bought from external sources as well. In these cases, contracts are also made between the heat producer and the forest owners. Depending on the country, there may be a need to pay taxes in advance for selling or buying wood. In addition to buying the raw material, contracts may be necessary to arrange harvesting, forwarding, chipping and long distance transport. In some cases, the co-operative members or the single entrepreneur may have machinery for these operations readily available. If not, contractors are needed. When using contractors it is better to have the contract written (Saramäki 2007).

5.4.2. Business Models

5.4.2.1. Investment by Customer

A business model in which the municipality or other customer owns the heat production equipment and an entrepreneur produces heat, is popular because the economic risk for the entrepreneur is small. In practice, the customer invests in the heating plant and entrepreneurs take care of the fuel supply and operations for a set compensation (Okkonen et al. 2005).

The size of the plant, that is, the amount of heat produced, affects the details of the business model. The entrepreneur often runs their business on a part-time basis if the plant is small. Since the biggest investment comes from the customer, the entrepreneur can operate with a small initial capital and the business model is often a trade name/company name/sole trader. One way to organise heat production is a company ring, where several entrepreneurs share responsibilities according to their strengths, and agree on compensations. Similarly, in the case of a larger heating units, it makes sense to choose a business model to correspond to challenges of business activity, e.g. co-operative or limited companies (Suhonen 2006).

From the customer's point of view the advantage of the business model is the fact that the heat production equipment stays in the customer's ownership, in other words, the customer retains authority over heat production. However, if the initial investment is high, the customer also has to carry the economic risk. In addition, the question of responsibility between the entrepreneur and the customer can in some cases be problematic.

In practice, in the business model of investment by the customer, an entrepreneur purchases the raw material as cheaply as possible, either as wood chips or as by-products of forest or sawmill operations. The entrepreneur can have various suppliers such as forest machine contractors, chipper users, or foresters. Correspondingly, the customer acquires the operational institutions like the plant and network as well as taking care of the sale of heat to other customers. Basically operations cannot be divided between several contractors if the operations are small-scale and the business is meant to be profitable. From the entrepreneur's point of view the investment is functional if the entrepreneur can minimise risks and work part-time. Correspondingly, where the intention is to expand the operation and make it more and more profitable, this business model is not the best choice (Suhonen 2006).

5.4.2.2. Investment by Entrepreneur

In this second business model the entrepreneur invests in heat production equipment. In practice, the entrepreneur carries the economic risk, because all the possible technical faults and economic risks (e.g. rise in interest rate) are directed straight to the entrepreneur. On the other hand, greater investment should enable the entrepreneur to achieve greater profit (Okkonen et al. 2005).

The amount of heat produced affects the business model and its corporate forms, as in the investment by customer model. From the customer's point of view outsourcing the business is a good option when one wants to direct capacities to core functions, such as health care services. On the other hand, if business is completely outsourced, the heat entrepreneur acquires what may effectively be a leading market position. However, this can be influenced by a detailed contract which defines, among other things. factors that affect the price of heat. From an entrepreneur's point of view the business model is favourable if they are capable of and willing to carry risks. In addition, in slightly larger operations the entrepreneur can work fulltime and the investment can be expected to make profit (Suhonen 2006).

The working method for the customer on the level of practical business operations is to pay only for the heat produced, which payment consists of a joining fee, basic fee and user fee. The entrepreneur supplies production equipment and takes care of operational activity and management. Raw material can be acquired individually by the entrepreneur or by subcontracting. It has to be remembered that where the business is small-scale the raw material supplied as a subcontract reduces the entrepreneur's profits. On the other hand, in large-scale operations the entrepreneur can reduce the risks; investments in transportation equipment or chipper are not necessary (Suhonen 2006).

As a rule, the more the entrepreneur refines the raw material, the better the profits are for the company. As an example, if an entrepreneur produces the raw material from their own forest, takes care of transportation, storage, chipping and heat production in their own heat plant, the return from the sale of wood heat is highest. However, this presumes strong tolerance for risks, and economic, as well as mental, resources.

5.4.2.3. Large-scale Enterprise: A Network Model

Heat production organised by a large-scale enterprise constitutes another business model. A large-scale enterprise can organise heat production in two ways: 1) an enterprise invests in and owns production equipment and takes responsibility for heat production; and 2) a customer invests in and owns the equipment, but the enterprise is responsible for heat production (Vapo 2005).

What is typical for both methods is that a large company shares heat production activities between subcontractors. These include, for instance, raw material supply, transportation, chipping and the service and maintenance of a heat plant. An enterprise can thus carry the risk of investment, but share the risk of production with subcontractors and pay for a small scale entrepreneur to deal with agreed measures. In general the model requires heat production to be large-scale (Suhonen 2006).

It is important that a large company has experience of heat production, and good risk taking capacity. These matters are also important from the customer's point of view, because they secure heat production. The model is suitable for small-scale entrepreneurs when they are not willing to expand their operations. This activity/operation is well suited to a business model in which a customer owns the heat production equipment and an entrepreneur produces heat for the customer. It has to be noted that if there is an extra participant between the customer and the service producer it may reduce the entrepreneur's business profit (Saramäki 2007).

It may be that in this model the company only has to supervise or take care of administration. The company also controls the heat plant acquisition process. In addition, the unit's/company's operational activity is left to a subcontractor. Raw material is acquired from where it is the most economical and thus local entrepreneurs can be in competition with subcontractors. In a large-scale enterprise model a customer pays for a large company that takes responsibility for the operations (Suhonen 2006).

5.4.2.4. ESCo

The ESCo (Energy Service Company) business model derives from functional models aimed at energy saving. In the original ESCo concept, a company (from outside) provides services and investments for a customer to reduce energy consumption. The company improves energy efficiency, and operations are paid back with the savings from reduced energy costs. In heat production, the company invests in heat production equipment and the customer pays the same price as before the investment. The heat produced with a new (wood fuel based) system is cheaper than in the older (fossil fuel) system. After the company has had the investment back, the customer gain ownership of the equipment and also lower heating costs. Model has been applied for heat production in Scotland, for instance, and pilot projects have also been tested in Finland (Kokkonen 2005).

This model is suitable for customers who are willing to keep the ownership of heat production equipment, but who do not have the resources for large investments. For the entrepreneur who has experience in profitability calculations, and also resources to make investments, the ESCo concept may be a good option. However, this concept requires very good basis in both heat production techniques, and in investment calculations. This model is quite difficult to apply on a small scale. The biggest problem from a company's point of view is the size of the investment and long pay back periods (5 to 15 years). If a company makes several simultaneous investments, significant financial resources are needed. On the other hand, a company is sure to have the ready-made concepts and skills to run the operations. A stable price level during the payback time reduces the economic risk of the company (Suhonen 2006).

From the customer's point of view, the strengths of this model are: a small investment risk, steady heat price for agreed period and ownership of the equipment. The negative aspect is a long payback period. Usually a heating system can be used for 15 to 25 years without any major re-investments, which must be remembered when making the contract; although the price for the customer is the same, the total costs are affected by the length of the payback time (Suomen Kuntaliitto 2002).

Since the ESCo company operates on a broad scale, raw material has a major effect on business profitability. A company must have ready and clear raw material supplier chains: 1) by-product flow, or 2) considerable forest resources. In practice this means that by-product flow can supply high quality raw material at an economic price. On the other hand, considerable forest resources in a particular area make co-operative activity possible. Moreover, it is possible that the ESCo company could take over the supply of raw material and operational activity as a subcontractor. In this case the operation can be considered a type of franchising. All in all, ESCo company operations are limited by large investments that tie up capital for equipment; this is too high a risk for the entrepreneur from the point of view of profit as well as long-term investment.

5.4.2.5. Franchising

Franchising is a business model where two independent partners (franchiser and franchisee) have a contract. The franchiser has a developed business model and concedes rights to the franchisee to use this model according to the franchise agreement. The franchisee operates according to the operational instructions, which are planned and looked after by the franchiser. The franchisee pays the franchiser for the rights to use a developed business trademark. In heat production, franchising could be organised in the following way: a franchiser offers the trademark, business concept and operational principles, and the entrepreneur (franchisee) would work for both themself and for the franchiser. In practice, the franchiser would support the franchisee in planning, investments, financing, contracts, maintenance, fuel supply and other practical issues. As compensation, the franchisee would pay for this support. For the entrepreneur, franchising would provide professional support and economic reliability. In practice franchising would require full-time entrepreneurship. The customer does not need to invest in a heating plant, i.e. the entrepreneur takes the risk of investment. This model is just starting to be explored in Finland, building on experience gained in Austria (Suhonen 2006).

Mentioned process would help the entrepreneur in planning the chain. This would mean that the chain would decide the best alternative for raw material resources, clearing, chipping transportation and storage, which make the operations effective for the entrepreneur and the chain. The chain would also take care of, among other things, subcontracts and other administrative issues, which makes it easier for the entrepreneur. On the other hand, quality requirements of the raw material supply may complicate the entrepreneur's businesses. There is a demand for a franchising business model in heat entrepreneurship, because potential entrepreneurs and customers might consider a ready-made concept a good and flexible option.

However, the need for major initial capital constitutes a problem for the business activity. The investment needed to open a ready-made chain are considerable, which means that the model requires great risk taking. Actual profits would only be made after several years (Saramäki 2007).

5.4.2.6. Biomass Heat Containers

Figure 73. Maxicont 250 heating container (Megakone Oy)

In Finland a business model where a company provides a ready-to-use heating unit for the customer has evolved. There are similarities between this model and the large-scale enterprise model and franchising concept, but it differs from them in some respects. The company provides a ready-to-use heating unit for the customer. The company owns the unit and customer pays for the company on the basis of produced heat. The company takes care of the management and subcontracts practical operations (e.g. fuel supply chains). Subcontractors have an opportunity to purchase company shares. It may be problematic for the customer as well as for the company that the heating unit does not fit into all cases. In addition, the company may have problems recruiting professional staff, for example, to various building projects in different areas (Saramäki 2007).