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GREEN CITIES AND SETTLEMENTS

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# SOCIAL AND REGIONAL ECONOMIC IMPACTS OF USE OF BIOENERGY AND ENERGY WOOD HARVESTING IN SUOMUSSALMI


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*Report for WP2: Urban and rural resource management*


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ENPI CBC KARELIA

THULE INSTITUTE

Kainuu

KAEEC

## PREFACE

This research report includes two separate cases. First case deals with social and regional economic impacts of use of bioenergy and energy wood harvesting in Suomussalmi. Second case introduces two difference energy investments made in Russian.The research report was made by Adult and Continuing Education AIKOPA, Kajaani University Consortium, Finland. Research was carried out by project manager Anna-Mari Kynsijärvi, project researcher Sirpa Korhonen and coordinator Ville Manninen. Kainuu Bioenergy Programme Coordinator Timo Karjalainen from Kajaani University Consortium participated in project as an expert. Regional development expert Jouni Ponnikas from Regional Council of Kainuu also participated in project as an expert.

This research report has been related as part of the "GREENSETTLE – Green Cities and Settlements" project and which is coordinated in Thule Institute, University of Oulu. Greensettle project is financed from the Karelia ENPI CBC Programme. The aim of the project is to encourage development of green cities and settlements in remote cross border areas of Finland and Russia.

Thanks are owed to all the persons who filled in the evaluation questionnaires and participated in the interviews. Special thanks to The Green Cities and Settlements project leader Eva Pongracz, project manager Niko Hänninen and project worker Elena Fedorova. Also thanks to the partners from Russian Karelia, head specialist of Economic Development Galina Potapova, Administration of the Kostomuksha County and leading specialist of development department Elizaveta Druzhinina Karelia regional institute - KRIMEL.

*Kajaani, February 2014*

*Writers*

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# CONCLUSIONS AND RECOMMENDATIONS

## Conclusions

The results of Suomussalmi case modelling show very clearly that financial support for purchasing energy wood from young forests is needed. The benefits getting out from the financial support are much larger than the costs of it. In Finnish circumstances the support should be more than 5 but less than 15 euros per cubic meter.

The support for bioenergy use of local wood fosters local business, entrepreneurs and creates positive employment impacts. For example wood chips and peat energy productions are significant regional employers. The using of local energy wood is considered very important especially in small remote and rural municipalities. Normally in the areas of rural municipalities is also lot of forest and wood bioenergy could be a significant product for export. Because of logistical problems and problems with stor-ing of bioenergy wood in Kainuu region, the export processes are hard to organize and the quality of wood stays too low level in order to export local wood energy it in large scale. Of course electricity is an exception and it is exported in large scale already.

Social impacts of local forest energy production are mostly positive. It is hard to find any group of population suffering from forest energy production. Instead local forest energy production seems to have many kind of positive social impacts at local and at regional level. Impacts of local forest energy production on employment and entrepreneurship are large and they have positive social impacts. Local forest energy production produces so called environmental jobs, which have many positive social im-pacts. The harvesting of energy wood can generate more work in rural areas. Positive image of local energy, created via above mentioned positive impacts, is quite common among local stakeholders in rural municipalities. This can be clearly seen from the results of survey made in the project. All groups participated surveys and interviews, forestry professionals, largest forest owners, public servants and councillors, energy suppliers and logging companies, shared the positive image of local energy.

All groups as well supported economical support for using local energy. Public servants and councils considered that the level of subsidy paid for wood energy should be at so high level that the local energy wood would be competitive. Forestry sector professionals wished financial support for either the energy wood or for the electricity generated by energy wood. Also taxes for a use of fossil fuels could be raised. Forest owners said that the competition should determine the price, but the use shipping sub-sidies for local could help the use energy wood. Wood energy should also be used commonly when demand would be more stable.

It can be estimated roughly that for example 10 000 k-$m^3$ (20 GWh) of local energy wood production will bring out from three to five annual jobs. The starting point of this estimation is that a part of harvesting in thinnings has been done manually. How-ever, mechanical harvesting in thinnings has come more and more common in Finland during recent years.

In order to come true the positive work impacts need the supply and demand for wood energy. So far there is not enough demand. Clearly local wood energy needs the long term (10 years) and predictable subsidy policy, which would make it possible for entrepreneurs to develop their business. In that way also other players in the field could count on stable and predictable development of the local wood energy use. At the same time research, development and innovation activities should be supported, which would help to create

sustainable and profit making local wood energy sector. Development activities are also needed because the quality of wood energy is not high enough. Many times wood is for example too wet. The raw material is stored outside and this causes quality problems for the wood. More launch terminals are needed for local forest energy production.

In remote areas; bioenergy is one good source of living. Produce of forest energy creates taxes and more tax payers; this creates incomes at local level for municipality. Local forest energy production has created these possible social impacts. Price of wood is lower than oil or gas and this creates positive local impacts. The money is used at local level. Wood energy produces hardly any side-effects at all. Solvency ratio of region is getting higher by producing and using local forest energy. This is the positive impact of local forest energy production that local forest energy production has fostered in Kainuu region.

Local forest energy production has some impacts also on recreation and refreshment use of forest, on immaterial values of forest and on landscape. Energy wood harvest-ing has positive impact on recreational use of forests and landscape. It is also more comfortable for example to pick berries and mushrooms in well-managed forests. Removing stumps after final cutting makes it easier to move on the ground. Of course all people do not like the view after stumps have been removed. Thinning out the forest is a soft way to produce forest energy. Stumps removing have developed during the years. Nowadays stumps can be removed in a way that the harms for landscape and for refreshment use of forest are minimal.

## Redommendations

In order to create optimal local benefit from local wood energy the following recommendations should be taken into consideration.

In order to further develop local wood energy sector needs economical support or steering mechanism by government (f. ex. workable emission trade -system). This helps to create stable and lasting demand for wood energy.

- The local wood energy sector needs long term and predictable subsidy policy. The time scale for predictable should be around 10 years.
- Research, development and innovation activities should be supported and activated. This helps to create sustainable and profit making local wood energy sector, which has positive employment and entrepreneur impacts.
- Development activities should be focused on the logistics of the supply chain and bettering the quality of wood energy. Many times energy wood is for example too wet. The raw material is stored outside and this causes quality problems. Launch terminals and store buildings are needed for energy wood. Also logistic should be developed.
- In order to minimize negative impacts on refreshment use of forest, for example stumps have to be removed in softest way. Harvesting, stumps removing and other operations of local wood energy production as well as traffic cause noise and emission. These should avoid if possible or at least minimize. Especially impacts on refreshment use of forest have to be minimized in areas, which are on active refreshment use and are located near population centers and suburban areas.
- The regional benefits concerning the use of forest biomass must be underlined and informed to the municipal decision makers.

# JOHTOPÄÄTÖKSET JA SUOSITUKSET

## Johtopäätökset

Suomussalmen tutkimustulokset osoittavat hyvin selvästi sen, että taloudellista tukea tarvitaan energiapuun korjuuseen nuorista metsistä. Saadut hyödyt ovat paljon suuremmat kuin siitä aiheutuvat kustannukset. Suomen olosuhteissa tuen tulisi olla suurempi kuin viisi euroa mutta pienempi kuin 15 euroa/$m^3$.

Paikallisen bioenergian käytön tukeminen edistää paikallista yrittäjyyttä, liiketoimintaa ja lisäksi sillä myös positiivisia vaikutuksia työllisyyteen. Esimerkiksi haketus ja turpeen energiatuotanto ovat merkittäviä paikallisia työllistäjiä. Etenkin pienillä syrjäisillä alueilla ja maaseutukunnissa paikallista energiapuun käyttöä pidetään erittäin tärkeänä. Maaseutukunnissa on normaalisti myös paljon metsiä ja bioenergia voisi olla myös merkittävä vientituote. Kainuun alueella logististen haasteiden ja bioenergiapuun varastointiongelmien takia metsähakkeen vientiketjua on vaikea toteuttaa. Tämän myötä myös puun laatu heikkenee, mikä estää myös viennin toteuttamista suuremmassa mittakaavassa. Energiapuusta saatavaa sähköä sen sijaan viedään jo runsaasti.

Paikallisen energiapuun tuotannon sosiaaliset vaikutukset ovat enimmäkseen positiivisia. On vaikea löytää väestöryhmää, joka kokisi kärsivänsä metsäenergian tuotannosta. Sen sijaan paikallisella metsäenergian tuotannolla on monenlaisia positiivisia sosiaalisia vaikutuksia paikallisella ja alueellisella tasolla. Paikallisella energiapuun tuotannolla on merkittäviä vaikutuksia työllisyyteen ja yrittäjyyteen ja näillä on puolestaan myös myönteisiä sosiaalisia vaikutuksia.

Paikallisen metsäenergian tuotanto tuottaa ympäristöön liittyviä ”vihreitä” työpaikkoja, joilla on paljon sosiaalisia vaikutuksia. Energiapuun korjuu voi tuottaa työtä enemmän maaseudulla. Paikallisen energian positiivinen imago, mikä on syntynyt edellä mainituista positiivisista vaikutuksista, on melko yleinen maaseutukuntien eri sidosryhmissä. Tämä käy hyvin esille kyselyn tuloksista. Kaikkien kyselyyn ja haastatteluun osallistuneiden mielestä paikallinen energiapuun käyttö luo positiivista mielikuvaa.

Kaikki sidosryhmät kannattavat myös paikallisen energiapuun käytön tukemista. Virkamiesten mielestä energiapuun tuen tulisi olla niin korkealla tasolla, että paikallinen energiapuu olisi kilpailukykyistä. Metsäalan ammattilaiset toivoivat taloudellista tukea energiapuun tuotantoon tai energiapuusta saatavan sähkön tuotantoon. Myös fossiilisten polttoaineiden verotusta voitaisiin heidän mielestä korottaa. Metsänomistajat puolestaan totesivat, että hinta ratkaisee, mutta kuljetustuki voisi paikallisesti lisätä energiapuun käyttöä. Energiapuuta olisi käytettävä yleisemmin, jolloin kysyntä olisi vakaampaa.

Karkeasti voidaan arvioida, että esimerkiksi 10 000 k-$m^3$ paikallista energiapuuta tuo korjuumenetelmästä riippuen 3–5 vuotuista työpaikkaa. Energiapuu korjataan nykyisin pääasiassa koneellisesti ja metsurikorjuu soveltuu vain erikoiskohteisiin.

Energiapuu tarvitsee kysyntää ja tarjontaa, jotta sen positiiviset vaikutukset toteutuisivat. Toistaiseksi kysyntää ei ole riittävästi. Paikallinen energiapuu tarvitsee selvästi pitkäaikaista (10 vuotta) ja ennustettavissa olevaa tukipolitiikkaa, joka mahdollistaisi yrittäjien liiketoiminnan kehittämisen. Tämän myötä myös muut alan toimijat voisivat luottaa vakaaseen ja ennustettavissa olevaan kehitykseen paikallisen energiapuun käytöstä. Samalla tutkimus-, kehitys-, ja innovaatiotoimintaa olisi tuettava, jotta voidaan luoda kestävää energiapuun toimintaa. Kehittämistoimintaa tarvitaan myös, koska energiapuun laatu ei ole riittävällä tasolla. Esimerkiksi usein puu on liian märkää. Energiapuuvarastot ovat usein kattamattomia, mikä

aiheuttaa usein laatuongelmia. Näin ollen energiapuun tuotantoon tarvitaan terminaaleja, joiden kautta hyvälaatuista metsäpolttoainetta voidaan toimittaa käyttökosteisiin kustannustehokkaasti.

Syrjäisillä alueilla bioenergia on yksi hyvä tulonlähde. Metsäenergian tuotanto tuo veroja ja enemmän veronmaksajia – tämä puolestaan tuo kunnalle tuloja paikallisella tasolla. Metsäenergian tuotanto on luonut näitä mahdollisia sosiaalisia vaikutuksia. Puun hinta öljyä tai kaasua alhaisempi, mikä luo myös positiivisia paikallisia vaikutuksia. Varat käytetään paikallisella tasolla. Puunenergian tuotanto tuottaa tuskin ollenkaan haittavaikutuksia. Alueen omavaraisuus kasvaa tuottamalla ja käyttämällä paikallista metsäenergiaa. Tämä on positiivinen vaikutus, jota paikallinen energiapuun tuotanto on edistänyt Kainuussa.

Paikallisen energiapuun tuotannolla on myös vaikutuksia metsien virkistys- ja viihtyvyyskäyttöön, metsien aineettomiin arvoihin ja maisemaan. Energiapuun korjuulla on positiivisia vaikutuksia metsien virkistyskäyttöön ja maisemaan. Esimerkiksi marjastaminen ja sienestäminen on mukavampaa hyvin hoidetuissa metsissä. Kantojen poisto hakkuiden jälkeen helpottaa metsässä liikkumista. Tietenkään kaikki ihmiset eivät pidä näkymästä kaikkien kantojen poistamisen jälkeen. Metsän harventaminen on kevyt tapa tuottaa metsäenergiaa. Kantojen poistaminen on kehittynyt vuosien varrella. Nykyään niiden poistaminen voidaan toteuttaa siten, että haitat maisemaan ja virkistyskäyttöön ovat mahdollisimman vähäiset.

## Suositukset

Seuraavassa on esitelty suosituksia, jotka tulisi huomioida optimaalisen hyödyn saamiseksi paikallisesta energiapuusta

- Energiapuuala tarvitsee kehittyäkseen taloudellista tukea tai hallinnollista ohjausta. Tämä auttaa luomaan kestävää ja vakaata kysyntää energiapuulle.
- Energiapuuala tarvitsee pitkäaikaista ja ennustettavissa olevaa tukipolitiikkaa. Ennustettavuuden tulisi olla noin 10 vuotta.
- Tutkimus-, kehitys-, ja innovaatiotoimintaa tulisi tukea ja aktivoida. Tämä auttaa luomaan kestävän voittoa tuottavan paikallisen puuenergiasektorin, jolla on myönteisiä työllisyys- ja yritysvaikutuksia.
- Kehittämistoimet tulisi suunnata toimitusketjun logistiikkaan, mikä parantaisi puuenergian laatua. Epäasiallinen varastointi nostaa usein polttoaineen kosteutta, mitä laskee polttoaineen energiasisältöä. Metsäenergian hankintalogistiikkaa tulee kehittää mm terminaaliverkoston kautta.
- Kielteisten vaikutusten minimoimiseksi metsän virkistyskäytössä esimerkiksi kannot pitää poistaa keveimmin keinoin. Korjuu, kantojen poisto ja muut toimenpiteet puuenergian tuotannossa aiheuttavat melua ja päästöjä. Nämä tulisi mahdollisuuksien mukaan poistaa tai ne tulisi ainakin minimoida. Erityisesti kielteiset vaikutukset metsien virkistyskäyttöön tulee minimoida sellaisilla alueilla, jotka ovat aktiivisessa virkistyskäytössä ja sijaitsevat lähellä asutuskeskuksia ja esikaupunkialueita.
- Metsän biomassaa koskevaa alueellista hyötyä tulee korostaa ja informoida kunnan päättäjiä siitä.

# 1 BACKGROUND

## 1.1 Green Cities and Settlements Project

Green cities and settlements project aims to encourage the development of green cities and settlements in remote border areas. The main target of this project is to contribute to the long-term spatial development of the area by proposing a balanced progress of the economic and social requirements. (GREENSETTLE project.)

Specific objectives the project are to improve the utilisation of the spatial potential in remote border areas, to explore the potential of green cities and settlements in the border areas; to develop an effective cross-border exchange of best practices in public facilities and services minimizing environmental impact; and to identify and address the key challenges of climate change in remote border areas. Moreover, the other objectives are to enhance the role of local business and entrepreneurship through training, consulting and support; and to build awareness and sharing information on the potentials and possibilities of sustainable spatial development. (Communication and publication plan of Greensettle project)

Is to create the smallest possible ecological footprint and to produce the lowest quantity of pollution possible, while efficiently using land and providing a pleasant living environment.

Apart from providing a pleasant living environment, green settlements protect natural resources and the natural heritage as well as utilize the cultural heritage as a factor for development. The outcome of the project will therefore promote competitive capacity and the living standard in remote border areas through utilizing cross-border best practice approaches to spatial planning based on efficient utilization of local potential and environment friendly technologies.

Project is divided in to five working packages and this paper is belonging to working package number 2 (Urban and rural resource management). The Suomussalmi subproject examines social and regional economic impacts of use of bioenergy and energy wood harvesting.

The third objective of the EU's structural funds and instruments for regional development is European Territorial Cooperation, which receives its funding from ERDF. This element, which constitutes only less than 5 per cent of the total funding allocated to ERDF during 2007–2013, is a key element in promoting co-operation within and beyond the borders of EU. The territorial cooperation offers an opportunity to put the ESPD into practice, to share good practices in spatial planning between the participating regions. This makes it possible to test new, potential common European objectives in smaller scale between some regions, before they might be introduced throughout the whole EU. The objective consists of almost 90 programmes, which are divided into three dimensions: Cross-Border Cooperation (CBC), Transnational cooperation and Interregional cooperation.

## 1.2 Research task and questions

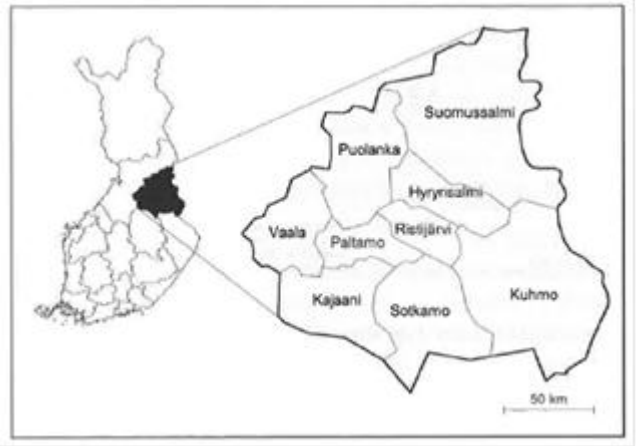
Research task of this paper is to find out what kind of socioeconomically influences use of local resources does have. In this paper it is researched by two research areas. In first one it is observed, what kind of benefits bioenergy has. Municipality of Suomussalmi in Finland has been chosen for example. They are using forest energy to produce district heat.

Second research area is Russian Karelia. In both pilots, Korablic kindergarten in Kostomuksha and kindergarten No. 2 Rycheek in Kalevala, energy improvement measures are examined.

Research questions are:

- How large are the energy wood resources of Suomussalmi and what is their sufficiency in local heating plants.
- What kind of impacts the use of energy wood has in the regional economy (well-being, jobs and tax revenues)?
- What is the real availability of the energy wood?
- How to increase the use of energy wood and what obstacles the increase has?

## 1.3 Suomussalmi, Kostomuksha and Kalevala as study areas




**Kainuu region** is situated in the eastern border of Finland (Fig. 1). It consists of nine municipalities and covers a surface of 24 452 km$^2$. The region in characterized by a very low population density: 3.4 persons per km$^2$. 90 per cent of the land area is forest.

Figure 1. Kainuu region and its municipalities.

**Municipality of Suomussalmi** is located in northeastern part of the province of Kainuu, along the road 5 and is limited to municipalities of Taivalkoski, Puolanka and Hyrynsalmi, towns of Kuusamo, Pudasjärvi and Kuhmo and Russia to the east. The nearest airport is located in Kajaani (110 km) and distance to Oulu is 200 km. The nearest passengers taking railway station is in Kontiomäki, 85 km away. At the end of 2012 municipality of Suomussalmi had 8813 inhabitants. Municipality had 2820 workplaces in 2011 and 439 enterprise establishments in 2012. Tenth of jobs were in primary production, less than a quarter in industry and two thirds in services. The public sector is a major employer. Companies of the municipality are Kiantama Ltd, KEMET Electronics, Ämmän Betoni Oy, Tulikivi and Sumetek. Municipality is large, its surface area is a quarter of the area of Kainuu region. (Statistics Finland, Municipality of Suomussalmi)

The study focuses mainly on the conurbation areas of Suomussalmi (Fig. 2). Situation of Suomussalmi and Kajaani in Finland together with Kostamus and Kalevala in Russia are in Figure 3.

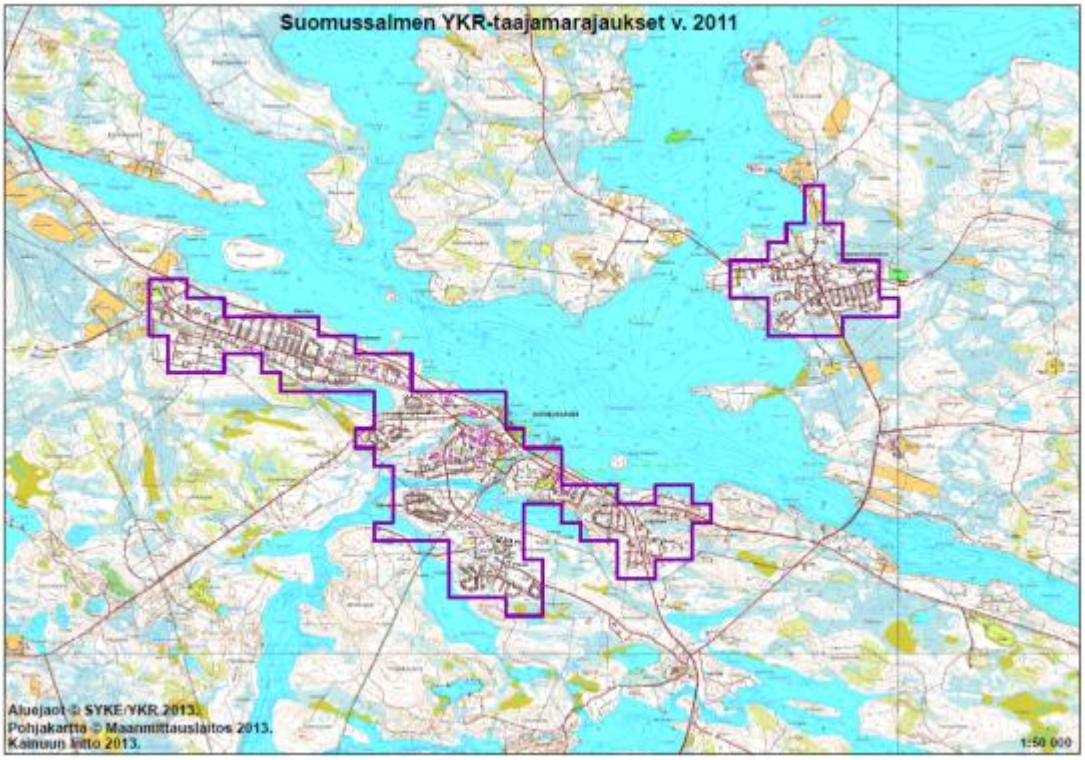



Figure 2. YKR (community structure) conurbation definings of Suomussalmi in 2011. (Maanmittauslaitos ja Kainuun liitto 2013; National Land Survey of Finland and Kainuu Regional Council 2013)

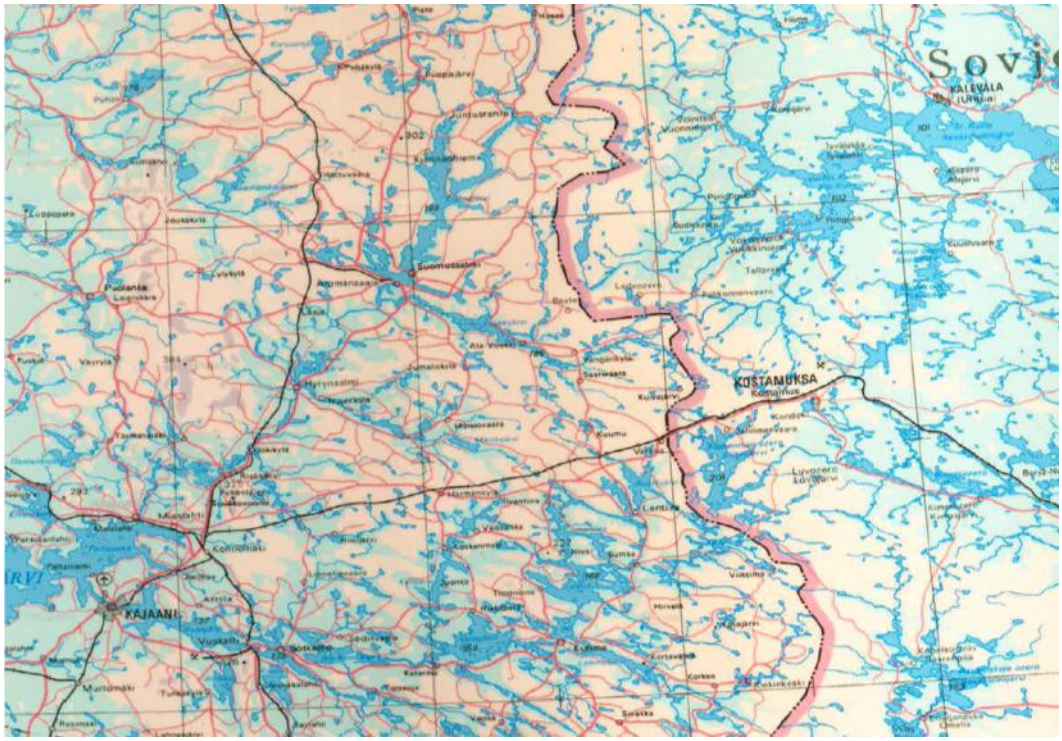



Figure 3. Situation of Suomussalmi and Kajaani in Finland together with Kostamus and Kalevala in Russia. (Map: National Land Survey of Finland, Map Printing, Helsinki 1986)

**The Republic of Karelia** is a federal subject of Russia, located in the north Europe and in the northwest of Russia. At the beginning of 2013 the republic is estimated to have 636 932 inhabitants. The Republic of Karelia is divided in local government at a higher level to 18 scopes, two of which are urban and 16 municipal districts. Scope boundaries and administrative centers are shown in the figure above. Kostomuksha is part of Kostomuksha city circuit and Kalevala part of the Kalevala National scope. (Wikipedia)

**Kostomuksha** is a mining town located near Kontokkijärvi of the Republic of Karelia, Russia, near the Finnish border. Town has 31 600 inhabitants (2005). The largest employer of Kostomuksha is the mining industrial complex. Kostomuksha and its surroundings form Kostomuksha urban district, which is an administrative unit and is comparable to the Republic districts (raion). Both road and railway lead to the town from Finland via Vartius Border Station. Kostomuksha has also a rail link to east, to Ledmozero station which is located in the rail section Suojärvi-Jyskyjärvi. Kostomuksha covers an area of 15 km$^2$ (Wikipedia) City map of Kostomuksha is in Figure 4.

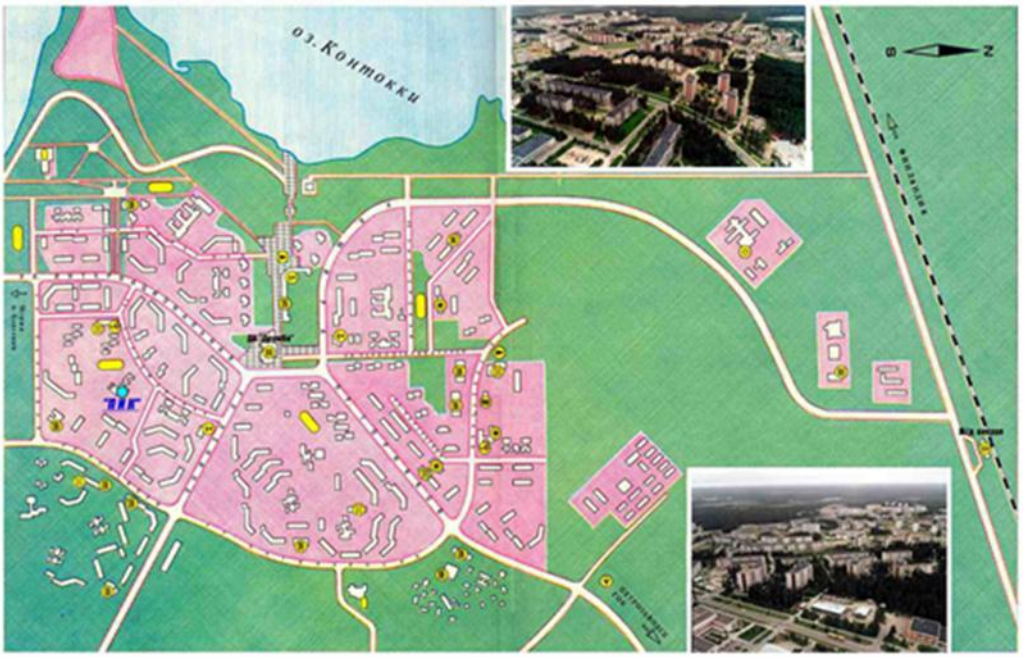



Figure 4. City of Kostomuksha (PIK project 2003)

**Kalevala** is an urban locality (an urban-type settlement) and the administrative center of Kalevalsky District of the Republic of Karelia, Russia. Uhtua conurbation had 4 529 people according to the 2010 population census and the whole municipality, the rural population including 4840. Kalevala has 8 321 inhabitants and is administrative center of the Kalevala national district. The municipality is limited to the eastern edge of the municipality Jyskyjärvi and is otherwise surrounded by Luusalmi. (Wikipedia) The Finnish/Russian state border runs between municipalities of Kalevala and Suomussalmi. Kalevala community center is located 80 km from the Finnish border. Figure 5 introduces Kalevala (Uhtua). Image in a satellite photo.

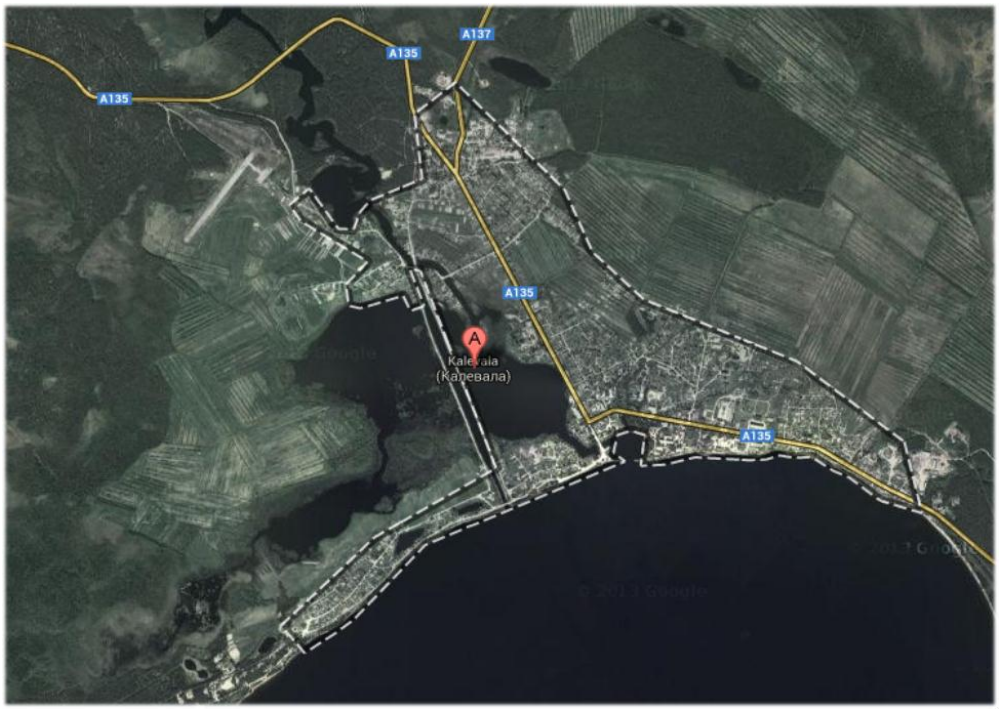



Figure 5. Kalevala (Uhtua). (Google Maps 27.2.2014)

## 1.4 Research task

The Suomussalmi study exploited the following **existing materials**: Earlier reports of energy wood resources of Suomussalmi (Karjalainen 2003, 2005 and 2009), topical publicatios of forestry sector's operators (Finnish Forest Research Institute Metla, Forestry Development Cente Tapio), publications and newsletters of energy sector and different kind of statistics.

The Russian Karelia study exploited the following existing materials: Green Settlement project brohchures, Presentations in Greensettle seminar 'Building Eco-Cities' in Oulu, Thule institute 18th of February, 2014, different kind of calculations and Statistics and E-mail correspondence with Russian contact persons.

Data for this research of Suomussalmi was **collected** from three separate questionnaires. The questionnaires were directed to professionals in forest industry, represents of the largest forest owners and both public servants and councillors of the municipality of Suomussalmi (Appendices 1 – 3). Also the suppliers of energy wood and local companies harvesting energy wood were phone interviewed (Appendices 4 - 5). Total number of answers was 30 (Table 1). From people reached for this research 40 percent gave their answer.

Table 1. Participants of surveys and interviews.

| Group | Number of people reached | Answers | Answer percentage |
|---|---|---|---|
| Forestry professionals | 11 | 4 | 36,4 |
| Largest forest owners | 6 | 4 | 66,7 |
| Public servants and councillors | 39 | 15 | 38,5 |
| Energy suppliers | 3 | 3 | 100,0 |
| Logging companies | 16 | 4 | 25,0 |
| **Total** | **75** | **30** | **40,0** |

# 2 ENERGY WOOD RESOURCES AND USE IN SUOMUSSALMI

## 2.1 Wood and energy wood resources and heating centres in Suomussalmi

Finns are in favor of increasing the use of bioenergy. This result can be found in bioenergy barometer, which was made by TNS Gallup commissioned by the Association of bioenergy in January 2013. This survey involved 4,300 15–74 years of Finns. The respondents, 70 percent would increase the use of bioenergy and 20 per cent would use the same number. The use of volume increase was based on the availability of the energy source. Of those who supported the increased 65 % considered an important criterion used source of energy for domestic production, 63 % climate Zero Emission and more than half of the impact on employment in Finland and water system Zero Emission. (CO2 report.)

In 2012, the total energy consumption in Finland was 380 TWh. No less than 32 % came down from renewable energy resources. The share of wood energy was 24 % and hydro power 4 %. (Itä-Suomen maakuntien liitot 2014.)

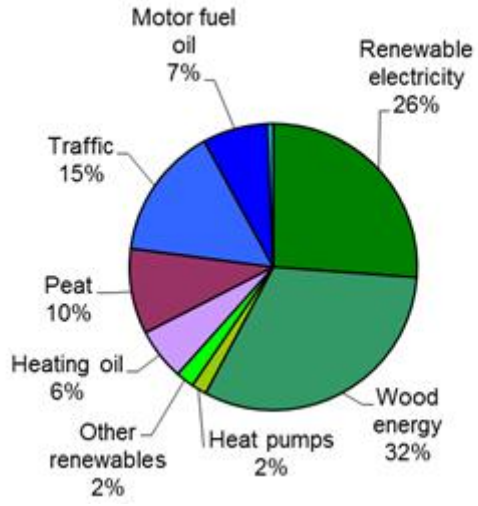



Figure 6 shows the primary energy consumption in Kainuu Region 2012. The share of renewable of primary energy consumption is high, 62 percent. Wood energy forms 32 per cent of the consumption. Kainuu has a huge forest energy potential (young stands and residues from final cuttings) and is focused on forest energy production and use.

Figure 6. Primary energy consumption in Kainuu Region 2012 (4,7 TWh). Source: Kainuu Bioenergy Programme.

The energy wood resources of Kainuu are 1.3 million cubic meters per year against the recent estimated possibility of harvesting of the Forest Research Institute (2013). In recent years one-third of the potential has been harvested. A large part of the energy wood does not spread for use because the wood does not have enough users in surrounding areas. Kainuu is one of the most bio-energy utilizing provinces of our country, where for more than half of the raw materials used for energy production is renewable energy. There is less demand for energy-wood in Northern Finland than in Southern Finland. Export of energy wood, in turn, dampen profitability, because the transport of timber far will be costly. What is crucial is the use of local energy. Several municipalities of Kainuu have already wood-fired heating plants, but more investment should be obtained. (Mustonen 2013)

Figure 7 shows the theoretical availability of energy, so in practice the actual availability is lower in Kainuu Region.

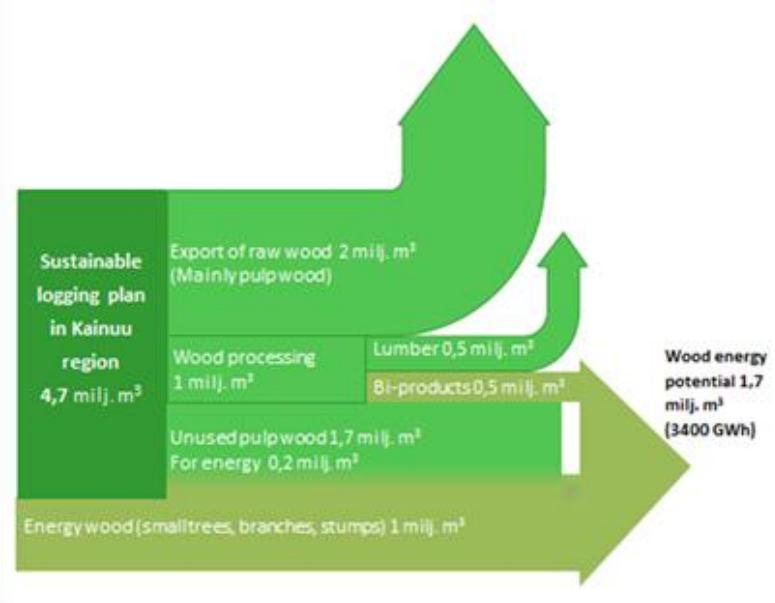



Figure 7. Forest energy potential in Kainuu Region. Source: Kainuu Bioenergy Programme.

Next figure (8) shows the location of the district heating plants in Kainuu region. Municipality of Suomussalmi and some other municipalities are principally using wood energy. Following figure (9) indicates the use of fuels in district heating plants in Kainuu 1998–2012. Use of wood has clearly increased while the amount of peat has collapsed. Emissions trading and other instruments have had a negative impact on the use of peat.

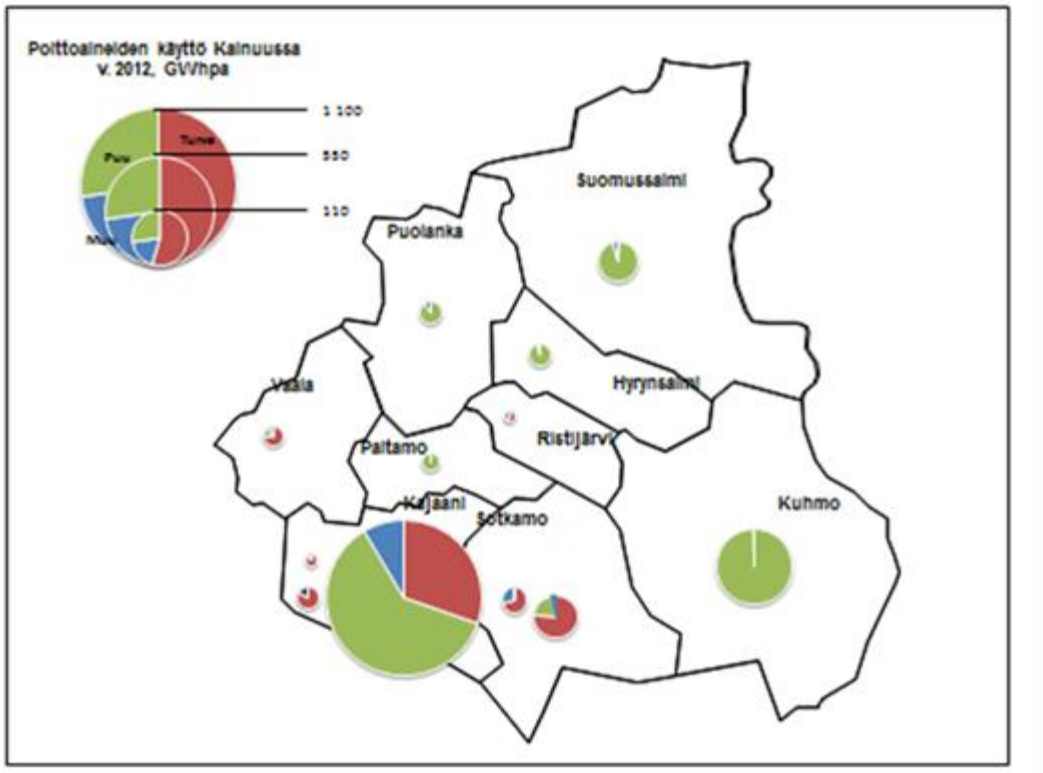



Figure 8. District Heating Plants in Kainuu region. Source: Kainuu Bioenergy Programme. (Pie chart shows the use of fuels in Kainuu 2012. Puu=wood, Turve=peat, Muu=others)

The past few years have been poor for peat production because of high rainfall, and it it has not been possible to produce peat as much as it has been in demand.

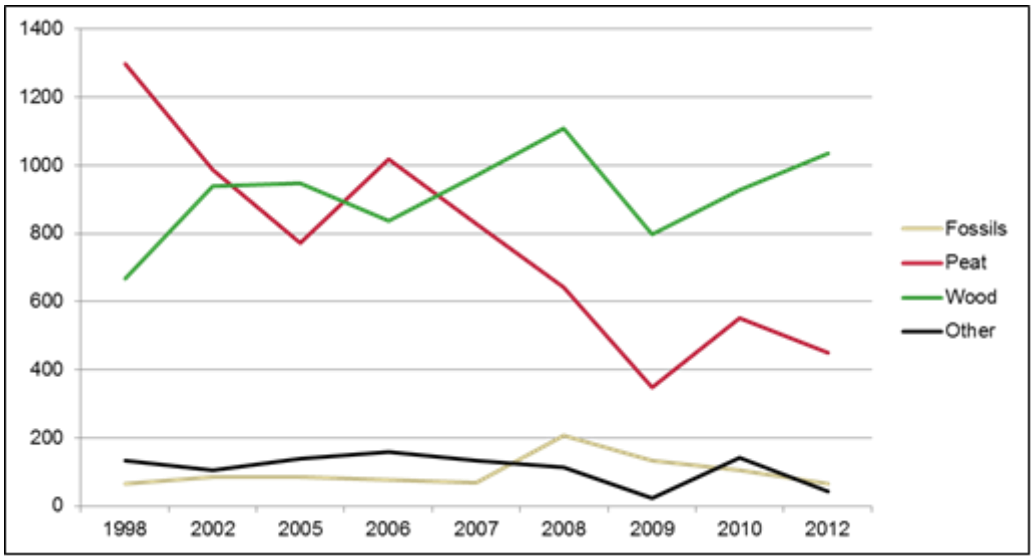



Figure 9. The use of fuels in district heating plants in Kainuu 1998–2012 (GWh). Source: Kainuu Bioenergy Programme.

Table 2 shows the energy wood potential in terminal logging of spruce forests in municipalities of Kainuu. The review is based on the annual cut, and it takes into account the context of accumulating felling branch and crown biomass and stumps. The energy wood accumulation is taken into account poor forest areas and hard to reach areas, whose forest biomass accumulation is not included. Table 2 shows the final felling, but also the energy wood accumulation of young stands.

Table 2. Energy wood accumulation of regeneration fellings in spruce-dominated forests (Source: Forestry Centre of Kainuu)

| Municipality | Felling ha | Proportion of spruce stands % | Spruce ha/year | Harvestable portion % | Harvestable ha/year | Stumps k-m³/year | Branches and crowns k-m³/year | Accumulation of energy wood k-m³/year | Energy content GWh |
|---|---|---|---|---|---|---|---|---|---|
| Hyrynsalmi | 787 | 25 | 197 | 70 | 138 | 13773 | 11018 | 24791 | **48** |
| Kajaani | 787 | 15 | 118 | 70 | 83 | 8264 | 6611 | 14874 | **29** |
| Kuhmo | 2162 | 20 | 432 | 70 | 303 | 30268 | 24214 | 54482 | **105** |
| Paltamo | 561 | 20 | 112 | 70 | 79 | 7854 | 6283 | 14137 | **27** |
| Puolanka | 1692 | 25 | 423 | 70 | 296 | 29610 | 23688 | 53298 | **102** |
| Ristijärvi | 535 | 20 | 107 | 70 | 75 | 7490 | 5992 | 13482 | **26** |
| Sotkamo | 1274 | 25 | 319 | 70 | 223 | 22295 | 17836 | 40131 | **77** |
| Suomussalmi | 3458 | 15 | 519 | 70 | 363 | 36309 | 29047 | 65356 | **125** |
| Vaala | 470 | 5 | 24 | 70 | 16 | 1645 | 1316 | 2961 | **6** |
| **Kainuu total** | **11726** | | **2250** | | **1575** | **157507** | **126006** | **283513** | **545** |

*) m³ = solid cubic meter

Table 3 demonstrates the technical and economic potential of forest biomass in Suomussalmi and in Kainuu region. The annual biomass potential in Suomussalmi is nowadays three times higher than the use in local heating centre.

Table 3. Forest biomass potential in Suomussalmi and Kainuu Region. (Source: Forestry Centre of Finland).

| Region | Forest biomass from final cuttings GWh | Forest biomass from young stands GWh | Total GWh |
|---|---|---|---|
| Suomussalmi | 125 | 43 | 168 |
| Kainuu region | 545 | 275 | 820 |

Forest biomass concerning final cuttings is coming from spruce forests, where the production of forest biomass is technically and economically possible.

According to the latest stocktaking (inventointi) the forest biomass reserve is much more higher and is growing rapidly.

There is a typical district heating network in Suomussalmi centre. It is typical system to Finnish city and village centres. There are two domestic fuel driven boilers (9 and 4 MW) in Suomussalmi municipal centre (Siikaranta, Fig. 10). In addition to this there is 12 MW oil boiler capacity as reserve in the area. The energy production belongs to the emission trade system. The use of fuels is shown in table 4.

Table 4. The use of fuels in Siikaranta district heating plant in 2012.

| Fuel | Use of fuel GWh |
|---|---|
| Forest chips | 58,5 |
| Peat | 0,4 |
| Bi-products from mechanical wood industry (Saw dust, bark) | 1,5 |
| Heavy oil | 2,8 |
| **Total** | **63,2** |

Figure 10. Siikaranta district heating plant in Suomussalmi.

There is also another smaller heating plant in Suomussalmi school center, which uses forest chips 4500 MWh/a. The efficiency of this heating plant is 700 kW. Forest chips for this heating plant comes from local young stands. Tulikivi company has 1 MW forest biomass driven heating plant in the Saarikylä village.

In addition to this family houses and farms have wood boilers and fireplaces in order to produce heat and warm water.

Energy wood harvesting companies of Kainuu have enough equipment at their disposal. The survey asked firms for their suitable equipment of wood energy production. Most companies had harvesting equipment. They had one or more machines, multi-purpose machines and diggers. Almost all enterprises had also local transportation equipment. One company had chipping stock and transportation machines.

The number of wood supply had company-specific variation. An average of energy wood supply was 6–10 per cent of the wood supply amount per year in the companies which were included in the study. Energy wood was purchased each year from 5000 to 15000 m3.

## 2.2 Import of energy wood to Suomussalmi

Energy wood supply companies were asked what energy wood and how much wood (cubic meters) they provided to Siikaranta regional heating plant of Suomussalmi in 2012. Most of the energy wood, 80-100 per cent, was commercial thinning wood. Logging residues accounted for, depending on the company from 9 to 20 per cent. From one company submitted to a lesser extent, the mechanical forest industry by-products. Less than four per cent of the energy wood that one company had provided to Siikaranta was whole-tree chips from Russia. Amount of energy wood delivered to the district heating plant had a great company-specific variation. The smallest amount of space measuring 1000 cubic and the largest of more than 25,000 cubic meters of solid wood energy. Total volume of energy wood delivered to Siikaranta was 30,200 cubic meters of solid (60 GWh) in 2012.

A significant part of the energy wood, almost 40 percent, which was delivered in Siikaranta had been acquired Suomussalmi municipal area in 2012. A third was acquired in the other areas of Finland, and about a fourth of the other municipalities in Kainuu. Share of forest chips imported from Russia was small. (Table 5) In some years, more energy wood has been brought from Russia to Kainuu. At the time, it has complicated the use of local wood.

Table 5. Number and share of energy wood of Siikaranta by producement area in 2012.

| Procurement area | k-m$^3$ | % |
|---|---|---|
| Suomussalmi | 11915 | 39,5 |
| Other municipalities in Kainuu | 7367 | 24,3 |
| Other areas in Finland | 9964 | 33,0 |
| Russia | 954 | 3,2 |
| Total number of energy wood | 30200 | 100,0 |

# 3 IMPACTS OF USE OF BIOENERGY AND ENERGY WOOD HARVESTING IN SUOMUSSALMI CONURBATION

## 3.1 Subsidy for energy harvesting on bioenergy production

Subsidy for energy harvesting will be paid in connection with the treatment harvested for wood energy. The subsidy is paid based on sustainable forestry act financing (KEMERA)'s assets. Subsidy amounts is 7 € per cubic meter and as a requirement for getting the subsidy is that the energy wood accumulates in at least 20 cubic meters and harvested tree is transferred to third parties for energy use. In Kainuu is available € 500 000 this year for supporting energy wood harvesting. In the end of July only 24 per cent of funds had been used. Agriculture and Forestry Ministry has outlined that energy wood support system remains unchanged at least a year.

Table 6 shows accumulation of energy wood from young forests. For these thinning stands it was possible to get a government subsidy (KEMERA support; Act on the Financing of Sustainable Forestry) which allowed an economically viable energy wood harvesting.

Table 6. Accumulation of energy wood income and employment in Kemera (Act on the Financing of Sustainable Forestry) eligible treatment targets of young stands.

| | Logging site ha | Accumulation k-m³ | Accumulation of chips-m³ | Energy GWh |
|---|---|---|---|---|
| Hyrynsalmi | 250 | 6250 | 15000 | **12,0** |
| Kajaani | 650 | 16250 | 39000 | **31,2** |
| Kuhmo | 900 | 22500 | 54000 | **43,2** |
| Paltamo | 400 | 10000 | 24000 | **19,2** |
| Puolanka | 650 | 16250 | 39000 | **31,2** |
| Ristijärvi | 300 | 7500 | 18000 | **14,4** |
| Sotkamo | 1200 | 30000 | 72000 | **57,6** |
| Suomussalmi | 900 | 22500 | 54000 | **43,2** |
| Vaala | 450 | 11250 | 27000 | **21,6** |
| **Kainuu total** | **5700** | **142500** | **342000** | **273,6** |

All the represents of forest industry answered yes when they were asked if there should be financial support for purchasing energy wood from young forests.

From represent of forest industry, wood delivers and wood harvesting companies were asked how big the financial support should be to expedite the harvest of energy wood from young forests. Based on answers financial support should be from 9 to 11 € per cubic meter. Lowest answer was 5 € and highest 15 € per cubic meter.

It was stressed in open answers fact that the action and its development will require predictability and continuity of subsidies. The exact amount of subsidies is not necessarily was as decisive as the predictability of subsidies. One respondent considered that the market should price energy wood. In his opinion, subsidies distort competition and guide harvesting unprofitable destinations.

Forestry professionals were asked where support should be allocated? Most of them were of the view that the aid should be directed to forest owners, but according to one respondent, the aid should be allocated the purchase-making company. The answer was explained by the two respondents. Another stated that it is simpler if the aid is directed to the machine contractor. Another respondent considered that the support to improve throughout the supply chain field.

## 3.2 Local employment and income effects

Likewise, Pellervo Economic Research PTT examined in 2013 regional employment impacts of wood chips, energy peat and industrial wood residues. The study was ordered by the Bioenergy Association. According to the report, in particular wood chips and peat energy are significant regional employers. Fuel peat employs especially in peat land based areas (Ostrobothnia, Northern Ostrobothnia and Lapland), but it has also a significant impact on employment in other parts of Finland. Employment effects of wood chips are more evenly spread over the whole country compared to energy peat. (CO2 report.)

Harvesting of energy wood has employment effects. Public servants and councillors were asked how important they consider the use of local energy wood in Suomussalmi. More than half of them considered the use extremely important and in addition one-third thought it was important (Fig. 11). A few respondents felt that the use was moderately important or that it had little significance.

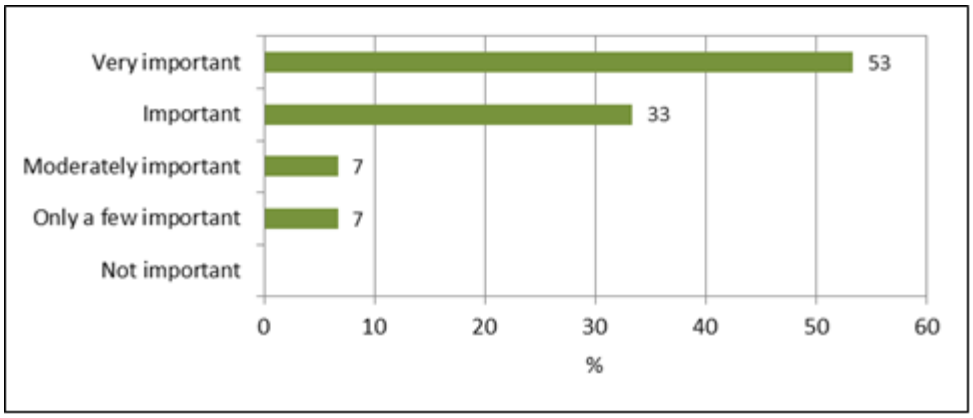



Figure 11. How important do you consider the use of local energy wood at Suomussalmi? (Public servants and councillors, N 15)

Eight responders comment on the issue more detail. One respondent said that the price may not be too high. One respondent said that the tendering rules hamper the local energy wood acquisition. In the three replies it was found that the local energy wood resources should be unleashed. One respondent stated that the energy wood is an ecological and economical alternative to fossil fuels.

Forestry experts as well as Public servants and councillors were asked their opinion if the use of energy wood affects to an external image of the municipality as a green and environmentally responsible municipality. More than half of the respondents felt that the energy wood use had affected a lot and in addition a fifth was thinking that it has had very considerable influence to an external image of the municipality (Fig. 12). One in five respondents felt that it has had only little influence.

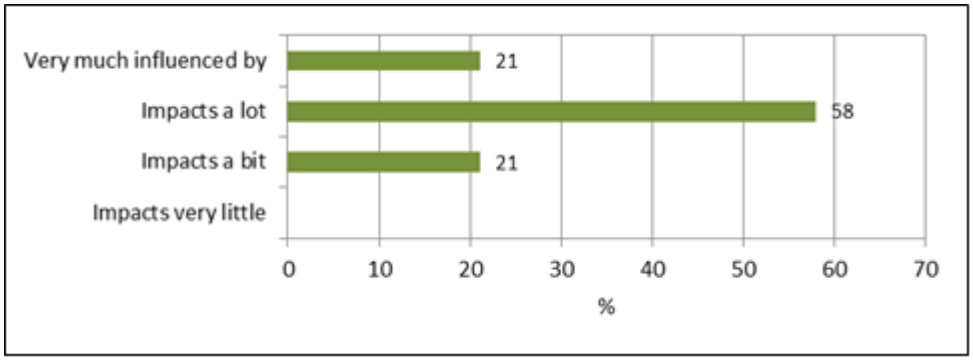



Figure 12. Do you think that use of energy woos is affecting to an external image of municipality as a green and environmentally responsible municipality? (Public and councillors, experts of forest industry; N 19)

Forest owners and logging companies were asked how important they think that at Suomussalmi or on their respective operating area is a forest fuel consuming plant. Nearly two out of three respondents considered it very important, and the rest of respondents importance (Fig. 13). None of the respondents did consider the importance of the matter moderate or low.

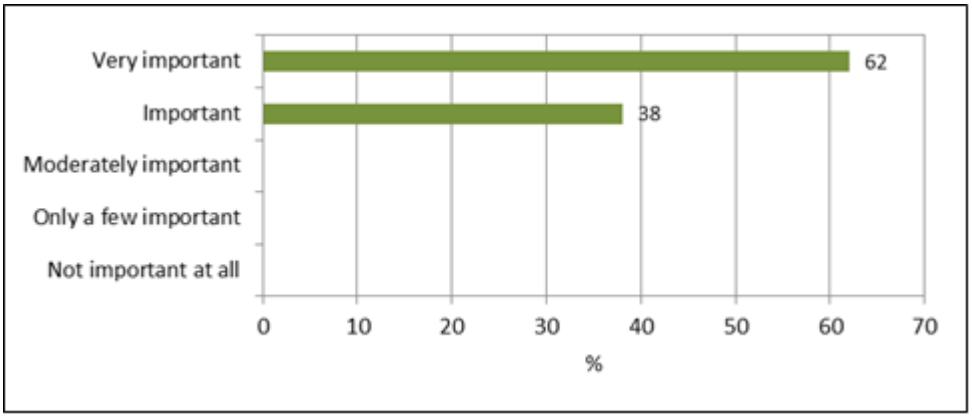



Figure 13. How important it is that at Suomussalmi or on your operating area is a plant using forest fuel? (Forest owner, logging companies N 8)

The forest owners were asked how important they consider the fact that there is demand for energy wood. All respondents considered it important or very important. For forest owners price to be paid for energy wood was important or very important.

The forest owners were also asked about the circumstances in which they would be willing to sell the energy wood. Four people answered. Two respondents highlighted the price. In one reply, it was considered that the location of using plant should be close enough so the transport costs decreased and energy wood logging would be more profitable. One respondent said that the demand will affect sale decision. Similarly, in one response was considered that harvesting matters should be in order.

One of the forest owner answered the question of when he would not be willing to sell the energy wood. He took the view that energy wood can be sold, if the operation is economically profitable.

Public servants and councilors were asked whether the price of heat could be higher in the building owned by the municipality than in buildings owned by private sector if the thermal plant would be

using local wood chips. The majority of respondents said that the price may be higher, while some respondents expressed the opposite view (Fig. 14).

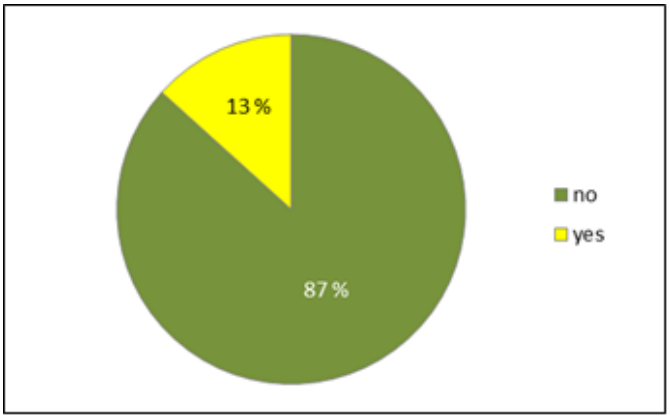



Figure 14. Could the price of heat be higher in municipal owned buildings than in building owned by private sector if the thermal plant would be using local wood chips? (Public servants, N 15)

Most of respondents specified their answer. Majority of them took the view that the price should not be higher. They based their argument on the grounds that it would be hidden subsidy for forest owners, and that the price should be equal for everyone. Some respondents felt that the use of energy wood would benefit the area economically so much that the price could be higher.

Producing energy wood from young stands brings a lot economic impacts to local economy. These impacts are better employment rate, which brings more collected taxes to municipality and the stimulation of the branch of forest industry and entrepreneur. Also forest owners are able to get more stamp price. The areas where thinning have been made in time, are able to produce high-quality round wood to mechanical wood industry in future.

Figure 15 shows a typical interim storage chipping chain, the steps are tree felling, hauling to interim storage, chipping and transportation to the Heating Plant.


Figure 15. The energy wood chain (Source: Piirainen 2013, figure is modified by Timo Karjalainen)

It has been calculated that if we produce 10 000 cubic meter energy wood from the first thinning, this brings 400 000 euro income to local economy. This income is consist of the pay of workers, taxes with multiplier impacts and subsidies to energy wood production. The production of 10 000 cubic meter energy wood is the annual capacity to one harvesting chain. This brings about 4 000 working hours or 3 person years to production chain. (Piirainen 2013.)

Thinnings harvested for energy use has fallen by one third of the earlier of view. Puolanka has the only district heating plant in Kainuu, the fuel used by a significant proportion of thinning wood. Harvested area and the cubic volume could be six times higher. For example, Suomussalmi district heating plant for the vast majority of heat production use of the first thinning wood would employ three harvesting chain in one year. Activities around could employ 15 people. (Moilanen 2013)

## 3.3 Regional impacts of local energy wood

Public servants and councillors were asked their thoughts about the fact that energy chips are being imported from Russia for municipal heating plant and the energy wood of the municipality of Suomussalmi will be unused. It was stated in answers that the competitiveness of the domestic energy wood has to be developed. One respondent also wondered the fact that despite of the subsidies, the domestic wood has not been introduced more cost-effective. Some respondents were of the opinion that the energy wood resources of the municipality should be utilized first. It also was mentioned that the price matters. Some of the answers raised the fact that this perhaps is not the most overall economical option for the municipality. Few respondents stated that based on the Acquisition Act it is not possible to define the areas from where the energy wood is being harvested. It was seen that the situation is not looking good but was also stated that this way more affordable heat energy is available to be sold to the consumers. It was also felt that the amount of the energy wood harvested from the municipality area should be defined in the Acquisition Act.

Same question was also answered by forest industry professionals. All respondents had a critical approach to the imported wood chip. It was brought up in all the answers that the regional economic impacts (the tax incomes coming from harvesting and transporting) should be considered. It was stated that currently the prize determines acquisition decisions and therefore it is most profitable to acquire the wood chip from the most economical area.

Entrepreneurs also answered the question. In all answers was seen that the wood chip should be acquired from the municipality area because of the work and tax incomes it brings to the region. One of the respondents saw that this kind of decision deteriorates and perhaps closes down the local wood chip development. It was also stated that harvesting energy wood is useful for the development of the young forests.

Energy wood suppliers were asked which advantages of wood chips imported from Russia have. In advantages was held in a low price and good quality of wood chip. Disadvantages of Russian wood chip were considered mostly unsure availability and customs formalities. There were also problems in a taxation and transportation. There has been problems with availability of wood chips: *"even though there is a contract, then it may be that the chips did not come"*. Customs formalities are rigid*: "customs cannot ask for advice"*. Further up was risen the issue of uncertainty in authority regulations and the lack of long-term ambition.

## 3.4 Social impacts

### Social impacts

Social impacts of local forest energy production can be defined in the following way: social impacts describe how the planned or made actions (local forest energy production) will affect or affect to the surrounding community; livelihood, quality of life, cohesion, distribution of wellbeing. Social impacts normally are different on different segment of the population. (Ponnikas 2012.)

Energy wood harvesting from our forests is increasing. About half of the Finnish outdoor activities is happening in managed forests, so energy wood harvesting effects on experience of outdoor activities and experiences related to perceived pleasantness of the landscape (Karjalainen & Sievänen 2008:56).

Generally harvesting of small wood and logging residue improves forest environments making them more suitability and appropriateness for leisure use. However, it is not known how much of the logging residue to be collected from the landscape for achieving the positive effects. In addition, the impact of harvesting of logging residue on the landscape may even be negative, if the large piles of logging residue are stored in the column or columns along the road. There are not data available about effects of stump removal to the landscape, but it is likely that at least direct traces of the stump lifting to the landscape and carrier bags of stumps are considered disruptive. It would be desirable that the logging residues and stumps are transported as soon as possible out of the forest and energy wood harvesting would happen with minimum terrain damages and noise pollution caused by harvesting is minimised to foster the leisure use. (Karjalainen & Sievänen 2008:56).

There is not much research data about the impacts of energy wood harvesting to the landscape, navigability and various forms of recreation such as mushroom and berry picking and hunting. Information is missing about acceptable amount of logging residue left to forest and the impact of removal and storage of logging stump and the noise generated from energy wood harvesting. (Karjalainen & Sievänen 2008:56)

The same issue was also addressed in evaluation of Robin Wood Plus project (Ponnikas 2012). Local forest energy production has some impacts also on recreation and refreshment use of forest, on immaterial values of forest and on landscape. Mostly these impacts are positive or neutral. There are also some negative impacts of local wood energy production on recreation and refreshment use of forest. Especially these impacts may occur in the areas which are intensively used for refreshment. Stump removing is the single action which creates negative impacts in largest scale if it is done very roughly.

In the publication of Metla and Tapio (Karjalainen & Sievänen 2008: 56) recommended following to reduce the impact of the energy wood harvesting:

- The side effects of energy wood harvesting should be taken into account in areas that are active leisure use, such as peri-urban areas, tourist centers, outdoor trails, conservation areas and surroundings of the high-density leisure settlements.
- The noise arising from harvesting the energy wood should be reduced by minimizing number of harvesting days in in the forest.
- Harvesting of energy wood should be scheduled for a quiet time of year considering outdoor activities (late autumn).
- Inconvenience caused by harvesting of energy wood can be reduced by informing users of the area about the actions.
- Routes used by outdoorsman should be kept free of energy wood stocks and machines used in harvesting, chipping and transportation.

### Social impact assessment

Social impact assessment (SIA) is a method for fostering participatory forestry planning and evaluating social impacts of local forest energy production. "SIA includes the processes of analyzing,

monitoring and managing the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions. Its primary purpose is to bring about a more sustainable and equitable biophysical and human environment." (Ponnikas 2012; Vanclay 2003.)

By using this model and evaluating social impacts of local forest energy production the participatory forestry planning can be developed. Social impact assessment is a method for fostering participatory forestry planning. (Ponnikas 2012.)

Social impacts of local forest energy production can be recognized from local and from regional level. At the regional level social impacts mean different kind of impacts like economic and demographic development of region, which can be analyzed via regional statistics. On regional scale social impacts could mean impacts on economy and employment or wider feedback impacts on region's development or impacts derived from possible infrastructure construction made for local forest energy production. Regional scale impacts can be analyzed via national and regional statistics and via expert interviews and by using focus group discussions. (Ponnikas 2012.)

The local scale analyze of social impacts is maybe the most crucial and informative analyze of social impacts. On a local scale there might be impacts to local subsistence, small to medium-scale enterprise, residents' wellbeing and domestic and recreational use of natural resources, including impacts on refreshment use of woods and impacts on immaterial values of forests. Local scale impacts should be analyzed via questionnaires and interviews targeted to local people, entrepreneurs and public officers of some case area. The impacts at local level can be evaluated by asking how people feel the changes, observing how they change their operation modes. In principle the model of SIA, used in this best practice, can be described as follows (Fig. 16). (Ponnikas 2012.)

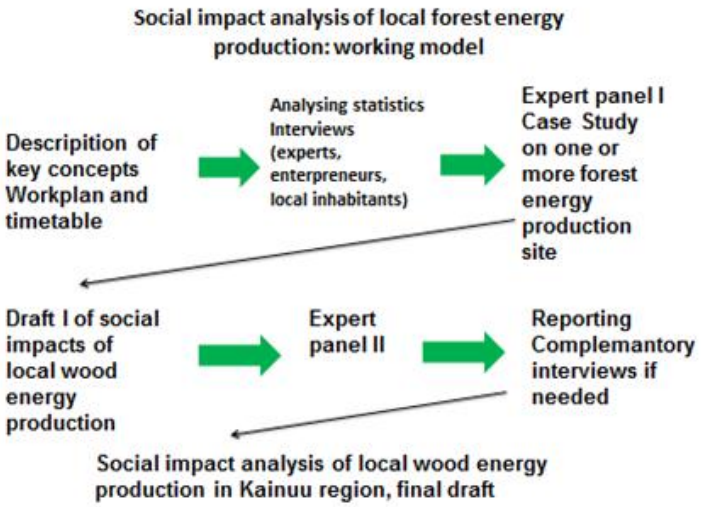



Figure 16. Social impact analysis of local forest energy production: working model.

Social impact assessment is an important method, because it helps local people to get their voice heard. Public hearings, interviews, questionnaires and observing used as a part of SIA collect the opinions of local people. Local people do not get their voice heard if the SIA don't have official position in the planning system. In order to be effective SIA has to be a part of official planning system so that the results of hearings made in the SIA process will also affect to the final decisions. In Finland the

official SIA is a part of environmental impact assessment and it is regulated by law. People turn against SIA if they find it useless and this has bad influence for those objectives SIA should work for (targeting more sustainable and equitable biophysical and human environment). (Ponnikas 2012.)

Social impacts at local and regional level should be analyzed at least from following perspectives: intended and unintended social impacts, positive and negative social consequences, contradictions between different lines of business. It is also crucial to analyze who will benefit and who will suffer from the local forest energy production, because impacts are different for different group of people. (Ponnikas 2012.)

### Impacts of local wood energy use – Suomussalmi case

From all of the groups (forest specialists, forest owners, public servants and councillors, wood suppliers, entrepreneurs) were asked how the use of the local energy wood from the region of Suomussalmi has influenced in different things. The majority of respondents felt that the local energy has slightly improved the most of the present cases. The landscape in logging areas is easier to move, local employment and the local residential amenity of the area and the community spirit was seen as slightly improved thanks to the use of wood energy (Fig. 17 ). Some of the respondents experienced a significant improvement in for example in usability of logging areas and the amenity in surrounding landscape, while others were of the opinion that the use of energy wood has weakened slightly condition of the roads. The majority of respondents saw that use of energy wood had not have any impact on such things as road condition, road network coverage or the provision of public services in nearby areas.

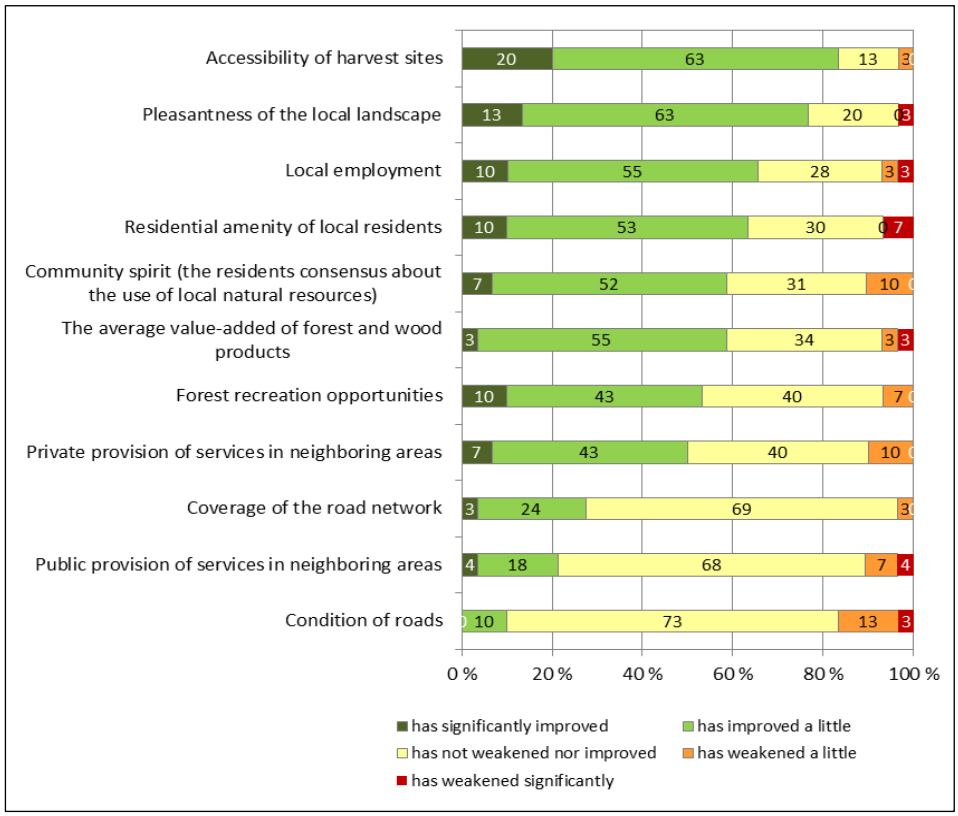



Figure 17. How the use of the local energy wood from the region of Suomussalmi has influenced in different things? (Forest specialists, forest owners, public servants and councillors, wood suppliers, entrepreneurs, N 28-30)

Respondents commented on the textual of other effects. In some answers it was considered that the energy wood gathering has brought jobs and prosperity in the region. Few respondents considered that the energy wood harvest improve forest growth in the future. It was mentioned that the effects have been minimal, since the activity is currently so little. It also was said that the energy wood is currently the only effective form of wood processing. One respondent was afraid of the potential environmental impacts that could arise from the collection energy wood.

All respondent groups (forestry professionals, forest owners, public servants and councillors, wood suppliers, entrepreneurs) were asked how the use of the local energy wood of Suomussalmi has influenced in following subjects. The majority of respondents were of the opinion that things had absolutely no effect or that the effect was negligible (Fig. 18). More than half of the respondent sees that the use energy wood caused emissions to the environment. The majority of respondents felt that the use of energy wood caused minor dust and noise harm.

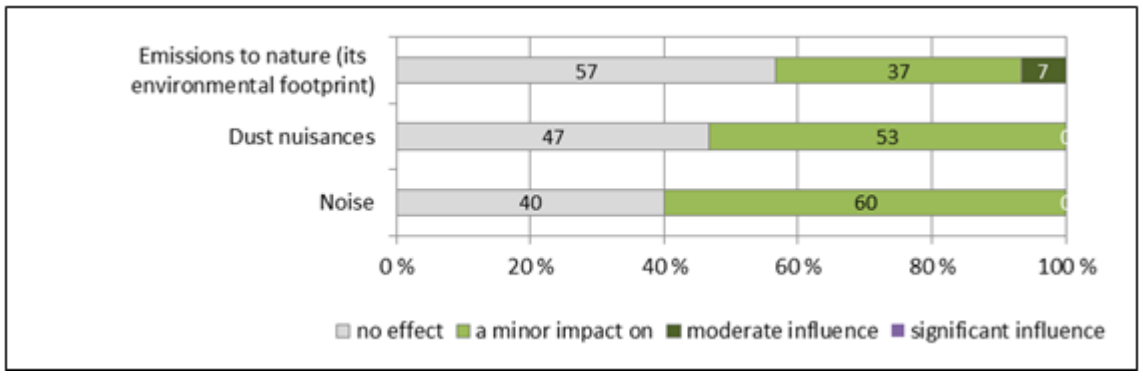



Figure 18. How the use of the local energy wood of Suomussalmi has influenced in following different subjects? (Forest specialists, forest owners, public servants and councillors, wood suppliers, entrepreneurs, N 30)

Respondents commented on the effects. Half of them took the view that the effects are minimal. Some respondents considered that the condition of forests has improved as a result of energy wood collection. Respondents were concerned that the forests would suffer from deficit of nutrient if logging waste is exported out of the area.

## 3.5 Promoting the use of bio-energy in Suomussalmi

Use of heavy fuel oil is not possible at the end of this decade, so the wood fuel is available at these locations. Also, light fuel oil use has fallen. Light oil using single-family homes has shifted to the use of wood pellets. Oil heating has also been renovated in geothermal energy.

### Support of the use of local energy wood in national level

Public servants and councils were asked how the use of local energy wood could be best promoted in their opinion. Majority of answers it was considered that the level of subsidy paid for wood energy should be raised to the level that the local energy wood would be competitive. Some respondents highlighted tax increase for fossil fuels. It also was wished to have changes on procurement legislation so that the locality of energy wood could be taken into account. One respondent raised up the question how could there be tax changes, which could make the using of energy wood more affordable.

The same question was asked from the forestry sector professionals. Respondents wished financial support for either the energy wood or for the electricity generated by energy wood. Some respondents

highlighted that taxes for a use of fossil fuels should be raised. Contributors brought up the question should there be target of energy generated by bioenergy.

Question was also answered by forest owners. They said that the competition should determine the price, but the use shipping subsidies for local could help the use energy wood. It was also emphasized that the energy of wood should be used commonly when demand would also be more stable.

The same question was represented to the wood suppliers. All respondents consider in their responses the need for long term, predictable subsidy policy. It should be predictable to the next 5-10 years. To same question answered the entrepreneurs who raised the question about subsidy policy sustainability and predictability. Some of the replies hoped that the competitiveness of fossil fuels would be weakened by taxation. One respondent thought that the environmental protection tax set to peat has improved the competitiveness of coal, and this has led to decrease in use of wood energy. It was considered that the subsidies do not take the use of energy wood the long term but the research and development should be supported. When combined with decentralized electricity and heat production, energy policy would increase investment in the provinces and thus increase the use of energy wood in new places. Also responses arose the need to get in provinces large heating plants which have modern equipment.

### Support of the use of local energy wood in local level

Public servants and councils were also asked about how energy use could be promoted at the local level. It was underlined a need for cooperation between different actors. For example sawmill would allow a wider use of wood and the use of surplus electricity, heat or biodiesel. Some respondents wished encouragement and support for local entrepreneurship. It was hoped that the procurement decisions would reflect the overall economy and ecology of the area. In one reply, it was considered that there just nothing to be done. It was also emphasized that an adequate supply of wood chips and production reliability has to be guaranteed.

Forestry professionals answered at the same question. Answerers hoped that the profitability calculations would reflect the regional economic impacts when purchasing decisions are made. It was speculated if small municipalities should set up a common acquisition chain via which could be purchased energy wood for municipalities. Similarly there were suggested that the thermal plants could buy small loads of wood chip from small suppliers, such as farmers. This would not have much impact on the big picture, but it would support the local industry. One respondent called for society to support for firms, especially in start-up phase. Likewise, he was in need for better briefing about possibilities.

Also forest owners and wood suppliers answered the question. Majority of the respondents considered that benefit of collecting and using of energy wood should be informed more efficiently and market that alternative. For example, forest owners should have the knowledge about the impact of energy harvesting has to the subsequent profit of the forest. Some respondents hoped aids to entrepreneurs. It was wished that there would be more local development and research about quality and storing of energy wood. Together with the answer hoped for local research and develop-raising activities, especially the quality of energy and storage. One respondent called for better cooperation between the different actors.

Further the entrepreneurs answered to the question. They hoped for more places which should have up-to-date equipment and who would be committed to use the local energy wood. Similarly in some answers it was hoped that in acquisition decisions there would be a condition about amounts of local wood. It was wished that the decision-makers would have better understanding about the subject. In the same answer it was hoped that the forest owners have more knowledge about thinning loggings.

# 4 CASE KOSTOMUKSHA AND KALEVALA

This chapter gives a brief overview of two different pilots in Russian Karelia. Both of them have been a subject of renovation. Energy improvement measures have been different but clearly show how necessary they have been.

## 4.1 Heat pump installation in the Korablic kindergarten in Kostomuksha

First pilot, Kindergarten Korablic was constructed in 1986 (Fig. 19). There are approximately 300 children and 80 staff members. Low energy prices did not encourage using economical solutions and there were not efficient technologies available at the time of construction.

Figure 19. The kindergarten Korablic (the Ship).

The main project on Korablic was swimming pool area built using technologies that are now outdated. High humidity levels and the temperature of water and air in pool were not filling the standards. The temperature of water had to be kept too high, which resulted in strong evaporation of water. Since there was no proper ventilation installed, high humidity caused discomfort and damaged structural materials and finishes. It also led to the appearance and proliferation of fungi and mold. Also the level of carbon dioxide increased when children exercised in the pool. (Heat Pump Installation in the Korablic Kindergarten in Kostomuksha brochure.)

By these factors it was clear that something should be done. City of Kostomuksha decided to reconstruct the heat recovery system of the swimming pool area. The main components were new ventilation unit (Litened 50-25) and two new air dryers (Neoclima). Reconstruction and installation started on August 12th and it was completed by the end of October 2013 (Fig. 20). The pool was open for kids on November 4th, 2013. (Heat Pump Installation in the Korablic Kindergarten in Kostomuksha brochure.)

Figure 20. The entire swimming pool, after repair.

At the moment, air temperature has normalised, and there is no excess humidity. Proper ventilation should save energy from 62 to 92 percentages. It also minimises the load on the heating system and it provides optimal conditions for recreation and maintains better health conditions for the children. The investment to this project was 20 000 euro (half Kostomuksha city administration and other half was provided by the Karelia ENPI CBC programme). (Heat Pump Installation in the Korablic Kindergarten in Kostomuksha brochure.)

Figure 21 shows the energy consumption of three winter months (November – January) in two consecutive years. Power consumption has increased due to installation of two additional air dryers. Power consumption for is each 1.56 KWh. In the short term, this will increase the energy consumption. Repair utility will appear later.

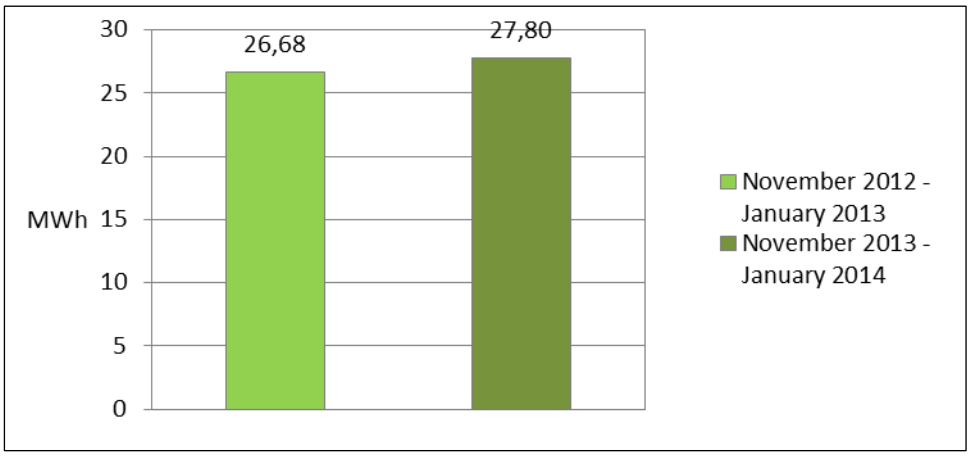



Figure 21. Energy consumption of three winter months (MWh) in two consecutive years. Consumption monitoring concerns the whole buildning.

Next figure (22) reveals the cost of energy consumption of three winter months of two consecutive year-end. The costs have increased. There are two explanations. First: the price for 1kWh has risen from 0,12 Euro in 2012 to 0,13 Euro in 2013. Second: consumption has increased (see Fig. 21).

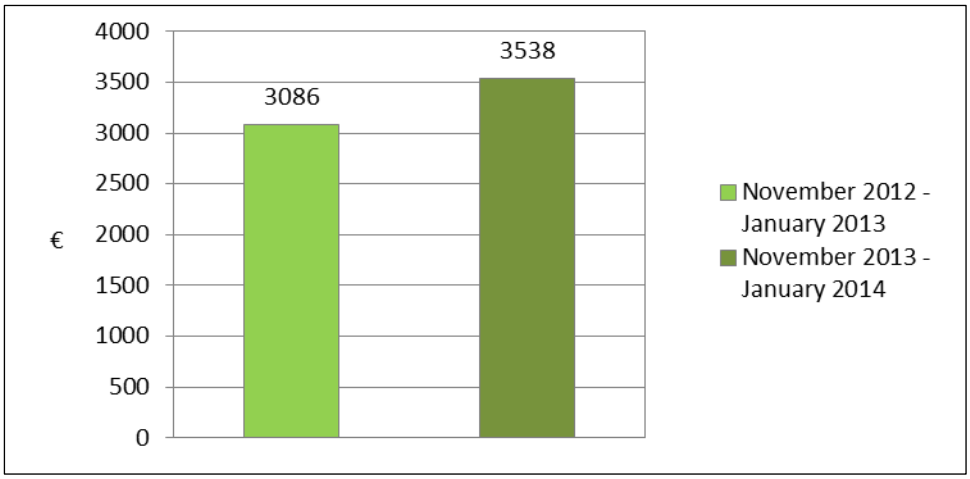



Figure 22. Cost of energy consumption of three winter months (€) in two consecutive years.

However the investment has been absolutely necessary because of the comfort of use, energy conservation and the decreased humidity stress to the structures. Also the increase of energy consumption would have been higher without new ventilation system with heat recovery.

Two periods (that lasted three months) is a short time to make conclusions about the utility of the repair. Temperatures of winter days have significant differences in two consecutive years which directly affects to heat needs of the buildings. Here is shortly examined the heating degree days of above dates (Figs. 21 and 22). The heating degree days obtained from Finnish Meteorological Institute and the locality is Kajaani. City of Kajaani is situated almost at the same latitude as Kostamus and the numbers are only indicative. In 2012–13 the read-out of heating degree days was higher than one year later (Table 7). Especially December 2012 was cold. January 2014 was in turn colder than January 2013.

Table 7. Heating degree days in Kajaani, Finland in two consecutive years. (Source: Finnish Meteorological Institute 2014)

| period | heating degree days | period | heating degree days |
|---|---|---|---|
| 11/2012 | 529 | 11/2013 | 519 |
| 12/2012 | 945 | 12/2013 | 616 |
| 1/2013 | 794 | 1/2014 | 885 |
| 3 months | 2268 | 3 months | 2020 |

In the future it is important to study the impacts of the investment. For example now when the limit values of the humidity are correct (earlier the humidity was too high and there was mold in the pool area), what kind of effects it has on children's health?

## 4.2 Thermal insulation in the kindergarten Rycheek in Kalevala

The kindergarten No. 2 Rycheek in Kalevala was selected as a second pilot site for a small scale demonstration project (Fig. 23). The criterion for selection was the high social significance of the

facility and the fact that this investment may be used as a model for other similar buildings and projects. About 9000 euros was going to be used for this investment. (Thermal Insulation Investment in the Kindergarten Rycheek in Kalevala brochure.)

Figure 23. Kindergarten Rycheek in Kalevala.

The wooden building was constructed in 1992 and it was not properly insulated at that time. There are approximately 50 children and 10 staff members in the kindergarten. Size of the building is 360 m$^2$. In April 2013 energy auditor and other experts from KRIMEL conducted a thermal imaging survey to the kindergarten. Both the interior and the outer sides of the building were inspected. The results showed significant heat losses occurring through the floor slabs of the building and particularly through the attic and the roof (Fig. 24.) (Thermal Insulation Investment in the Kindergarten Rycheek in Kalevala brochure.)

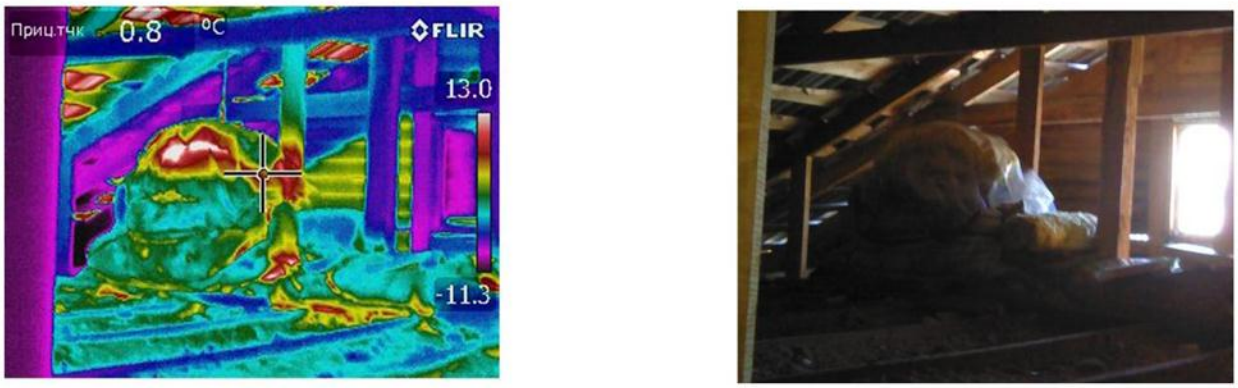



Figure 24. Photos of the attic of the kindergarten before repair. Thermal camera image left: the outside temperature is +0,8 degrees, but in the attic there are many degrees below the zero. Purple color shows the lowest temperature. On the right is the same point with an ordinary camera photographed.

Based on findings, it was decided that the situation had to be fixed. The attic was to be insulated in order to stop heat losses. The insulation was made with effective thermal insulation material (basalt rock wool, density of 30-40 kg/m$^3$) with the thickness of 200 millimeters (Fig. 25). The construction and repair work on the inter-floor insulation (ceiling) of floor slabs was carried out during the summer of 2013. The work was accepted by a commission including representation of the kindergarten, the Administration of Kalevala and of the Education Department of the municipal district of Kalevala. New energy audit is scheduled for December 2013. (Thermal Insulation Investment in the Kindergarten Rycheek in Kalevala brochure.)

Figure 25. Attic of the kindergarten after repair. Isolations of the ceiling, walls and floor are shown in photo.

Figure below (Fig. 26) shows the heating energy consumption in kindergarten before and after the insulation. Consumption of energy and at the same time heating costs of heating decreased considerably after the repair. (Koshelev 2014.)

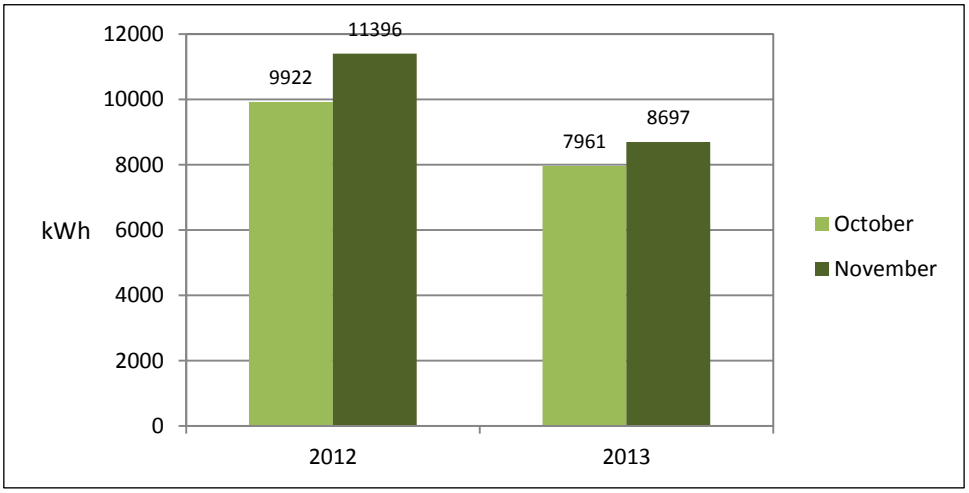



Figure 26. Heating energy consumption in kindergarten Rycheek in two times (kWh). Source: Koshelev 2014.

Air temperature impacts on the need of heating energy and it may have influenced on the results of calculations (Fig. 26). Table 8 indicates the heating degree days in Kajaani, above mentioned months and years.. Kajaani is situated somehow further to the south than Kalevala (Fig. 3), so the numbers are only indicative. Anyway, they reveal, that the need of heating energy varied a little bit in these years.

Table 8. Heating degree days in Kajaani, Finland in two consecutive years. (Source: Finnish Meteorological Institute 2014)

| period | heating degree days | period | heating degree days |
|---|---|---|---|
| 10/2012 | 437 | 10/2013 | 415 |
| 11/2012 | 529 | 11/2013 | 519 |
| 2 months | 966 | 2 months | 934 |

Analyses of KRIMEL show reduction in energy consumption by an average of 19 %. In Rycheek this will entail 15 200 kWh per year energy saving. Investment savings can be calculated in money. KRIMEL has calculated thet the payback period of the project implemented would be 4 years. (Koshelev 2014.)

The outcome of this project was, that the most vulnerable and troubled spots in the structure of the building in terms of energy efficiency were identified. Heat loss through the attic floor was eliminated by using modern energy saving solution. Implemented activity entailed considerable heat loss decrease and saving of money. Also now expedience and advantage of using such solutions is established and the solution can be recommended for wider application.

Energy auditor and other experts from KRIMEL also made recommendations about further activities (Koshelev 2014):

- Replacement of the window frames for plastic ones with multiple glass units
- Replacement or insulation of the emergency exit door in the bedrooms
- Installation of the automatic heating boiler

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**Appendix 1.** Questionnaire of forest professionals 2013

## KYSELY METSÄALAN AMMATTILAISILLE

Kyselyn vastaukset käsitellään luottamuksellisesti siten, etteivät yksittäisten vastaajien henkilötiedot ja kommentit paljastu raportoinnissa.

| | |
|---|---|
| **Vastaajan nimi** | |
| **Organisaatio** | |

**Nuorten metsien hoidolla ja energiapuun korjuulla on selkeä metsänhoidollinen vaikutus.**

**1a. Tarvitseeko energiapuun hankinta nuorista metsistä mielestänne tukea?**

- ☐ Kyllä
- ☐ Ei

**1b. Jos hankinta tarvitsee korjuutukea, kuinka suuri tuen pitäisi olla, jotta hankinta saataisiin todella käyntiin? _____€/km$^3$.**

**2a. Mihin tuki pitäisi kohdistaa?** (valitkaa ensisijainen vaihtoehto)

- ☐ Metsänomistajalle
- ☐ Hankintaa tekevälle yritykselle
- ☐ Lämpölaitokselle

**2b. Voitte halutessanne kommentoida edellä olevaa kysymystä**

| |
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| |

**3. Vaikuttaako mielestänne energiapuun käyttö kunnan ulkoiseen kuvaan ”vihreänä” ja ympäristövastuullisena kuntana?** (valitkaa mielestänne sopivin vaihtoehto)

- ☐ Vaikuttaa erittäin paljon
- ☐ Vaikuttaa paljon
- ☐ Vaikuttaa vähän
- ☐ Vaikuttaa erittäin vähän

**4. Millaisia ajatuksia teissä herättää se, että Venäjältä tuodaan energiahaketta kunnan lämpölaitokseen ja oman kunnan energiapuu jää tältä osin käyttämättä.**

| |
|---|
| |

**5a. Miten Suomussalmen alueella toteutettu paikallinen energiapuun käyttö on mielestänne vaikuttanut seuraaviin asioihin?** 1= on heikentynyt merkittävästi, 2= on heikentynyt hieman, 3= ei ole heikentynyt mutta ei parantunutkaan, 4= on parantunut hieman, 5= on parantunut merkittävästi.

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Metsän virkistyskäyttömahdollisuudet | | | | | |
| Hakkuualueiden kulkukelpoisuus | | | | | |
| Lähimaiseman viihtyisyys | | | | | |
| Paikallisten asukkaiden asuinviihtyisyys | | | | | |
| Alueen yhteishenki (asukkaiden kokema yhteisymmärrys paikallisten luonnonvarojen käytöstä) | | | | | |
| Tiestön kunto | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Tieverkoston kattavuus | | | | | |
| Paikallinen työllisyys | | | | | |
| Metsä- ja puualan tuotteiden keskimääräinen jalostusarvo | | | | | |
| Yksityinen palvelujen tarjonta lähialueilla | | | | | |
| Julkinen palvelujen tarjonta lähialueilla | | | | | |
| Muu vaikutus, mikä? (kommentoi alla) | | | | | |

**Mikä muu vaikutus?**

| |
|---|
| |

**5b. Miten arvioitte Suomussalmen alueella toteutetun paikallisen energiapuun käytön vaikutusten kohdistuneen seuraaviin asioihin?** 1= ei lainkaan vaikutusta, 2= vähäinen vaikutus, 3= kohtalainen vaikutus, 4= merkittävä vaikutus.

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Meluhaitat | | | | |
| Pölyhaitat | | | | |
| Päästöt luontoon (ympäristön kuormittaminen) | | | | |
| Muut vaikutukset lähiympäristöön, mitkä? (kommentoi alla) | | | | |

**Mitkä muut vaikutukset lähiympäristöön?**

| |
|---|
| |

**6. Kuinka paikallisen energiapuun käyttöä voitaisiin mielestänne parhaiten edistää**

**a. Valtakunnan tasolla?**

| |
|---|
| |

**b. Paikallisella tasolla?**

| |
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| |

**KIITOS VASTAAMISESTA!**

**Appendix 2.** Questionnaire of forest owners 2013

## KYSELY METSÄNOMISTAJILLE

Kyselyn vastaukset käsitellään luottamuksellisesti siten, etteivät yksittäisten vastaajien henkilötiedot ja kommentit paljastu raportoinnissa.

| | |
|---|---|
| **Vastaajan nimi** | |
| **Yritys/organisaatio** | |

**1. Kuinka tärkeänä pidätte sitä, että alueella on kysyntää energiapuulle?** (valitkaa mielestänne sopivin vaihtoehto)

- ☐ Erittäin tärkeänä
- ☐ Tärkeänä
- ☐ Kohtalaisen tärkeänä
- ☐ Vain vähän tärkeänä
- ☐ Ei lainkaan tärkeänä

**2. Kuinka tärkeänä pidätte sitä, että Suomussalmella on metsäpolttoainetta käyttävä laitos?** (valitkaa mielestänne sopivin vaihtoehto)

- ☐ Erittäin tärkeänä
- ☐ Tärkeänä
- ☐ Kohtalaisen tärkeänä
- ☐ Vain vähän tärkeänä
- ☐ Ei lainkaan tärkeänä

**Kuinka suhtaudutte energiapuun myyntiin tilaltanne?**

**3a. Olisin periaatteessa valmis myymään energiapuuta, jos…**

| |
|---|
| |

**3b. En ole valmis myymään energiapuuta, koska…**

| |
|---|
| |

**Nuorten metsien hoidolla ja energiapuun korjuulla on selkeä metsänhoidollinen vaikutus.**

**4. Kuinka tärkeänä pidätte Teille energiapuusta maksettavaa hintaa?**

- ☐ Erittäin tärkeänä
- ☐ Tärkeänä
- ☐ Kohtalaisen tärkeänä
- ☐ Vain vähän tärkeänä
- ☐ Ei lainkaan tärkeänä

**5. Kuinka suuri energiapuun korjuutuen pitäisi olla, jotta energiapuun hankinta nuorista metsistä saataisiin todella käyntiin? _____€/km$^3$.**

**6a. Miten Suomussalmen alueella toteutettu paikallinen energiapuun käyttö on mielestänne vaikuttanut seuraaviin asioihin?** 1= on heikentynyt merkittävästi, 2= on heikentynyt hieman, 3= ei ole heikentynyt mutta ei parantunutkaan, 4= on parantunut hieman, 5= on parantunut merkittävästi.

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Metsän virkistyskäyttömahdollisuudet | | | | | |
| Hakkuualueiden kulkukelpoisuus | | | | | |
| Lähimaiseman viihtyisyys | | | | | |
| Paikallisten asukkaiden asuinviihtyisyys | | | | | |
| Alueen yhteishenki (asukkaiden kokema yhteisymmärrys paikallisten luonnonvarojen käytöstä) | | | | | |
| Tiestön kunto | | | | | |
| Tieverkoston kattavuus | | | | | |
| Paikallinen työllisyys | | | | | |
| Metsä- ja puualan tuotteiden keskimääräinen jalostusarvo | | | | | |
| Yksityinen palvelujen tarjonta lähialueilla | | | | | |
| Julkinen palvelujen tarjonta lähialueilla | | | | | |
| Muu vaikutus, mikä? | | | | | |

**Mikä muu vaikutus?**

| |
|---|
| |

**6b. Miten arvioitte Suomussalmen alueella toteutetun paikallisen energiapuun käytön vaikutusten kohdistuneen seuraaviin asioihin?** 1= ei lainkaan vaikutusta, 2= vähäinen vaikutus, 3= kohtalainen vaikutus, 4= merkittävä vaikutus.

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Meluhaitat | | | | |
| Pölyhaitat | | | | |
| Päästöt luontoon (ympäristön kuormittaminen) | | | | |
| Muut vaikutukset lähiympäristöön, mitkä? | | | | |

**Mitkä muut vaikutukset lähiympäristöön?**

| |
|---|
| |

**7. Kuinka paikallisen energiapuun käyttöä voitaisiin mielestänne parhaiten edistää**

**a. Valtakunnan tasolla?**

| |
|---|
| |

**b. Paikallisella tasolla?**

| |
|---|
| |

**KIITOS VASTAAMISESTA**

**Appendix 3.** Questionnaire of public servants and councillors 2013.

## KYSELY VIRKAMIEHILLE JA LUOTTAMUSMIEHILLE

Kyselyn vastaukset käsitellään luottamuksellisesti siten, etteivät yksittäisten vastaajien henkilötiedot ja kommentit paljastu raportoinnissa.

| | |
|---|---|
| **Vastaajan nimi** | |
| **Organisaatio** | |

**1a. Kuinka tärkeänä pidätte paikallisen energiapuun käyttöä Suomussalmella?** (valitkaa mielestänne sopivin vaihtoehto)

- ☐ Erittäin tärkeänä
- ☐ Tärkeänä
- ☐ Kohtalaisen tärkeänä
- ☐ Vain vähän tärkeänä
- ☐ Ei lainkaan tärkeänä

**1b. Voitte halutessanne kommentoida edellä olevaa kysymystä.**

**2. Vaikuttaako mielestänne energiapuun käyttö kunnan ulkoiseen kuvaan ”vihreänä” ja ympäristövastuullisena kuntana?** (valitkaa mielestänne sopivin vaihtoehto)

- ☐ Vaikuttaa erittäin paljon
- ☐ Vaikuttaa paljon
- ☐ Vaikuttaa vähän
- ☐ Vaikuttaa erittäin vähän

**3. Millaisia ajatuksia teissä herättää se, että Venäjältä tuodaan energiahaketta kunnan lämpölaitokseen ja vastaava määrä oman kunnan metsien energiapuuta jää käyttämättä.**

**4a. Voisiko lämmön hinta kunnan omissa kiinteistöissä olla yksityistä kaukolämmön ostajaa korkeampi, jos lämpölaitoksella käytettäisiin paikallista metsähaketta?**

- ☐ Kyllä
- ☐ Ei

**4b. Perustele edellä antamaasi vastausta.**

**5a. Miten Suomussalmen alueella toteutettu paikallinen energiapuun käyttö on mielestänne vaikuttanut seuraaviin asioihin?** 1= on heikentynyt merkittävästi, 2= on heikentynyt hieman, 3= ei ole heikentynyt mutta ei parantunutkaan, 4= on parantunut hieman, 5= on parantunut merkittävästi.

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Metsän virkistyskäyttömahdollisuudet | | | | | |
| Hakkuualueiden kulkukelpoisuus | | | | | |
| Lähimaiseman viihtyisyys | | | | | |
| Paikallisten asukkaiden asuinviihtyisyys | | | | | |
| Alueen yhteishenki (asukkaiden kokema yhteisymmärrys paikallisten luonnonvarojen käytöstä) | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Tiestön kunto | | | | | |
| Tieverkoston kattavuus | | | | | |
| Paikallinen työllisyys | | | | | |
| Metsä- ja puualan tuotteiden keskimääräinen jalostusarvo | | | | | |
| Yksityinen palvelujen tarjonta lähialueilla | | | | | |
| Julkinen palvelujen tarjonta lähialueilla | | | | | |
| Muu vaikutus, mikä? | | | | | |

**Mikä muu vaikutus?**

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| |

**5b. Miten arvioitte Suomussalmen alueella toteutetun paikallisen energiapuun käytön vaikutusten kohdistuneen seuraaviin asioihin?** 1= ei lainkaan vaikutusta, 2= vähäinen vaikutus, 3= kohtalainen vaikutus, 4= merkittävä vaikutus.

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Meluhaitat | | | | |
| Pölyhaitat | | | | |
| Päästöt luontoon (ympäristön kuormittaminen) | | | | |
| Muut vaikutukset lähiympäristöön, mitkä? | | | | |

**Mitkä muut vaikutukset lähiympäristöön?**

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**6. Kuinka paikallisen energiapuun käyttöä voitaisiin mielestänne parhaiten edistää**

**a. Valtakunnan tasolla?**

| |
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| |

**b. Paikallisella tasolla?**

| |
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**KIITOS VASTAAMISESTA**

**Appendix 4.** Questionnaire of energy wood suppliers 2013

## HAASTATTELUT ENERGIAPUUN TOIMITTAJILLE

Haastattelun vastaukset käsitellään luottamuksellisesti siten, etteivät yksittäisten vastaajien henkilötiedot ja kommentit paljastu raportoinnissa.

| | |
|---|---|
| **Vastaajan nimi** | |
| **Yritys** | |

**1. Mitä energiapuuta ja kuinka paljon (kiintokuutiometreinä) toimititte vuonna 2012 Suomussalmen Siikarannan aluelämpölaitokselle?**

Siikarannan voimalaitokselle toimitetun energiapuun määrä:_____ k-m$^3$, josta

a) Mekaanisen metsäteollisuuden sivutuotteet,_____ %
b) Kantomurske,_____ %
c) Hakkuutähteet,_____ %
d) Nuoren metsän harvennuspuu,_____ %
e) Kokopuuhake Venäjältä, ,_____ %
f) Muu____, % Mikä?_____

**2. Mistä hankitte em. Siikarantaan toimittamanne energiapuun vuonna 2012?**

Suomussalmen kunnan alueelta hankitun energiapuun osuus_____ %?
Muun Kainuun alueelta, _____%
Muualta Suomesta, _____ %
Venäjältä, _____%

**Venäjältä tuodaan Suomeen haketta.**

**3a. Mitkä ovat Venäjältä tuotavan hakkeen hyviä puolia?** (voitte valita useamman vaihtoehdon seuraavista)

☐ Hinta
☐ Hyvä saatavuus
☐ Hyvä laatu
☐ Joku muu, mikä _____

**3b. Mitkä ovat Venäjältä tuotavan hakkeen huonoja puolia?** (voitte valita useamman vaihtoehdon seuraavista)

☐ Epävarma saatavuus
☐ Tullimuodollisuudet
☐ Verotuskäytännöt
☐ Kuljetuskustannukset
☐ Joku muu, mikä _____

**Nuorten metsien hoidolla ja energiapuun korjuulla on selkeä metsänhoidollinen vaikutus.**

**4. Kuinka suuri pitäisi energiapuun korjuutuen olla, jotta energiapuun hankinta paikallisista nuorista metsistä saataisiin todella käyntiin? _____€/km$^3$.**

**5a. Miten Suomussalmen alueella toteutettu paikallinen energiapuun käyttö on mielestänne vaikuttanut seuraaviin teemoihin**. 1= on heikentynyt merkittävästi, 2= on heikentynyt hieman, 3= ei ole heikentynyt mutta ei parantunutkaan, 4= on parantunut hieman, 5= on parantunut merkittävästi.

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Metsän virkistyskäyttömahdollisuudet | | | | | |
| Hakkuualueiden kulkukelpoisuus | | | | | |
| Lähimaiseman viihtyisyys | | | | | |
| Paikallisten asukkaiden asuinviihtyisyys | | | | | |
| Alueen yhteishenki (asukkaiden kokema yhteisymmärrys paikallisten luonnonvarojen käytöstä) | | | | | |
| Tiestön kunto | | | | | |
| Tieverkoston kattavuus | | | | | |
| Paikallinen työllisyys | | | | | |
| Metsä- ja puualan tuotteiden keskimääräinen jalostusarvo | | | | | |
| Yksityinen palvelujen tarjonta lähialueilla | | | | | |
| Julkinen palvelujen tarjonta lähialueilla | | | | | |
| Muu vaikutus, mikä | | | | | |

**Mikä muu vaikutus?**

| |
|---|
| |

**5b. Miten arvioitte Suomussalmen alueella toteutetun paikallisen energiapuun käytön vaikutusten kohdistuneen seuraaviin teemoihin?** 1= ei lainkaan vaikutusta, 2= vähäinen vaikutus, 3= kohtalainen vaikutus, 4= merkittävä vaikutus.

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Meluhaitat | | | | |
| Pölyhaitat | | | | |
| Päästöt luontoon (ympäristön kuormittaminen) | | | | |
| Muut vaikutukset lähiympäristöön, mitkä? | | | | |

**Mitkä muut vaikutukset lähiympäristöön?**

| |
|---|
| |

**6. Kuinka paikallisen energiapuun käyttöä voitaisiin mielestänne parhaiten edistää**

**a. Valtakunnan tasolla?**

| |
|---|
| |

**b. Paikallisella tasolla?**

| |
|---|
| |

**7. Mitkä urakoitsijat tekevät energiapuun hankintaa teille?**

| |
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| |

**KIITOS HAASTATTELUSTA!**

**Appendix 5.** Questionnaire of logging companies 2013

## HAASTATTELU PUUN HANKINTAA HARJOITTAVAT YRITYKSET

Haastattelun vastaukset käsitellään luottamuksellisesti siten, etteivät yksittäisten vastaajien henkilötiedot ja kommentit paljastu raportoinnissa.

| | |
|---|---|
| **Vastaajan nimi** | |
| **Yritys** | |

**1. Millaista energiapuun tuotantoon soveltuvaa kalustoa yrityksellänne on?**

Korjuukalusto:_____
Lähikuljetuskalusto:_____
Haketuskalusto:_____
Hakkeen kuljetuskalusto:_____

**2. Energiapuun hankintamäärä:** _____ **k-m3/v**

**3. Muun puun hankintamäärä:** _____ **k-m3/v**

**4. Kuinka tärkeänä pidätte sitä, että toiminta-alueellanne on metsäpolttoainetta käyttävä laitos?** (valitkaa mielestänne sopivin vaihtoehto)

- ☐ Erittäin tärkeää
- ☐ Tärkeää
- ☐ Kohtalaisen tärkeää
- ☐ Vain vähän tärkeää
- ☐ Ei lainkaan tärkeää

**5. Toimitteko myös Suomussalmen alueella?**

- ☐ Kyllä
- ☐ Ei

### Nuorten metsien hoidolla ja energiapuun korjuulla on selkeä metsänhoidollinen vaikutus.

**6. Kuinka suuri energiapuun korjuutuen pitäisi olla, jotta energiapuun hankinta nuorista metsistä saataisiin todella käyntiin? _____€/km$^3$.**

**7. Millaisia ajatuksia teissä herättää se, että Venäjältä tuodaan energiahaketta paikalliseen lämpölaitokseen ja oman toiminta-alueen energiapuu jää käyttämättä?**

| |
|---|
| |

**8a. Miten energiapuun käyttö on mielestänne vaikuttanut seuraaviin teemoihin?** 1= on heikentynyt merkittävästi, 2= on heikentynyt hieman, 3= ei ole heikentynyt mutta ei parantunutkaan, 4= on parantunut hieman, 5= on parantunut merkittävästi.

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| Metsän virkistyskäyttömahdollisuudet | | | | | |
| Hakkuualueiden kulkukelpoisuus | | | | | |
| Lähimaiseman viihtyisyys | | | | | |
| Paikallisten asukkaiden asuinviihtyisyys | | | | | |
| Alueen yhteishenki (asukkaiden kokema yhteisymmärrys paikallisten luonnonvarojen käytöstä) | | | | | |
| Tiestön kunto | | | | | |
| Tieverkoston kattavuus | | | | | |
| Paikallinen työllisyys | | | | | |
| Metsä- ja puualan tuotteiden keskimääräinen jalostusarvo | | | | | |
| Yksityinen palvelujen tarjonta lähialueilla | | | | | |
| Julkinen palvelujen tarjonta lähialueilla | | | | | |
| Muu vaikutus, mikä | | | | | |

**Mikä muu vaikutus?**

| |
|---|
| |

**8b. Miten arvioitte energiapuun käytön vaikutusten kohdistuneen seuraaviin teemoihin?** 1= ei lainkaan vaikutusta, 2= vähäinen vaikutus, 3= kohtalainen vaikutus, 4= merkittävä vaikutus.

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Meluhaitat | | | | |
| Pölyhaitat | | | | |
| Päästöt luontoon (ympäristön kuormittaminen) | | | | |
| Muut vaikutukset lähiympäristöön, mitkä? | | | | |

**Mitkä muut vaikutukset lähiympäristöön?**

| |
|---|
| |

**9. Kuinka paikallisen energiapuun käyttöä voitaisiin mielestänne parhaiten edistää?**

**a) Valtakunnan tasolla?**

| |
|---|
| |

**b) Paikallisella tasolla?**

| |
|---|
| |

**KIITOS HAASTATTELUSTA!**