SolidStandards

Enhancing the implementation of quality and sustainability standards and certification schemes for solid biofuels (EIE/11/218)

D5.2a

Case studies of sustainably certified solid biomass supply chains –

Kyyjärvi, Finland

26 August 2013

EKO
ECOENERGY CERTIFIED
BY FINNISH ASSOCIATION
FOR NATURE CONSERVATION

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The SolidStandards project

The SolidStandards project addresses on-going and recent developments related to solid biofuel quality and sustainability issues, in particular the development of related standards and certification systems. In the SolidStandards project, solid biofuel industry players will be informed and trained in the field of standards and certification and their feedback will be collected and provided to the related standardization committees and policy makers.

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About this document

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Table of contents

1. Introduction

1.1. General introduction

As of January 2013, national sustainability requirements for solid biomass exist in Belgium and the UK, and their introduction is debated in e.g. the Netherlands. Also, voluntary industry standards are also developed by the various organizations. As part of the SolidStandards project (and especially regarding the work on sustainability certification), four existing different solid biomass supply chains using voluntary sustainability standards are investigated in detail, including all steps from sourcing the raw material (e.g. wood chips from the forest or by-products from sawmill e.g. sawdust), all pre-processing steps (e.g. chipping, pelletisation) to the end-user (small to large scale consumers).

The specific aim is to explore different types of case studies, i.e. to investigate different supply chains in terms of:

- Size of the end-user: from medium-sized installations of $\geq$ 1 MW capacity to (very) large consumers such as utilities with capacities of $\geq$ 100 MW
- Geographical boundaries, i.e. regional, national and international supply chains (including one chain originating outside the EU-27)
- Type of biomass: e.g. wood chips, wood pellets, or other solid biomass
- Each case study will investigate *applicability*, *barriers*, *costs*, *time efforts*, etc. associated with the actual implementation of sustainability certification of solid biomass.

Originally, it was also intended to analyse the implications of the EC decision on possible mandatory solid biofuel sustainability criteria. However, at the time of writing (May 2013), the European Commission has not yet published a decision. Nevertheless, the case studies of sustainably certified solid biomass chains will provide valuable experiences to other market actors, but also to national governments which still may decide to implement mandatory criteria on a national level.

1.2. Aims and scope

The Finnish Association for Nature Conservation (FANC) has been ecolabeling electricity since the liberalization of the Finnish electricity market in 1998. In 2009 the scope of the certification broadened to heat and energy saving services. In the same year, the name changed from Norppa to EKOenergia. This case study focuses on the period 2009-2013.

Year 2013 is a transition year for the EKOenergia label. The fast internationalization of the electricity market has brought along the internationalization of electricity label. EKOenergy is now a international label managed by a network of 23 NGOs from 19 countries. The new (international) EKOenergy criteria for electricity have been approved in February 2013, and they will replace the old Finnish criteria (EKOenergia) no later than by the end of 2013.

No decision has been taken yet about the future of Finnish ecolabeling system for the production of heat.

This case study focuses on the sustainability scheme used by a small district heating company in Kyyjärvi, namely the *EKOenergia certification system*. This study aims to investigate and analyse concepts, introduction and implementation experience, current status and on-going development of the system, by taking the supply chain of *Kyyjärvi* as a case study. The scope of this study concerns views and experience of different stakeholders along the supply chain, and provides up-to-date information. This study is concentrated on

heat system, but also a new international EKOenergy criteria for electricity production is introduced.

2. Description of the EKOenergia certification system

2.1. General description

EKOenergia is an ecolabel managed by the Finnish Association for Nature Conservation (FANC). The FANC launched in 1998 first ecoenergy criteria “Norppa suosittelee” (Recommended by Saimaa ringed seal) for electricity. Planning for these criteria started already in 1995. The current EKOenergia label was launched in 2009 for electricity and heat. The latest updating of criteria was carried out in 2012. Introduction of new international EKOenergy Label for electricity production was launched in March 2013 (Table 1).

Table 1. Development of EKOenergy label

Year	Name of label	Goverage
1998	Norppa suosittelee (Recommended by Saimaa ringed seal)	Renewable electricity
2009	EKOenergia	Renewable heat and power
2012	EKOenergia (updated criteria)	Renewable heat and power
2013	International EKOenergy label	Renewable electricity

2.2. Coverage and target groups

EKOenergia label is granted to renewable energy. Renewable energy production which satisfies the set criteria, companies that use EKOenergia certified energy in their premises or production, and companies providing energy saving services can obtain permission to use the EKOenergia label.

In Finland 12 companies are selling EKOenergia labelled electricity and in total different kind of ecoenergy is sold by 25 companies. Electricity produced by EKOenergia amounted to 600 GWh in 2011 and maximum sold amount was 3 TWh in 2008 in Finland.

The following companies are selling EKOenergia labelled electricity produced by biomass: Ekosähkö Oy (Kajaani), Etelä-Savon Energia (Mikkeli), Lappeenrannan Energia (Lappeenranta), Pohjois-Karjalan Sähkö (Joensuu), Porvoon Energia (Porvoo) and Tammisaaren Energia (Raasepori). Most of the plants are situating in Eastern part of Finland. The EKOenergia label can be granted to electricity generated in Denmark, Finland, Norway or Sweden.

2.3. Criteria

The same criteria apply to electricity generation and heat production as of 2009. Only the proportion of a facility’s production that complies with the FANC criteria can carry the

EKOenergia label. Companies producing electricity or heat from renewable biomass fuels must declare the fuel they have used and its origins, and the quantity of carbon dioxide emissions they have generated. Statements must be delivered to FANC together with company's audited annual energy accounts.

In 2009 FANC launched also EKOheat (EKOlämpö) and two district heating plants were invited to participate in the pilot phase. Kyyjärvi and Tammisaari district heat plants were selected for case studies. FANC agreed to test this scheme until end of year 2012. Fees for EKOheat are as the following: annual fees of €500 and for heat production 0.01 cents/kWh. Annual fee is lower €250, if less than 10 persons are working in the organisation applying EKOenergia.

EKOenergia must be produced by using the following fuels (criteria 1 January 2012):

- wood chips
- sawdust
- bark
- wood-based waste liquids
- reed canary grass
- straw
- energy willow
- biogas from decomposing material
- gas extracted from landfill sites
- processed fuels originating from wood, such as pellets
- other energy sources may be accepted. Energy generated by combusting waste or peat cannot be accepted within the scope of the EKOenergia label scheme.

Only that proportion of a plant's production that complies with the FANC criteria can carry the EKOenergia label. For example, if a facility burns 80% wood and 20% peat, 80% of production can be sold as wood-based EKOenergia. Companies producing electricity or heat from renewable biomass fuels must declare the fuel they have used and its origins, and the quantity of carbon dioxide emissions they have generated.

EKOenergia label can be granted to such a district heating network, which produces less than 100 g CO_2/kWh (27.8 g CO_2/MJ) during a year. CO_2 factor is calculated as an average for 3 years. In the first year only this year CO_2 factor is calculated and so on. When operation has been carried out more than three years, when factor is calculated using last 3 years average. If CO_2 factor is more than 100 g CO_2/kWh in first year, then CO_2 emissions should be reduced during next 2 years so that the average factor for three year is less than 100 g CO_2/kWh.

When heat is produced by CHP then calculation is carried out by using the formula below:

District heat share in CHP production (kh) = $(E_h / \eta_h) / (E_e/\eta_e + E_h / \eta_h)$,

in which

E_e = Produced electricity

E_h = Produced heat

η_e = Electricity production efficiency, when electricity is produced separately (39%)

η_h = Heat production efficiency, when heat is produced separately (90%)

Calculated fuel production in CHP production: F_h = kh x F, in which

F = Total fuel consumption in CHP production

When producing heat by other than biomass fuels or electricity the following CO_2 factors listed in Table 2 are used (for combustion, not biomass supply taken into account).

Fuel/energy	gCO_2/kWh_{fuel}	gCO_2/MJ_{fuel}
EKOenergia produced electricity	0	0
Tree stumps and roots	150	41.67
Heavy fuel oil	279	77.5
Light fuel oil	267	74.17
Natural gas	202	56.11
Liquid gas	227	63.06
Peat*	382	106.1
Coal	341	94.72
Coke	389	108.06

*value is for milled peat. Value for sod peat is 367.2 and for peat pellets 345.6 g CO_2/kWh.

For waste incineration the factor is calculated for each plant separately based on energy content of the fuel.

If heat produced by electricity, an average CO_2 factor of the year for Finnish electricity production is applied. If fuel is imported this will be calculated separately.

As of 1 January 2012 wood energy producers should also follow the Tapio´s guidelines for energy wood cultivation and harvesting (Äijälä et al. 2010). EKOenergy label is also requiring that ash is reused. In Finland, when using ash as a fertilizer permission from Finnish Food Safety Authority, Evira is required. Ash can be used as a fertilizer or in earth construction.

The main principles of Tapio´s guidelines for forest fuels are:

Principle 1: Wood fuel should be harvested only on suitable sites.

- Wood fuel should not be harvested in places where it constitutes a substantial threat to profitable silviculture, biodiversity, water protection or recreation.

Principle 2: Wood fuel harvesting should not substantially diminish growth potential or silvicultural quality of the harvesting sites.

- A portion of the biomass is always left on the harvesting sites.
- Thinnings should maintain proper stand density and structure
- Damage to remaining trees and soil surface should be avoided
- Harvesting operations should not increase fungal or insect damages in the stands.

Principle 3: Wood fuel harvesting should not diminish the biodiversity of forest ecosystems

- Wood fuel harvesting should not reduce the amount of coarse woody debris in the forests.
- Tree species' diversity and natural stand structure should be maintained

Principle 4: Wood fuel harvesting should not cause erosion nor reduce the ecological value of water systems

- The risk of erosion should be recognised and managed
- Buffer zones are applied beside all water courses
- Unnecessary disturbance of soil surface should be avoided.

Principle 5: Recreational, cultural and landscape values should be taken into account in wood fuel harvesting

- Objects valuable to cultural heritage are taken into account in wood fuel harvesting.
- Harvesting sites with special recreational values or landscape values are felled with specific instructions and planning.

Principle 6: Climate change mitigation should be a prime consideration in all wood fuel harvesting operations

- Wood fuel harvesting should not reduce the carbon sinks of the harvested stands.
- The carbon storage in the forest soils should be preserved.
- Carbon efficiency is maximized throughout the whole procurement chain.
- The energy content of the wood fuel should be maximized throughout the whole procurement chain.

Principle 7: Quality and energy content of wood fuel should be maximized throughout the whole procurement chain

- Wood fuel is seasoned and stored properly
- Impurities amongst wood fuel are minimized

More detailed description of criteria is available in the AFO publication (Kuusinen 2010).

2.4. Governance and management

The EKOenergia team at FANC works to ensure that standards are verifiable and information supplied by licencees to the scheme is accurate and up-to-date. Information about energy production under the EKOenergia scheme must be submitted to FANC together with the annual audited accounts. Information must be supplied on the total amount of energy produced and sold, the amount of energy produced by each plant, the origin of biomass fuel used and the amount of energy procured from another energy company and sold on. In Finnish EKOenergy label only a book keeper´s certification was enough.

Auditing of production devices fuelled with biomass fuels in new international EKOenergy system is required. The fulfilment of the criteria will be checked at least once a year by

- the same entities checking the biomass installations on behalf of the authorities in the frame of the guarantee of origin legislation, emission trade legislation and/or support scheme legislation.
- Or by any other qualified external auditor accredited by a (full) member organization of the European Co-operation for Accreditation.

The audit report must be sent to the EKOenergy Secretariat. EKOenergy is managed by Board, which consists of representatives of each NGO (see Annex II).

3. Case study setting and description

3.1. Supply chain

Kyyjärvi Energy co-operative is managing Kyyjärvi district heating plant with two boilers: 1 MW_{th} and 1.5 MW_{th}. District plant is located in Kyyjärvi town with 2,000 inhabitants (Figure 1). Kyyjärvi is situating 120 km to Northwest from Jyväskylä. The 1 MW_{th} plant was constructed in January 1999 and new unit in the end of year 2001. Investment costs for 1 MW plant was €206,900, including one km district heat network and investment costs for extension of a second boiler was €185,000. The fully automatized heating plant use wood chips as fuel and is owned by Kyyjärvi municipality, but operated by an energy co-operative. Altogether 50

members of the co-operative are local forest owners and farmers, two wood harvesting companies, a local Forest Management Association, a boiler plant supplier, chipping and a transportation company. Kyyjärvi plant is using mainly small-sized delimbed stem wood or whole tree chips produced by two members of the co-operative. Total use is about 10,000 loose m^3 annually and total heat production is 6,000 MWh annually (see annual figures for years 2010 to 2012 in Annex I). The Kyyjärvi plant is selling 100% EKOheat. EKOheat is part of EKOenergia label from Finland. Kyyjärvi is first plant piloting EKOheat label in Finland.

Figure 1. Kyyjärvi district heating plant.

The Kyyjärvi energy co-operative is using only wood fuels for their heat production. Main fuels are the following: wood chips from stems (usually small sized thinning wood), wood chips from whole trees, small amounts of hog fuel from wood processing industry plant (Keitele wood), and wood pellets as an ignition fuel.

Stems are produced by using a harvester and then forwards threes to road side for seasoning (Sakari Parkkonen). Harvesting and wood fuel storage is carried out according to Tapio´s guidelines for energy wood harvesting and production (Äijälä et al. 2010). Transportation to the heating plants is carried out by an entrepreneur Mauno Uusimäki. Chipping is carried out by two companies Jouni Saukko and Tuomas Pölkki and by drum chippers (Figure 4). Usually 20 – 30 m^3 are transported to plant and totally 96 loads was transported in 2012. Transport distance is about 20 kilometres (Figure 5).

Only small amount of trees are manually harvested (700 to 800 loose m^3) by farmers.

Supply chain is described in Figure 2.

All energy wood is purchased from 100% PEFC certified forests. Local Forest Management Association (FMA) plans the harvesting sites (70% of purchase) and informs them to the co-operative. PEFC certification is guaranteed by a Forest Management Association through group certification. As the plant is located in the centre of Kyyjärvi municipality, fuels are not stored or chipped at the plant, but the co-operative owns a fuel terminal in the industrial area of the municipality (Figure 3), at the distance of about 2 km from the plant, where it is possible to produce chips quickly and easily in wintertime.

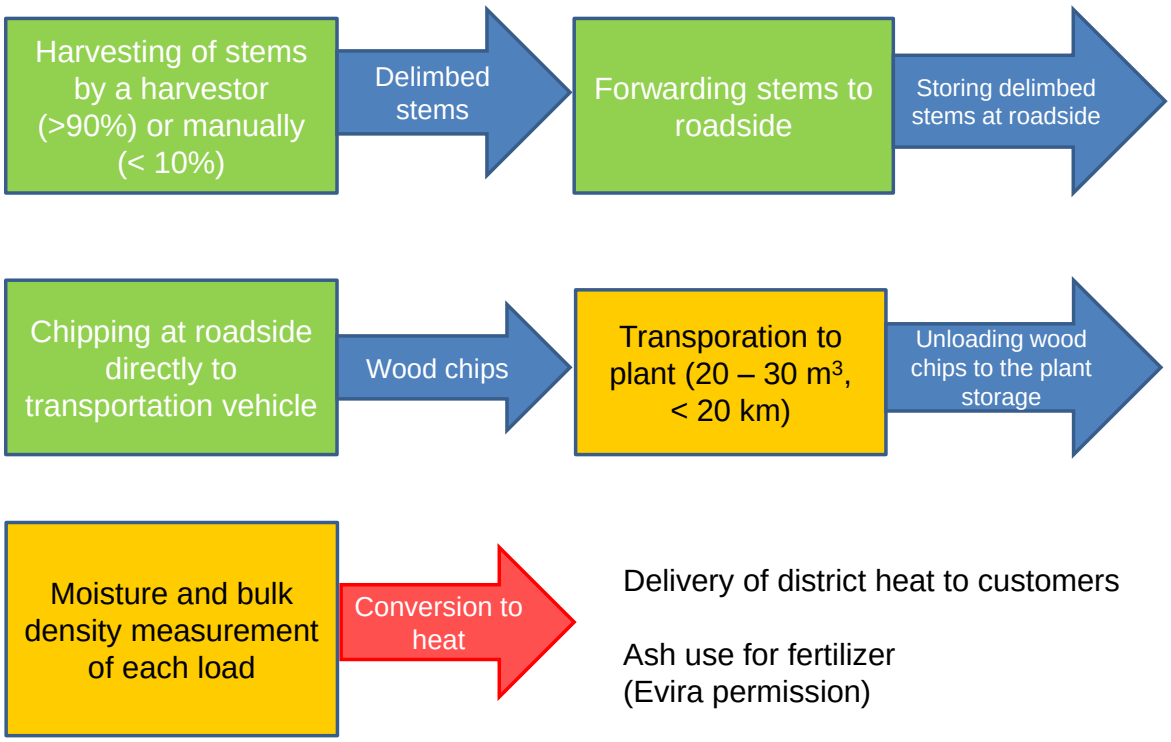

Figure 2. Production phase of wood chip supply.

Figure 3. Stem wood storage.

Figure 4. Chipping of delimbed trees or whole trees by Kesla drum chipper.

Figure 5. Wood chip transportation and unloading to the plant storage.

3.2. Product specifications and fuel quality control

Each load is quality controlled at the plant. The transport company representative or the plant operator in duty will take samples of wood chips for a moisture content analysis. Also bulk density is measured by 100 litre container from each load (Figure 6).

Moisture content of fuel has varied from 19.56 w-% to 52.1 w-% on wet basis. Average moisture content was 39.7 w-% in 2012. Bulk density has varied during the same period from 170 to 320 kg/loose m^3. The average bulk density was 249 kg/loose m^3. Energy density was during same period from 536 to 929 kWh/loose m^3 and an average was 734 kWh/loose m^3.

VTT has made a product declaration for a wood chip based on the date received from Kyyjärvi energy cooperative (Table 3). Because cooperative is producing wood chips for their own use it is important to use low moisture content fuel to guarantee high combustion efficiency, because the client is paying according to the produced heat.

Figure 6. Truck driver Mauno Uusimäki is measuring the bulk density of the wood chips.

Table 3. Product declaration for Kyyjärvi wood chips

	Product declaration based on EN 14961-1 or A2 (EN 14961-4)		
Normative	Property	Unit	Average wood chip quality
	Raw material	-	1.1.3.1 and 1.1.3.2
	Dimensions, P*	mm	P31 or P45*
	Moisture, M	w-%	M35 or M40
	Ash content, A*	w-% of dry matter	A1.0*
Informative	Bulk density, BD	kg/m^3	BD250
	Energy density, E	MWh/loose m^3	0.73

* VTT´s estimation based on the previous measured data of similar wood chips.

3.3. The actors

3.3.1. The end-user (biomass consumer)

Kyyjärvi energy co-operative is responsible for the fuel procurement and the plant operation. The fully automatized heating plant use wood chips as a fuel and is owned by Kyyjärvi municipality, but operated by a co-operative society. A local company Tulostekniikka Oy constructed the heating station, and its designer, Mr Kai Oinonen, is a member of the energy co-operative. The step grate is preceded by a fuel drying system, and hence moist fuels can also be used. The moisture content of chips can be reduced by about 10% before combustion.

In connection with the extension, another slightly larger boiler has been installed in parallel with the present boiler, and hence the total output of the plant is increased to 2.5 MW_{th}. The plant operates unmanned and is highly automated. The automatic control supervises the operation in principle of fuzzy logic. In case of operation malfunction, the system employs the original settings, at which the plant operated before the malfunction, and the operation is normalised. Combustion is controlled by an oxygen sensor.

There are always three co-operative members in on-call duty. Possible malfunction messages come to their mobile phones according to an order agreed in advance. The station has proved to be well-operating, and malfunctions have been very rare. The old oil-fired boilers of houses are used as a reserve system. Entrepreneurs have filled the fuel storage once in week. Drag conveyors are used for unloading in the fuel storage.

The co-operative sells heat to municipal schools, old-age home and youth house. Earlier all buildings used their own oil heating. Annual heat production has been about 6,000 MWh (see Appendix Table A-1).

The present building volume heated was tripled to about 120,000 m^3. Half of this building volume belong to Kyyjärvi municipality. Kyyjärvi Municipality pays for heat on the basis of a heat production contract, which is in force until further notice. The price is fixed and is agreed upon at discussions between the municipality and the co-operative for each heating season. The annual turnover of Kyyjärvi Energy co-operative is about €200,000. An average selling price of heat to the municipality is 32.51 €/MWh. Kyyjärvi Energy co-operative has calculated that their business also create same sum of income in the other organisations. In Kyyjärvi

consumers have to pay 52.5 €/MWh to municipality about the heat. In Finland usually consumers pay from 65 to 70 €/MWh for heat produced by heating entrepreneurship plant.

In Finland an average total income for selling heat for heating entrepreneurs were from 33 to 35 €/MWh for this size of plant, when plant and district heating network is invested by a heat buyer. Costs for stems at road side is 23 to 25 €/m^3 solid (10 – 12.5 €/MWh). Addition to this chipping and transportations costs will be added. Average prices of wood chips at plant is 20 €/MWh (BioEnergia 2013/2 p. 49). This includes also large scale plants, which are fuelled with cheaper chips produced from logging residues. In Kyyjärvi case the municipality can supply heat for their customers with low costs.

3.3.2. The producers and logistics company

Wood chips is produced by company owned by *Sakari Parkkonen*, who cuts trees using a harvester, forwarding delimbed trees to road side for seasoning. Tops and branches are left in the forest. Transportation to the heating plants is carried out by an entrepreneur *Mauno Uusimäki*. Usually 20 – 30 m^3 are transported to the plant and the transport distance is less than 20 kilometres.

Wood energy cutting and forwarding accounts 50% to the business activities of Sakari Parkkonen´s company. Kyyjärvi energy cooperative buys about 35% of the energy wood. The company employs 2 persons. Annual turnover is between €200,000 to 300,000. Thinning trees are cut and delimbed by a small-scale harvester. Annually 3,000 to 6,000 solid m^3 wood is produced for energy use. Tops and branches are left in the forest. Mainly thinning wood is used, but also small amounts of pulp wood are harvested for energy use. Amount of pulp wood is so small that it is not economically sound to sell this for pulp production and therefore it is used for energy wood. For energy wood production Tapio´s guidelines are followed. Sakari Parkkonen is harvesting from private forests, and he is seeking clients by announcing in local newspapers. Also Kyyjärvi Forest Management Association shows them stands to be harvested. Average stand size is about 5 hectares. Close cooperation is done with chipping companies.

Forest Management Associations (FMAs) are working in close co-operation with forest owners in all matters related to forests – from planting to harvesting. FMAs offer training and guidance and provide professional assistance in forestry issues thus protecting forest owners' interests and helping to achieve set objectives. The Associations take care of planning and implementation of forestry measures in private forests. They also provide consulting services in wood sales planning and wood sales transactions.

Forest Management Associations are governed and financed by forest owners. The Act on Forest Management Associations (534/1999) enables them to collect a forest management fee from forest owners. Every forest owner pays the fee and thus is automatically a member of the FMA in the area where his or her forest is located. Forest management fees account for approximately 20% of the associations' turnover. The rest is generated by the services provided. There are 103 Forest Management Associations, each financed and administered by the forest owners themselves. The total number of members in the associations is nearly 330 000. The co-operation between forest owners in Finland has long traditions. The first Forest Management Associations were founded in 1907. The Act on Forest Management Associations was passed in 1950. In 1999 the legislation was brought up to date. In the amendment the task of Forest Management Associations (FMAs) is set out as follows:

> *The Forest Management Association is a forest owners' body, the purpose of which is to promote profitability of forestry practised by forest owners and the realisation of the other goals they have set for forestry, and to advance the economically, ecologically, and socially sustainable management and utilisation of forests*.

About 70% of wood energy is contracted though Kyyjärvi Forest Management Association (4,000 to 5,000 m^3). Price has a great importance both for the buyer and the seller. Price which is paid to forest owner for energy wood is typically 6 to 8 €/solid m^3 (3 to 4 €/MWh) in Central Finland. Price for pulp wood is 25 to 35 €/solid m^3 and for timber logs 45 to 60 €/solid m^3. For small amounts price is lower, because administrative costs are higher per solid m^3 (2 to 10 €/solid m^3). If yield from one stand is less than 3 solid m^3 for timber wood that is paid according to the pulp wood price.

In the Act on the Financing of Sustainable Forestry (1094/1996), non-industrial, private forest owners are entitled to seek governmental grants for the afforestation of understocked areas, prescribed burning, the tending of young stands, the harvesting of energy wood, forest recovery, fertilisation, etc. The Ministry of Agriculture and Forestry will pay support for the harvesting, forestry transport and chipping of wood sold for fuel as part of the management of young stands. The energy support for fuel wood from small trees will be €7 per solid m^3 (about 3.5 €/MWh), of which cutting cover € 3.5 solid m^3 and forest transportation also €3.5 solid m^3. Minimum supported amount is 20 solid m^3 (≈50 loose m^3). Addition to these supports also €210 per hectare will be paid in Central Finland. The total wood energy support from small trees is about € 10 per solid m^3 (about 5 €/MWh). This support is paid to a forest owner according to an application sent to the Regional Forest Centre. The trees left in forest after cutting should have a diameter at breast height less than 16 cm. Until end of 2012 also support for chipping was paid to a chipping company. Support was €1.7 per loose m^3. These support mechanism has been important to mobilize wood procurement from young stands, which have higher procurement costs.

3.3.3. The certification body (the initiator)

The EKOenergy team at FANC works to ensure that standards are verifiable.

Facts and figures that have not been checked by the European, national or regional authorities, have to be verified by an external auditor accredited by a (full) member organization of the European Co-operation for Accreditation.

The audit will be based on a checklist provided by the EKOenergy Secretariat.

All opportunities to simplify the verification process (in particular by making use of existing tools, procedures and checks) will be grasped.

3.3.4. The certification body

Power plants will be audited by an external auditor accredited by a (full) member organization of the European Co-operation for Accreditation.

External book keeping auditing is required for EKOheat.

PEFC certification in Finland is carried out as regional group certification. “Regional” means that the geographical operating area of a Regional Forestry Centre defines a maximum coverage of one PEFC forest management certificate in Finland. On each of the thirteen Forestry Centre areas the “group” means that all forest owners (owners of private family forests, company, municipality and parish owned forests as well as state owned forests) have access to the certification group.

Forestry Centres and other forestry organisations have internal data collection systems to demonstrate and verify the quality of forest management activities on an area of a regional group certificate. Costs of this internal data collection are difficult to measure precisely because these activities are carried out in a decentralized manner by several organizations and because in addition to forest certification the data is used also for other monitoring

purposes. It can be estimated that the costs of internal data collection are about as big as the costs of external audits. External auditing is done every third year.

External third-party audit includes (Alakangas & Kaivola 2010).

(i) inspection of internal data collecting procedures,

(ii) visits to offices of organizations and

(iii) sample-based site-level inspections in forests that owned by forest owners that are enrolled as members of regional group certification. The cost of external audit is in the range of €30,000 to 60,000 per one region per year.

There are several auditors in Finland, who are carrying out forest certification auditing. In Central Finland annual auditing costs are around €50,000, which is divided between Forestry Management Associations. Forest Management Associations are representing the forest owners in the region. A certification fee is €2,000 for each visit to forest site. Finnish certification system (PEFC) includes also criteria for energy wood.

4. Method and data collection

This study is based on the principals of EKOheat labelling (www.ekoenergia.fi) January 2012) and interviews with the main actors in the Kyyjärvi case and other experts. Table 4 lists the persons interviewed for the study.

Table 4. Direct sources of information

Nr.	Interview	Role	Remarks
1	Hannu Kainu, Kyyjärvi co-operative	Operator of the plant	Personnel interview in 29 November 2012, Kyyjärvi
2, 3	Riku Eskelinen, FANC Steven Vanholme	Representative of EKOenergia label and certification body	Personnel interview on 8 January 2013 in Helsinki
4	Jouni Näreaho, Kyyjärvi municipality	Certificate holder, plant owner	21 May by phone
5	Sakari Parkkonen	Harvesting and forwarding stems to road side	15 May 2013 by phone
6, 7	Jouni Saukko, Jani Lehtinen (Kesla Oy)	Chipping	20 May 2013 by phone
8	Mauno Uusimäki	Transporting of wood chips	17 May 2013 by phone
9	Jukka Kainulainen, Kyyjärvi MHY, forest owners association	Planning of harvesting sites, trading of energy wood on behalf of private forest owners	16 May 2013 by phone
10	Veli-Matti Alanen, Bioenergy association of Finland, Heating entrepreneurship committee	wood chip consumption, heat prices and jobs	23 May 2013 by phone
11	Veli-Pekka Kauppinen, Finnish Forest Centre, Central Finland	forest supports, harvesting costs	23 May 2013 by phone

Results of the interviews are presented in the different parts of this report.

5. Results and discussion

Initiating the system: Why certification scheme?

The EKOenergia label has the purpose of promoting the consumption and production of sustainable renewable heat and electricity. The EKOenergia label aims to assess the defects and provide assurance of a more sustainable, not only renewable, form of energy production. Renewable energy production, which satisfies the set criteria, companies that use EKOenergia certified energy in their premises or production, and companies providing energy saving services can obtain permission to use the EKOenergia label. The EKOenergia label is a marketing tool. The aim is to continue to increase the market share of EKOenergia to reduce unsustainable production.

The EKOenergia label is the only impartial, independent ecolabel for energy in Finland. It is intended to increase demand for renewable energy generation and to support companies selling renewable energy on the free energy market. Energy companies selling renewable energy are encouraged to apply for certificates. The absence of ecolabel may raise suspicion of an unsustainable form of renewable energy production that does not stand up to the sustainability standards.

Start-up: How was the scheme set-up?

FANC started to plan the EKOenergia criteria in 1995 and launched the system “Norppa suosittelee” in 1998. The system was set up first for electricity production and after that the system also included heat production. In 2009 criteria were updated and EKOheat was introduced for pilot testing in two plants in Kyyjärvi and in Tammisaari. The current EKOenergia label was launched in 2009 for electricity and heat. The latest updating of criteria was in 2012.

Introduction and implementation: Overcoming the challenges

FANC has faced *challenges to get the funding for system development and marketing*. It is also *challenging to formulate criteria*, which takes sustainability into account and at the same time avoiding unnecessary bureaucracy.

On-going development: Opportunities and challenges ahead

FANC has *started together with different European NGO´s to develop international EKOenergy label for electricity*. International EKOenergy label was created by the network during 2012. It is the first ecolabel for electricity that results from a pan-European consultation process. It works on the whole European market and will be recognized by major stakeholders in all European countries. Criteria have been approved in February 2013. (See Appendix II for more details and www.ecoenergy.org).

VTT has commented draft international EKOenergy criteria for bioenergy. In the draft criteria is mentioned that logs which have a diameter breast height (d1.3) less than 20 cm is only included in EKOenergy. It is difficult to verify this criteria and it is also very difficult to know the DBH from already cut trees. You should measure this value from standing trees! There are also stem wood with a diameter breast height more than 20 cm, which is unmercantable for forest industry use. Also if the yield of logs is very low especially for pulp wood then it is usually sold to energy use. The use of wood according to a certain diameter depends on species. One single rule will not be meaningful. There is not harmonization of round wood/stem wood standardization at global level and not even at European level. In certain regions in Europe, it is not economically interesting for the wood industry to mobilise wood (e.g. forests that are not located in the supply area of sawmills or pulp mills). In these

regions, trees keep growing. Wood energy offers an opportunity to forest owners to sell wood and keep managing their forests. Measuring the diameter of each and every harvested log would be extremely expensive. To date, only the high value and high quality wood diameters are measured on forest industry site.

VTT proposed to use the following definition for EKOenergy: Stem wood loss consisting low quality off cuts of pulpwood and saw logs that can't be utilised in pulpmills and sawmills due their defects. Because of the feedback from VTT and other stakeholders during the public consultation EKOenergy decided that such logs can be used, if they are suited for any other industrial use because of root rot (heterobasidion) or other pathogens. Other exceptions can be accepted by the EKOenergy Board.

VTT has also *proposed to apply the European standards for quality requirements and quality analysis for biomass fuels*. Applying EN-standards is difficult for the developers, because standards are not available free of charge, and they are not published on internet.

International EKOenergy is a new initiative. It is the result of an intense cooperation between NGOs from several European countries. It *works on the whole European market and aim to be recognized by major stakeholders in all European countries*. EKOenergy is the result of the RES-E, 'Renewable electricity for Europe project'. Organisations are now gradually moving from consultation to implementation. The aim is to start first EKOenergy certification in Italy, Latvia and Spain.

Conclusion: Is EKOheat a success? How can it be improved?

EKOenergia for heat production has been found successful in Kyyjärvi municipality. For the plant and the municipality the most important is the social acceptance of the label. It also *enhanced local entrepreneurship and use of local biomass resources*. When heat *production is based on local wood fuels, the fulfilment of criteria is easy for heating plant and certification is not too costly or time consuming* for the municipality and key stakeholders.

In Finland there are 505 smaller district heating plants with average size of 1 MW operating by entrepreneurs similar to Kyyjärvi plant. These plants consume annually 1,127,000 loose m^3 forest chips and producing about 850,000 MWh heat. Value of the sold heat is more than €40 million (based on an average selling price 55 €/MWh). If we calculated based on the case of Kyyjärvi this income will great as big value of money in other businesses (indirect economical effect). Wood chips are locally produced mainly from thinning wood, which improve forest productivity and silvicultural targets of forests. More than 30% of these plants are supplying heat to public buildings, which helps them in decarbonisation of the heat.

Earlier these plants have been fuelled by light fuel oil. When calculating that 850 GWh heat is produced by light fuel oil, GHG emissions would be about 220,000 tons higher. GHG emissions for fuel production, chipping and transportations are about 6,100 tons for wood chips. GHG-emission reduction is more than 90% compared to light fuel oil.

This EKOheat concept is *very suitable with reasonable costs for this kind of plants*. There are also in Europe similar type of district heating concepts managed mainly by farmers. Production of local heat can increase local tax income, bring job opportunities for rural areas and enhance better use of machines of forestry and farming sector. Most of the bioenergy heat is produced by CHP in Finland. There could also be market for these CHP plants to certificate that part of heat production, which has CO_2 emissions less than 100 gCO_2/kWh.

Employment effect in Finland is calculated by using heating entrepreneurs´ committee´s estimation that 3,300 MWh will create one direct job. This means that about 300 direct jobs are created in Finland. Usually indirect employment effect is as much as the direct effects.

FANC has not made a final decision, if EKOheat label for production of heat will be continued to full market implementation. This will require external income to develop the system and also require extra personnel for system management.

6. References

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7. Appendix I: Sustainability calculations

Table A-1. Fuel and heat production data for years 2010, 2011 and 2012

Fuel	2010	2011	2012
Wood chips, loose m^3 Wood chips, MWh	11 523 8 462	9 426 6 911	9 682 7 262
Heat produced, MWh	6 618	5 937	6 556
Wood chips/heat produced, loose m^3/MWh	1.74	1.59	1.47
Efficiency, %	78	86	90

According to the data given by Kyyjärvi energy cooperative, use of wood chips per heat produced varies. In Finland usually this is from 1.3 to 1.8 loose m^3/produced heat in MWh. Results of Kyyjärvi energy cooperative indicate that fuel quality control is not accurate in every case or loads might not always be full loads. EKOEnergia label takes only greenhouse gas emission from combustion into account. VTT calculated the emissions also for harvesting, forwarding wood to road side, road side chipping and transportation to the plant.

Results of calculation for GHG emissions are presented in Tables A-2 and A-3.

Table A-2. Data for calculation of GHG emissions for Kyyjärvi case

Kyyjärvi case	Value	Unit
Bulk density of wood chips, small-sized trees	249	kg/loose m^3
Moisture content of wood chips (average)	39.7	%
Energy content of wood chips	0.73	MWh/loose m^3
Energy content	2.94	MWh/t
Cutting and forwarding to roadside		
Diesel consumption, 2 – 3 litre/m^3 solid	2.5	litre/m^3 solid
Load space	5	m^3
Wood chips per load	12.5	loose m^3
Energy content of diesel per loose m^3	10	kWh/loose m^3
Energy input/output	***1.36***	**%**
Chipping at road side		
Fuel consumption litre per hour	23	l/h
Productivity per loose m^3	70	loose m^3/h
Energy content of diesel per loose m^3	3.3	kWh/loose m^3
Energy input/output	***0.45***	**%**
Transportation of wood chips to plant		
Transportation distance, maximum	20	km
Volume of vehicle	20	loose m^3
Average fuel consumption	20	l/100 km
Fuel consumption	0.4	l/loose m^3
Energy content of diesel per loose m^3	4	kWh/loose m^3
Energy input/out	***0.54***	%
Total input/output (efficiency of the whole chain)	**2.35**	**%**

Energy content of diesel is 10 kWh/litre (Statistics Finland, Fuel classification). 1 m^3 solid is about 2.5 m^3 loose.

Table A-3. Fossil fuel consumption and GHG emissions in fuel production and transport

Property	2010	2011	2012
Energy consumption in fuel production, diesel	199 MWh	163 MWh	171 MWh
GHG emission in fuel production	49 ton CO_2	40 ton CO_2	42 ton CO_2
GHG emissions/wood fuel consumption	5.8 kg CO_2/MWh	5.8 kg CO_2/MWh	5.8 kg CO_2/MWh
GHG emission/sold heat	7.4 kg CO_2/MWh ***2.0*** g CO_2/MJ	6.7 kg CO_2/MWh ***1.9*** g CO_2/MJ	6.4 kg CO_2/MWh ***1.8*** g CO_2/MJ
GHG reduction compared to light fuel oil	90%	91%	91%

Greenhouse gas emissions are very low for wood harvesting, forwarding to road side, chipping and transportation for local wood fuels, only 1.8 – 2.0 g CO_2/MJ. EKOheat calculates only GHG-emission for combustion and in this case they are 0, because no fossil fuels are used in heat production.

If we compared the competing fossil fuel, which in this case is light fuel oil, because earlier buildings were heated by light fuel oil (GHG emissions from combustion 74 g CO_2/MJ, 244.8 kg/MWh), we can make the conclusion that GHG-emission reduction is more than 90%.

8. Appendix II: International EKOenergy criteria

EKOenergy (Approved 23 February 2013) wants to increase the demand for renewable electricity by creating an easily recognizable and widely accepted electricity product. International EKOenergy is labelling electricity.

The partners of the EKOenergy network wants

- Stimulate the development of the renewable electricity sector and to promote climate friendly solutions.
- Contribute to the protection of biodiversity, habitats and ecosystem services.
- Inform all electricity consumers about the product they are buying and about the claims they can make about their purchase.
- Mobilize the positive energy of 1,000's of individuals, groups and companies sharing our ambition, and to give them the opportunity to get involved.
- Foster the dialogue between and join forces with the electricity sector, the environmental NGOs and other stakeholders (e.g. consumer organizations and authorities).

This relates to the following aspects:

- Consumer information.
- Renewability, sustainability and climate
- Tracking and avoidance of double counting
- Auditing and verification

The EKOenergy criteria are simple, efficient and easy to use supply. This information has to include minimally:

- The country of origin
- The way of production.

Management of EKOenergy

The EKOenergy Board is the highest governing authority within the management structure. The Board endorses the organization's strategy, decides about the criteria, decides about the acceptability of production devices (in the cases listed in this text), decides about the use of the EKOenergy Environmental Fund and the EKOenergy Climate Fund and appoints the head of the EKOenergy Secretariat. All decisions will be based on an intensive consultation of relevant stakeholders and forums. The current Interim agreement between the partners of the EKOenergy network gives all members 1 vote in the EKOenergy Board.

The Advisory Group is appointed by the EKOenergy Board and is approximately 3 times the size of the Board. The appointment is valid for 2 years and can be renewed.

In the Advisory Group there are reserved seats for the following stakeholder groups:

- Environmental NGOs: both environmental umbrella organizations at European level and national/regional NGOs.

- The electricity industry (producers, traders and suppliers).

- Consumers of EKOenergy, their branch organizations and consumers' organizations.

Others possible members are e.g. authorities involved in the implementation of the Guarantees of Origin system.

The Advisory Group can give input on any issue related to EKOenergy. The Advisory Group is actively informed about the Board's agenda. The Board has to respond within 2 months to comments and questions of the members of the Advisory Group.

The daily management of EKOenergy is in the hands of a Secretariat.

Criteria for bioenergy

Electricity produced in production devices fueled with biomass, biogas and bioliquids qualifies for EKOenergy if:

Text approved by the EKOenergy Board – 23 February 2013

> 1. The electricity is electricity from cogeneration, as defined in the Directive 2004/8/EC of the European Parliament and of the Council of 11 February 2004 on the promotion of cogeneration based on a useful heat demand in the internal energy market. The volumes of the electricity produced in cogeneration are calculated as described in Annex II of that Directive.

AND

> 2. The efficiency (average on yearly basis) of the cogeneration process is minimum 75%. The efficiency is the sum of the electricity and mechanical energy production and useful heat output divided by the fuel input used for heat produced in a cogeneration process and gross electricity and mechanical energy production. All words of the formula are interpreted in accordance with the Directive 2004/8/EC of the European Parliament and of the Council of 11 February 2004 on the promotion of cogeneration based on a useful heat demand in the internal energy market.

AND

3. The bioenergy comes from the following sources (only criteria for woody biomass reported here):

> a) Woody biomass harvested in the European Economic Area (EEA), but excluding:
>
> - Stumps and roots.
>
> - Woody biomass harvested from protected areas: nature reserves designated by the authorities, Natura 2000 areas and UNESCO World Heritage sites, unless it has been harvested according to a nature management plan approved by a national or regional nature protection agency.
>
> - Logs with a diameter breast height (DBH) of more than 20 cm. However, such logs can be used if they are not suited for any other industrial use because of

root rot (Heterobasidion) or other pathogens. Other exceptions can be accepted by the EKOenergy Board.

- Forestry products from countries where fellings in forests available for wood supply exceed 80% of the annual forest increment, unless it can be proven they come from a region where the fellings make up less than 70% of the annual forest increment. The felling rate to take into account is the average of the available figures for the last 5 years.

The same categories of biomass coming from neighbouring European zones can be allowed by the EKOenergy board, after consultation of relevant stakeholders. The decision will be public. The use of existing forestry and biomass certification schemes may help the approval process be conducted more efficiently.

For this paragraph, the overseas territories are not considered as a part of the EEA and Switzerland is put on equal footing with EEA countries. If other non-EEA countries would join the European electricity market (or if suppliers active in such countries would like to market.

domestic electricity originating from bioenergy as EKOenergy) electricity from bio-energy will not be accepted under the scheme until the EKOenergy Board has decided about the conditions.

Special rule in the case of cofiring

If a production device uses both eligible forms of biomass and other combustibles, it can only produce electricity that qualifies for EKOenergy if the eligible biomass constitutes at least 50% of the total yearly fuel input of the production device.

If that requirement is fulfilled, the amount of electricity that qualifies for EKOenergy is the following:

$$\text{Electricity from cogeneration} \times \frac{\text{used eligible biomass during the calendar year}}{\text{total fuel input during the calendar year}}$$

In the case of production devices fuelled by a mix of eligible biomass and non-eligible biomass, special rules apply with regard to the sales.

Auditing of production devices fuelled with bioenergy

Facts and figures that have not been checked by the European, national or regional authorities, have to be verified by an external auditor accredited by a (full) member organization of the European Co-operation for Accreditation.

The audit will be based on a checklist provided by the EKOenergy Secretariat.

All opportunities to simplify the verification process (in particular by making use of existing tools, procedures and checks) will be grasped. The fulfilment of the criteria will be checked at least once a year by

- The same entities checking the biomass installations on behalf of the authorities in the frame of the guarantee of origin legislation, emission trade legislation and/or support scheme legislation.

- Or by any other qualified external auditor accredited by a (full) member organization of the European Co-operation for Accreditation.

The audit report must be sent to the EKOenergy Secretariat.

Guarantee of Origin

In many countries, and in particular in these using the EECS-system, the Guarantee of Origin can also include additional information by means of an ICS tag (Independent Certification Scheme).

EKOenergy intends to enter into an agreement with the Association of Issuing Bodies as well as with each of the entities issuing Guaranties of Origin, regarding the operation of EKOenergy as an ICS Scheme. Because the EKOenergy criteria are formulated in such a way that the proof of compliance can be shown by the producer as a fact (e.g. a decision of the EKOenergy Board), the procedure for getting ICS tag can be simple.

Even if the Guarantee of Origin does not have an EKOenergy ICS tag, it still contains useful information, such as the name and the location of the production device. This information can be combined with information available on the EKOenergy website to determine whether the Guarantee of Origin qualifies for EKOenergy.

The EKOenergy Secretariat will, in collaboration with the stakeholders, develop online tools to facilitate the screening process:

- Maps with protected areas.
- A regularly updated online list with approved installations (especially for these cases where other criteria have been set apart from territorial criteria).
- Non-exhaustive lists of installations that are automatically eligible (such as wind turbines outside protected areas).
- Non-exhaustive lists of ineligible installations.

Special rule for biomass fuelled production devices

The possibility of having an EKOenergy ICS-tag is particularly important in the case of installations using both eligible bio-energy sources and non-eligible bioenergy sources.

As long as this is not possible, suppliers can only sell EKOenergy labeled electricity from production devices using bioenergy if the EKOenergy Licence Agreement allows them to do so. The Licence Agreement also specifies from which installations such electricity can originate.

Financing the EKOenergy work

For each Megawatt-hour (MWh) sold as EKOenergy, the supplier pays minimum 0,08 euro (eight eurocent) to the EKOenergy network, to finance the network's activities and to support its actions to increase the demand for renewable electricity.

If more than 250 GWh of EKOenergy is sold to the same end-consumer, this contribution doesn't have to be paid for the part exceeding 250 GWh.

Climate fund

Per MWh of EKOenergy sold, a contribution of minimum 0.10 euro (ten eurocent) has to be made to the EKOenergy Climate Fund. The Fund money will be used to stimulate further investments in renewable energy and to increase the share of renewable energy in the world's electricity production.

Sustainability

The EKOenergy label and the EKOenergy network want to play a role in bringing stakeholders together by:

- Adopting a pragmatic approach focusing on stakeholder involvement.
- Creating an environmental fund, whose money will be used for concrete biodiversity protection measure, agreed upon by relevant stakeholders.
- Allowing ourselves to exclude the most controversial types of renewable electricity production devices from EKOenergy's scope.

Tracking mechanism

EKOenergy uses the following tracking mechanisms:

- Guarantee of Origin system as set up in implementation of article 15 of the Renewable Energy Directive (Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources).
- Other book and claim systems may qualify for EKOenergy, if:
    - The entity running the book and claim system is the only one doing so in a given area. If the entity is not appointed by the authorities it has to be approved by the EKOenergy Board.
    - Certificates are cancelled as a proof of supply/consumption.
    - Double counting is avoided, e.g. by taking into account cancellations in the country's residual mix.
- This is for example the case with non-EU countries that have adopted the EECS system (European Energy Certificate System), such as Norway, Iceland and Switzerland.
- In principle, Guarantees of Origin shall be cancelled in the domain of consumption, and the use of the Guarantees of Origin shall be in line with national legislation on electricity tracking and electricity disclosure. All cancellations have to be reported to RE-DISS/EPED (For domains linked to the AIB (Association of Issuing Bodies, www.aib-net.org) hub, this is fulfilled)

Review of the criteria

EKOenergy is a living standard. As knowledge and experience develop, so will EKOenergy. Any stakeholder or interested party can submit a comment about EKOenergy's requirements or suggest a change in the criteria at any time by contacting the EKOenergy Board.

All reviews will happen according the rules set by the ISEAL Code of Good Practice for Setting Social and Environmental Standards (www.isealalliance.org). EKOenergy has also been inspired by the approach of the American Green-e label (www.green-e.org).

Within 3 years after its launch, EKOenergy will in particular evaluate

- Its policy relating to protected areas, and will consider if it is necessary to include extra areas into the list, such as these designated in implementation of the Agreement on the Conservation of Populations of European Bats, EUROBATS, 1991 and the RAMSAR Agreement.

- The rules for electricity from installations fuelled with bioenergy.

- The rules for hydropower.

New EKOenergy logo in English

www.ekoenergy.org.