Country Report – Finland

Stakeholder and Driver Analysis on Energy Efficiency in Agriculture

This project is funded by the European Union
The sole responsibility of this publication lies with the authors. The European Union is not responsible for any use that may be made of the information contained therein.
Country Report – Finland

Stakeholder and Driver Analysis on Energy Efficiency in Agriculture

This project was founded by the FP7 Program of the EU with the Grant Agreement Number 289139

Project Deliverable 2.2

Hannu Mikkola, Mari Rajaniemi, Tapani Jokiniemi, Jukka Ahokas

University of Helsinki

Photo credits: Jarmo Juga

© 2012 agrEE
Contents

1 Introduction ........................................................................................................................................... 3

1 Finnish agriculture in a nutshell ..................................................................................................... 3

2 Drivers related to energy efficiency in agriculture ......................................................................... 5

2.1 Demographic development of farms and agricultural sectors ............................................... 5

2.2 Energy market (price and supply) .......................................................................................... 6

2.3 Level of education and research, societal demands................................................................ 7

2.4 Technological development ................................................................................................... 7

2.5 Climate change concern, sustainability demands in supply chain.......................................... 8

2.6 Taxes, legislation .................................................................................................................... 8

2.7 Summary of drivers ................................................................................................................ 9

3 Key stakeholders .......................................................................................................................... 10

3.1 The Central Union of Agricultural Producers and Forest Owners (MTK), The Union for Market Gardeners ........................................................................................................................................... 10

3.2 Trade and retail (downstream from agriculture) ...................................................................... 11

3.3 Input suppliers to farmers (upstream from agriculture) .......................................................... 12

3.4 NGO’s that embody societal concern .................................................................................. 13

3.4.1 The Finnish Association for Nature Conservation (FANC)....................................................... 13

3.4.2 GreenPeace, Animal Protection organisations ...................................................................... 13

3.4.3 Finnish Bioenergy Society – FINNBIO ................................................................................ 13

3.4.4 National government ........................................................................................................... 13

3.4.5 Bioenergiatieto .................................................................................................................... 14

3.4.6 Motiva Ltd ................................................................................................................................ 14

3.5 Supranational government (EU) ........................................................................................... 14

3.6 Education, research and advisory organizations ....................................................................... 15

3.6.1 The main bioenergy research and development projects in Finland associated with agricultural energy use and energy savings .............................................................................. 15

3.6.2 The main bioenergy research and development projects in Finland associated with agricultural energy use and energy savings .............................................................................. 15

4 Summary ...................................................................................................................................... 17

References: ...................................................................................................................................... 19
**Introduction**

The purpose of this analysis was to introduce stakeholders and drivers which have impact on energy efficiency in Finnish agriculture. Because there was not available relevant studies which would identify or quantify the impact of various stakeholders on energy efficiency this analysis is based on expert estimate made in the department of Agricultural Sciences of the University of Helsinki.

Stakeholders can have short- and long-term impacts on energy efficiency which makes this estimation difficult. Learning of energy economic production processes and ways of doing work in an energy efficient way are examples of long-term impacts which hopefully also help to develop energy efficiency further. A decree given by authorities can decrease energy use or increase energy efficiency momentarily but it does not necessarily promote energy efficiency in the long run. For these reasons this analysis is approximate and it does not show quantitative differences between stakeholders.

1 Finnish agriculture in a nutshell

Finland is the northernmost country in the world which is capable of producing most of the food it needs. The conditions are severe, but the breeds, varieties and methods developed over centuries allow viable farming this far in the north.

Agriculture is the foundation of the Finnish food economy and agriculture is an important employer, which together with the rest of the food chain employs directly or indirectly over 300,000 people (Ministry of Agriculture and Forestry 2012a). The majority of Finnish farms (90%) are owned by individual farmers or farming families (Ministry of Agriculture and Forestry 2012b) which indicates that agriculture is still based on family farming.

The structure of Finnish agriculture has changed in recent years. The number of farms has decreased by more than three per cent a year, in livestock production by as much as seven per cent. In 2007 the number of active farms was 66,800. Efforts have been made to improve efficiency and increase the farm size to respond to the challenges of the time.

The majority of Finnish farms produce milk or cultivate cereals. Most of the farms derive additional income from forests. Of the cereal species, the cultivation of barley, oats, wheat and rye succeeds in our northern conditions. Several special crops are also cultivated. About a quarter of the cultivated area is under grass. Peas, carrots, onions, cabbages and certain other vegetables are grown outdoors, while tomatoes, cucumbers and potted lettuce and herbs are grown in greenhouses round the year. (Ministry of Agriculture and Forestry 2012b.)

The average arable area of Finnish farms was 36.7 hectares in 2010 and forest area was 48 hectares. More than half of the farms produce cereal. Most of these farms are located in southern Finland. The majority of them grow barley, oats and wheat. The average arable area of cereal farms was 34.7 hectares (Ministry of Agriculture and Forestry 2012b). Every fifth farm produces milk and most of these are located in eastern and northern Finland. The average number of cows was 30 and the average yield per cow was nearly 8,000 litres a year.
As an energy user agriculture is one of the smallest fields of business in Finland. The share of agriculture was 2 – 3% (8 – 10 TWh) of the total energy consumption (407 TWh ) in 2010 (Statistics Finland 2012a). Table 1 shows the distribution of direct energy consumption in agriculture and horticulture by production sector and by source of energy in 2010 (Maa- ja metsätalousministeriön tietopalvelukeskus – TIKE 2012a). Energy for manufacturing fertilizers and energy for heating farm houses is excluded. If energy consumption for fertilizer manufacturing was added the total energy consumption would be increased approximately 2.2 TWh and it would be divided between cereals, special crops, horticulture, and other plant production (grass for silage, pasture, potato, sugar beet). Domestic, renewable energy sources i.e. wood and field biomass covered 41% of the direct energy consumption of agriculture (Maa- ja metsätalousministeriön tietopalvelukeskus – TIKE 2012a).
Table 1. Distribution of the direct energy consumption in agriculture and horticulture in Finland by the production sector and by the source of energy in 2010 (Maa- ja metsäpalveluksesta – TIKE 2012a).

<table>
<thead>
<tr>
<th>Production sector</th>
<th>Electricity</th>
<th>Oil</th>
<th>Wood</th>
<th>Field biomass</th>
<th>Peat</th>
<th>Others</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Consumption GWh</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milk</td>
<td>467</td>
<td>790</td>
<td>1769</td>
<td>9</td>
<td>37</td>
<td>11</td>
<td>3083</td>
</tr>
<tr>
<td>Other cattle prod.</td>
<td>102</td>
<td>280</td>
<td>355</td>
<td>0</td>
<td>12</td>
<td>10</td>
<td>759</td>
</tr>
<tr>
<td>Pork</td>
<td>158</td>
<td>292</td>
<td>242</td>
<td>16</td>
<td>59</td>
<td>5</td>
<td>771</td>
</tr>
<tr>
<td>Poultry</td>
<td>58</td>
<td>122</td>
<td>452</td>
<td>13</td>
<td>72</td>
<td>0</td>
<td>717</td>
</tr>
<tr>
<td>Sheep and goat</td>
<td>6</td>
<td>12</td>
<td>14</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>32</td>
</tr>
<tr>
<td>Horse</td>
<td>30</td>
<td>29</td>
<td>29</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>90</td>
</tr>
<tr>
<td>Cereals</td>
<td>254</td>
<td>1240</td>
<td>882</td>
<td>35</td>
<td>75</td>
<td>1</td>
<td>2487</td>
</tr>
<tr>
<td>Special crops</td>
<td>58</td>
<td>238</td>
<td>87</td>
<td>1</td>
<td>28</td>
<td>1</td>
<td>413</td>
</tr>
<tr>
<td>Horticulture</td>
<td>476</td>
<td>528</td>
<td>219</td>
<td>26</td>
<td>305</td>
<td>190</td>
<td>1745</td>
</tr>
<tr>
<td>Other plant prod.</td>
<td>57</td>
<td>131</td>
<td>117</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>311</td>
</tr>
<tr>
<td>Others</td>
<td>8</td>
<td>11</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td>1674</td>
<td>3672</td>
<td>4178</td>
<td>99</td>
<td>592</td>
<td>222</td>
<td>10438</td>
</tr>
</tbody>
</table>

1) Motor and heating fuel oil, heavy fuel oil
2) Firewood, chopped firewood, and other whole wood and forest residue chips or chippings, other wood chips
3) Seed crops, straw and others
4) Milled and sod peat, peat pellets

2. Drivers related to energy efficiency in agriculture

This analysis follows the principles of the DESTEP analysis method. Drivers of development, that are demographic, economic, social, technological, and ecological development and policy, were at first stage related to the standard external factors of the method. The jointly chosen policy of the AGREE partners was to lower the energy footprint of agricultural products in an economically feasible way without unwanted side-effects on environment (carbon, nutrient and pesticide emissions). The second criteria for the selection of the drivers was that they were related to energy efficiency in agriculture.

2.1 Demographic development of farms and agricultural sectors

The number of people working in agriculture decreased in Finland from over 40% in 1945 to 6% in 2000 (Duodecim 2012). During that period human and animal work was replaced with machines and external fossil energy. Figure 1 shows the change of the structure of Finnish workforce and presents a forecast to the year 2030.
At the same time when the workforce in agriculture has decreased the structure of agriculture has changed significantly from small family farms to bigger specialized farms using paid employees (Pyykkönen & Tiilikainen 2009). Indicators of this development are an increased average field area and animal number per farm and the share of paid workers (Pyykkönen & Tiilikainen 2009, Ministry of Agriculture and Forestry 2012b).

The number of people working in agriculture can’t decrease any more significantly because the percentage is already now below 4%. The average age of people working in agriculture was 51 years in 2010 and it was ten years more than the average of people working in all professions (Maa- ja metsätalousministeriön tietopalvelukeskus – TIKE 2012b). It will be a challenge to get new workers to agriculture to replace the retiring workforce. Agriculture employs directly 90,000 people and 80,000 of those are entrepreneurs or members of their family. The rest 10,000 are paid employees (Ammattinetti 2012).

2.2 Energy market (price and supply)

Energy supply has been steady during past 10 years (oil, electricity, gas, renewables) and the trend of energy prices is ascending (Statistics Finland 20102a, 2012b). The price of oil has been more volatile than the prices of other energy carriers e.g. electricity, Figures 2 and 3. It is realistic to expect that the ascending trend of energy prices will continue.
2.3 Level of education and research, societal demands

Education in Finland is an egalitarian system, with no tuition fees and with free meals served to full-time students. The present Finnish education system consists of day care programs (for babies and toddlers) and a one-year "pre-school" (or kindergarten for six-year olds); a nine-year compulsory basic comprehensive school (starting at the age of seven and ending at the age of sixteen); post-compulsory secondary general academic and vocational education; higher education (University and Polytechnical); and adult (lifelong, continuing) education. The Nordic strategy for achieving equality and excellence in education has been based on constructing a publicly funded comprehensive school system without selecting, tracking, or streaming students during their common basic education. The education Index, published with the UN’s Human Development Index in 2008, based on data from 2006, lists Finland as 0.993, amongst the highest in the world, tied for first with Denmark, Australia and New Zealand.

The Academy of Finland has studied every third year the level and the state of the Finnish science since 1997. The latest report from the year 2009 discovers that challenges of research in agriculture and forestry have changed rapidly due to the climate change, increased food price and development in technology. New, significant innovations which would generate business opportunities are expected from the society of agricultural research. Bio energy research was rated to be national and pragmatic and more research efforts were demanded for basic research and for biomass production for energy purposes. The scientific level of the agricultural research was rated to be good due to the high publishing activity (0.6) and the high citation index (3.6). (Academy of Finland 2009.)

2.4 Technological development

The Academy of Finland and Tekes (The Finnish Funding Agency for Technology and Innovation) carried out an extensive foresight study into the future of science and technology in Finland in 2005 and 2006. Work on the FinnSight 2015 analysis was carried out through 10 panels, drawing on the knowledge and insights of leading research and industry experts. The
panels identified the driving forces in the global and Finnish business and research and innovation environment, what are expected to be the future trends in science and technology, the strengths and weaknesses of Finnish know-how today, as well as 80 focus areas for future competence. (Academy of Finland 2006.)

One of the 10 panels was named “Environment and energy” and this panel stated that Finland has proven competence in environmental sciences and technologies but a stronger drive is needed to make new solutions and innovations commercialised. Improved energy efficiency or “Negawatts” was mentioned as one focus area of competence. Negawatt is energy which is never produced. Ideas of negawatts were mainly related to construction of buildings and energy use in buildings. (Academy of Finland 2006.)

The recent trend in agricultural machinery manufacturing has been to increase energy efficiency by means of better efficiency of combustion engine and with higher field capacity of tractors and implements. Higher field capacity is a result of versatile, easy-to-use electronic control and monitoring systems. In livestock production corresponding electronic system improves e.g. possibilities to control feeding, animal health, quality parameters of indoor air and -ventilation systems. Higher field capacity and better production control optimizes the use of inputs and in this way advanced control and monitoring systems are tools to improve energy efficiency.

2.5 Climate change concern, sustainability demands in supply chain
Climate change can cause in Finland changes in the average temperature, volume and timing of precipitation which are partly positive and partly negative from the Finnish point of view. Higher average temperature makes possible to cultivate plants which have not thrived earlier in Finland. Longer pasture season lowers costs in milk, beef, and mutton production. Milder winters lower energy need for heating. On the other hand higher annual temperatures can favor insects and diseases (in plants and animals) which have not been a problem earlier. Climate change can also have significant impacts on native boreal plants, forests and animals. People are mostly worried about climate change for this reason but as a whole the expected changes are not a threat for the Finnish agriculture. (Räisänen 2008.)

Food stuff industry has reacted strongly on the concern of climate change and demands of sustainability by introducing labels of carbon, water, and energy footprints. Consumer studies have shown that consumers are worried about sustainability and they want to keep nature clean but when they are making decisions at shop shelves the price has a strong impact on purchasing decisions (Maa- ja metsätalousministeriö 2005). Consumers are interested in sustainability and they are willing to promote common good for nature but they are not willing to pay very much extra for that. However, there is an (increasing?) group of consumers i.e. young families and women who keep sustainability in mind and they are also ready to pay for it.

2.6 Taxes, legislation
Taxes are an essential part of the prices of energy products (diesel oil 50%, electricity 30% of the consumer price) (Öljyalan keskusliitto 2012) and they cover a significant part of the
budget of the Finnish state (Finnish government 2012). Taxes are also a tool to control energy consumption. Higher taxes mean higher consumer prices and in agriculture farmers have three possibilities to manage with these increased prices – they can reduce energy consumption by improving energy efficiency, or they can try to move the increased energy price to product prices. They can also replace purchased energy with bio energy produced on the farm. Most farms in Finland own forest (Ministry of Agriculture and Forestry 2012b) and wood is a proven source of energy for heating (Maa- ja metsätalousministeriön tietopalvelukeskus – TIKE 2012a). Farms will probably choose the most economical way and from the environmental point of view both energy saving and change from fossil to renewable energy are advisable choices.

At this moment the most important legislative decree promoting energy efficiency in agriculture is the Directive 2006/32/EC on energy end-use efficiency and energy services (European Parliament and the Council 2006). The target is to increase energy efficiency 9% by the year 2016 compared with the reference year 2005. However, this directive will be replaced with a new one which is still a proposal: Proposal for a directive of the European Parliament and of the Council on energy efficiency and repealing Directives 2004/8/EC and 2006/32/EC.

2.7 Summary of drivers
Table 2 outlines the drivers in terms of their importance to the policy on the short and long run. The wanted policy of the AGREE group was to lower the energy footprint of agricultural products in an economically feasible way without unwanted side-effects on the environment.

In the short run energy prices, taxes and legislation are the most important drivers of energy efficiency. Prices change daily and taxes and laws can be laid down in a period of few days or weeks. In the long run the change of generation, the level of education and research, and technological development are the most important drivers. A new generation of farmers has a good education and they have good possibilities to absorb information about energy use and energy efficiency from all sources of the electronic media. They have lived all their lifetime surrounded with electronic devices and the threshold to use these devices is low. Much depends on technological development. If significant breakthroughs will happen in exploiting solar energy, in energy storage and in energy transfer technology, energy price will stay on the current level or it goes down and energy saving ends up to the background. If such breakthroughs doesn’t occur energy saving and energy efficiency will be in focus.
Table 2 Drivers in terms of their importance to the policy on short and long run.

<table>
<thead>
<tr>
<th>Driver</th>
<th>Importance Short run (&lt;3 years)</th>
<th>Long run (&gt;5 years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic development of farms and agricultural sectors</td>
<td>No significant impacts on short run.</td>
<td>Change of generation takes place on many farms. It offers a possibility to change thinking and energy use traditions.</td>
</tr>
<tr>
<td>Energy market (price, supply)</td>
<td>Fast changes of the oil price can occur and in general the energy price rises moderately.</td>
<td>The energy price will come more and more important cost factor and motivates for better energy efficiency.</td>
</tr>
<tr>
<td>Level of education and research</td>
<td>The importance of renewable energy and energy saving strengthens in education and research. Sophisticated, well-paid consumers demand products with a low carbon footprint and low energy demand.</td>
<td>Integrated energy solutions improve energy efficiency. Transfer from fossil fuels to renewable can decrease energy efficiency on the other hand because energy generation from renewable sources requires more energy than energy generation from fossil sources. Importance of energy saving is emphasized.</td>
</tr>
<tr>
<td>Societal demands</td>
<td>The importance of renewable energy and energy saving strengthens in education and research. Sophisticated, well-paid consumers demand products with a low carbon footprint and low energy demand.</td>
<td>Integrated energy solutions improve energy efficiency. Transfer from fossil fuels to renewable can decrease energy efficiency on the other hand because energy generation from renewable sources requires more energy than energy generation from fossil sources. Importance of energy saving is emphasized.</td>
</tr>
<tr>
<td>Technological development</td>
<td>No significant breakthroughs on short-term. Advanced regulation and control technology comes more and more popular in agriculture and it improves energy efficiency of single units and integrated systems.</td>
<td>Breakthroughs in solar energy technology, in battery technology, or in energy transfer technology can have far-reaching impacts on energy efficiency.</td>
</tr>
<tr>
<td>Climate change concern</td>
<td>No significant impacts on short-term if any large climatic disaster does not occur.</td>
<td>Adaptation to climate change is as probable progression as mitigation.</td>
</tr>
<tr>
<td>Sustainability demands in supply chain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taxes</td>
<td>Energy carriers will remain as popular targets for taxation. Increased energy efficiency can be promoted with tax reliefs in the favor of lower CO₂ emissions.</td>
<td>Besides energy price, taxes and legislation remain the most important tool to control energy use and to promote energy efficiency.</td>
</tr>
<tr>
<td>Legislation (CAP)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3 Key stakeholders

Organizations related to agriculture and which can have impact on energy efficiency in agriculture were ranked as key stakeholders whether they want to use their status or not. Farmers were not mentioned as stakeholders because they were in the focus of this examination anyway and we have seen obvious they have interest in energy efficiency and they are also the quarter of people who put the energy efficiency measures into practise.

Economy is an as important factor in decision making for the farmers as it is for other entrepreneurs but on the other hand the farmers work very much on the conditions of nature and for this reason it should be easy for them to understand the importance of environment and sparing use of natural resources. The key stakeholders are not mentioned in the order of their interest in energy efficiency or their power to have impact on energy efficiency in agriculture. The order comes more from the outlines of the DESTEP-analysis.

3.1 The Central Union of Agricultural Producers and Forest Owners (MTK), The Union for Market Gardeners

MTK is a trade organisation and interest group representing farmers, forest owners and rural entrepreneurs. MTK has approximately 153,000 members in local agricultural producers’
organisations and regional forest owners’ unions. MTK’s sister organisation, SLC, operates in the Swedish-speaking areas of Finland and it has approximately 14,000 members.

The main task of MTK is to promote economic advantages for farmers. Energy is one production factor and during the period 2010 – 2011 the share of energy costs has risen from 4 – 5% over 8% from the total production costs. Figure 4 shows the share of direct energy costs, but increasing energy prices has an instant impact on the prices of fertilizers and fodders, too. For this reason energy is a strategic production factor.

MTK is a contracting party of the Farm Energy Programme 2010 - 2016 which indicates MTK’s interest to promote energy efficiency in agriculture. MTK is a nationwide organisation but due to the decreasing number of farmers and the change from national agricultural policy to common agricultural policy (CAP) MTK has lost its power as a negotiation partner.

![Figure 5 Energy costs on Finnish farms 2000 – 2011 (MTT Agrifood research Finland 2012).](image)

Market gardening is economically an important part of agricultural production (MTT Agrifood research Finland 2012) though the number of greenhouse enterprises is low (1,400) (Maa- ja metsätalousministeriön tietopalvelukeskus – TIKE 2012c) compared with the number of farms (62,800). Energy consumption is a significant cost factor in greenhouse production (e.g. 37% in tomato production (Karhula & Outa 2006)) and for this reason efforts to increase energy economy are even more important for gardeners than for farmers.

### 3.2 Trade and retail (downstream from agriculture)

Food industry, retail and trade are in Finland clustered to a few big units. There are two big mills, two big slaughterhouses, one dairy that operates all over the country, and two companies which have food markets in all parts of the country. They are powerful on their home market and during past 10 – 15 years they have enlarged their business to neighbouring countries including Russia and Estonia.
Already at an early stage these companies have added labels of carbon footprint to their products and later also energy and water footprint labels. This kind of information has seen to add value for customers. Clustered industry and trade is a powerful player to the direction of farmers. In order to reduce e.g. carbon footprint it is necessary to go through the whole food supply chain from input suppliers to the farm, and from the farm to refining industry, supply chains, and trade in order to make clear the total carbon footprint and energy demand of products. If customers prefer products with low carbon footprint and low energy demand, the food industry and the trade can set terms for raw material what they buy from producers. In this way customers can promote high energy efficiency and the impact reaches to industry and agriculture.

Already before launching carbon footprint labels in food packages it has been possible to trace the origin of raw material of Finnish food products to a single farm or at least to a group of farms. Development of this kind tracing system was stimulated by food disasters when contaminated fodder was fed to animals (not in Finland) and also for possible BSE cases. This is an example how accurately it would be possible to define the environmental labels if needed.

It is perhaps reason to suspect if trade and retail are willing to support the AGREE policy if it impedes their business. On the other hand it is reason to believe that there are sophisticated managers who follow the general discussion and trends in society. Managers of the food industry and the trade take part into this discussion and they also have to listen to customers with sense ears.

3.3 Input suppliers to farmers (upstream from agriculture)

- Technology (machines, buildings)
- Fossil energy suppliers
- Fertilizers, pesticides

Input trade is clustered (especially the fertilizer trade) in Finland but not so strongly as upgrading and trade downstream from farms. There are two big dealers which dominate input business but on the other hand there are smaller dealers especially in machine business. Light fuel oil is the most important fossil fuel in agriculture and there are many suppliers for that input.

Farmers demand from input suppliers at the first stage a high price/quality ratio. A low carbon footprint or low energy demand can be quality factors if industry downstream from agriculture demands it. Sophisticated customers buying agricultural products can create pressure upstream by demanding low carbon and low energy input products.

In basic input suppliers should not be against the AGREE policy if products can be adapted to the policy. E.g. Yara is a significant fertilizer supplier in Finland and they have developed their nitrogen manufacturing process so that since 2011-11-01 they guarantee the carbon footprint of their N-fertilizers to be less than 3.6 kg CO2-eq./kg N (Yara 2012). This guarantee is in effect in Finland, Sweden, Norway and Denmark. This is an example how an
input supplier supports an initiative made by Swedish food industry to set emission standards for food production.

### 3.4 NGO’s that embody societal concern

Nature conservation and animal protection organizations are the most significant NGO’s which can have impact on energy efficiency in agriculture. Organizations promoting organic farming can be also included to this group. Their impact can be positive or negative on energy efficiency. Requirements to limit fertilizer and pesticide use in arable farming or demands to change practices in animal housing to more natural for animals are often understood as actions that decrease energy efficiency and make economy worse. Perhaps these detailed requirements should not be loosened from the general message of nature and animal protection organizations which demand change towards less energy and nature resources wasting life style. It is an issue of discussion of values and in this discussion partners have to commit themselves which kind of energy use they see acceptable and which one is unacceptable.

These organizations do not necessarily have big sums of money to promote their ideas but in the modern information society internet is a powerful tool and some free-off-charge news can have as strong impact on public opinion as expensive promotion programs.

#### 3.4.1 The Finnish Association for Nature Conservation (FANC)

The Finnish Association for Nature Conservation (link: [http://www.sll.fi/english](http://www.sll.fi/english)) is the largest non-governmental organization for environmental protection and nature conservation in Finland. The purpose of the FANC is to protect the environment, promote nature conservation, preserve cultural heritage, and promote active citizenship and environmental awareness.

#### 3.4.2 GreenPeace, Animal Protection organisations


#### 3.4.3 Finnish Bioenergy Society – FINNBIO

FINNBIO (link: [http://www.finbio.fi/default.asp?SivulD=25578](http://www.finbio.fi/default.asp?SivulD=25578)) is a national, neutral organization, which promotes premises of the use of bio energy taking into account economy, sustainability and environmental protection.

#### 3.4.4 National government

The Ministry of Agriculture and Forestry (MAF) and The Ministry of Employment and Economy are two national governmental bodies which have impact on energy efficiency in agriculture. These ministries can manage energy efficiency by means of decrees, taxation, and investment supports. The general energy policy is a subject field of the Ministry of Employment and Economy and issues related especially to agriculture are managed by MAF. In Finland it is difficult to separate agriculture and forestry because farmers owned 37% of the private owned forest area in 2009 (Hänninen et al. 2011) and wood is an important source of renewable energy in agriculture (Maa- ja metsätalousministeriön tietopalvelukeskus – TIKE 2012a). Retired farmers are an important group of forest owners.
The Ministry of agriculture and Forestry has launched a Farm Energy Programme 2010 - 2016 which is based on sector agreement signed between the Ministry and producer organisations and the Government Decree on farm energy planning subsidy. The programme aims to implement the government energy and climate policy and to improve profitability of farms. The programme is voluntary for farms. The Ministry encourages farms to make in-house control plans and farm energy plans. Farm energy audits are intended for the largest energy users e.g. green house produces. The first audits were made 2010. (Ministry of Agriculture and Forestry 2012c.)

3.4.5 Bioenergiatieto
Bioenergiatieto.fi (link: http://www.bioenergiatieto.fi/ ) is an index of projects related to bio energy research and promotion of the use of renewable energy. This portal is supported by MAF.

3.4.6 Motiva Ltd
Motiva Ltd (link: http://www.motiva.fi/en/motiva_ltd/) is an expert company promoting efficient and sustainable use of energy and materials. Its services are utilised by the public administration, businesses, communities, and consumers. Motiva operates as an affiliated Government agency (an in-house unit), and its functions will be developed as such. The company’s entire share stock is in Finnish state ownership.

Services:

- Marketing of Energy Efficiency Agreements, support and monitoring of implementation
- Development of energy audit and analysis activity
- Increasing the use of renewable energy
- Promoting of material efficiency
- Publishing energy and material efficiency
- Influencing attitudes and consumer habits
- Monitoring and impacts assessment

Motiva Ltd in a nutshell:

- Operation began in 1993 as the Energy Information Centre
- Incorporated 1 November 2000
- Owned by Finnish state (100%)
- Turnover 7.9 million euros (2011)
- Personnel 67 (1 January 2012)

3.5 Supranational government (EU)
3.6 Education, research and advisory organizations

Education has reacted strongly on the concern of climate change by adding supply of courses of renewable energy. Energy saving and energy efficiency are less popular topics in energy discussion than bio energy production though their importance is clearly understood in education and in administration. Climate advantages can be gained both by saving energy and by replacing fossil fuels with renewable.

The department of Agricultural Sciences of the University of Helsinki (132 man-years, 13 professors) participates at this moment two projects (besides AGREE) which are related to energy use, increasing the share of renewable energy, and energy efficiency in agriculture. These projects are Energy Positive Farm (ENPOS, link: http://enpos.weebly.com/index.html) and Energy Academy (link: http://www.energia-akatemia.fi). Furthermore there are altogether four Ph.d. students who are studying the energy use in agriculture and possibilities to save energy in agricultural field work, in animal housing, and in grain drying.

MTT Agrifood Research Finland (link: https://portal.mtt.fi/portal/page/portal/mtt_en) is the biggest agricultural research institute in Finland (773 man-years in 2011 and the total budget 56.7 milj. €) and many of their research programmes focus on sustainable and responsible food production. Energy use and environmental impacts of agriculture are fundamental research topics.

TTS Work Efficiency Institute is a research, development, and training institute (link: http://www.tts.fi/index.php?option=com_content&view=article&id=236&Itemid=556). TTS Research develops the production, use, distribution, and quality of bio fuels and bio-refined products. TTS Research also develops heating technology, heating fire safety and small-scale heat production. TTS Research's heating test laboratory provides services for consumer markets and the product development of equipment manufacturers in the energy sector.

ProAgria and its sister organization SLF (for Swedish speaking farmers) are the leading agricultural advisory organisations in Finland serving farmers as well as other rural entrepreneurs (link: https://portal.mtt.fi/portal/page/portal/proagria_international and http://www.slf.fi/InEnglish.htm). ProAgria and SLF have specialized energy advisors who help farmers in planning heating systems, introducing energy saving working methods and learning energy efficient use of machines.

3.6.1 The main bioenergy research and development projects in Finland associated with agricultural energy use and energy savings

The Ministry of Agriculture and Forestry offers the website (www.bioenergiatieto.fi), where information on bioenergy, research and development projects, project financing, energy efficiency as well as links to other resources and websites has been collected and centralized. The project Index consists of bioenergy related research, development, education, and public utility investment projects. Most of the more than 200 projects cover the period 2007–2013. Around one-fifth are still running.

The 40 bioenergy projects associated with agricultural energy use and energy savings were examined more closely. There are also a number of wood energy related projects. The
The proportion of public funding of these projects has been, on average, 13 million euros per year. The majority of the project funding goes to arable farming and forest energy projects, but also for livestock, technology and educational projects. Many of the projects overlap between these fields. Half of the project funding goes to development projects and a third to research projects. Some of the projects are a combination of both. The following examines the key objectives and main themes of the most important projects, with emphasis on financing.

The Baltic Sea Region Bioenergy Promotion Project is partially funded by the EU. The project has just ended. The aims were to strengthen the integration and competitiveness of sustainable bioenergy development in the partner countries. The project was carried out with 33 partners from 10 different countries. The funding of the three-year project was more than 4 million euros.

BIOCLUS – The sustainable use of biomass resources is the second major joint international bioenergy project. Its funding is close to 3 million euros over three years and the project is still ongoing. International co-operation, education and the promotion of bioenergy are the central themes of the project.

HYÖTYLANTA – The research program to find recovery options for manure and other organic waste and by-products is an important research issue at the moment. The unit sizes for livestock production are growing in Finland. The need to improve manure nutrient and energy utilization has been growing at the same time, in particular environmental hazards, such as nutrient leaching and odor problems have increased.

The Rural Energy Academy Project will provide information about agricultural energy use, solutions for improving energy efficiency and renewable energy implementation.

In addition, the aims of a number of other projects are for example: to promote the production and utilization of suitable arable crops for bioenergy, biogas and biodiesel production and associated technologies.

BIOVIRTA Project “The biogas processes from materials into products” aims to develop the technologies and practices for different types of organic by-products and waste materials to be used in biogas plants. The products can be further processed into competitive, profitable and safe products for various applications.

The Energy-efficient animal shelter buildings Project aims to improve the economic profitability of dairy farms by reducing their energy use and production costs.

“Biodiesel from forest wood chips” Project implemented by Neste Oil and Stora Enso was carried out in 2007–2011. The funding was over 5 million euros. The project is a part of Tekes (The Finnish Funding Agency for Technology and Innovation) BioRefine – New Biomass Products Programme, whose resources are 137 million euros. The project developed transport fuel production based on biomass gasification.

The Forest Power Project studies the harvesting, quality and use of forest biomass and looked for new business models for energy cooperatives. The aims are also to improve the energy
efficiency of heating plants, the quality of fuel, to reduce emissions and to provide instructions.

The aim of **AFO Project** is to activate private forest owners to increase forest fuel supply by selling their wood energy through co-operatives and associations to a variety of small and medium-sized heating plants. The project aims to promote the EU’s target to increase forest bioenergy production.

**The FOREST ENERGY Project** developed sustainable forest and arable land energy production methods, environmental management and production technology.

### 4 Summary

As a whole there are good possibilities to promote energy efficiency in agriculture in Finland. It has been possible to get money for research programs related to EE and Finland tries to stay in the front row in energy efficiency and as a user of renewable energy.

Finland has ratified the Kyoto climate agreement and the EU directives 2006/32/EC and 2009/28/EC oblige Finland to cut CO2 emissions and to increase energy efficiency. So, the national government has a high interest to promote these two things.

NGO’s have also a high interest to increase energy efficiency, but the substantial difference between NGO’s and the government is that the government is the committed body and the organizer of the energy reform at the same time. NGO’s can state requirements and they can create pressure to administration but they are powerless to perform these reforms. Education, research and advisory organizations put policy into action, but their resources depend on the economic situation and often there is a delay of years between the actions and the impact. The union of farmers has interest in energy efficiency but their resources are limited. Furthermore, economy, welfare, and social services of farmers are closer to their interest than EE. The Farm Energy Program is an example how the farmers union has added its power by allying with the MAF.

In the dimension of influence and power there are on the top input suppliers, trade and retail, and governmental organizations. The main focus of commercial enterprises is in making business. Promoting energy efficiency is on their agenda if it supplies business. It is perhaps possible to combine these two things but promoting energy efficiency alone seems implausible for them. Governmental organizations are powerful also in this dimension because they can make laws and decrees, and they decide how to use tax revenues. At economically tough times as today there is not leeway in the state budget and it cuts the power of governmental organizations.
Figure 6 Estimated interest and power of stakeholders on energy efficiency in Finnish agriculture.
References:


