A spring-board for your exports

EU Handbook
Small Scale Heating Markets

Cross Border Bioenergy supports the bioenergy industry in going international to diversity its sales markets
Interested in the Cross Border Bioenergy Project?

This project is designed to help SMEs to evaluate markets in Europe and support their decision-making process to invest in them. Join the Cross Border Bioenergy network and benefit from exclusive information on European markets. There are absolutely no cost associated with the use of the network.

www.CrossBorderBioenergy.eu

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**4. Annex**  
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Glossary

**BAFA** - Federal Office of Economics and Export Control

**BBE** - Bundesverband BioEnergie

**BMU** - Federal Ministry for the environment, nature conservation and nuclear safety

**DEA** - Danish Energy Agency

**DEPI** - German Pellet Institute

**DEPV** - German Energy Wood and Pellet Association

**DERA** - Danish Energy Regulatory Authority

**EMU** - European Monetary Union

**ERM** - Exchange Rate Mechanism

**GHG** - Greenhouse Gases

**IFC** - International Finance Corporation

**KfW** - Reconstruction Loan Corporation

**KLIEN** - Climate and Energy Fund

**LIAA** - Investment and Development Agency of Latvia

**MAP** - Market incentive program for renewable energies

**NEAP** - National Energy Action Plan

**nREAP** - national renewable energy action plan

**ÖNACE** - Austrian classification of economic activities of companies

**RENERGIE** - Raiffeisen Managementgesellschaft für erneuerbare Energie GmbH

**RES** - Renewable Energy Source

**RS** - Renewable Sources

**SRC** - Short Rotation Coppice

**TPES** - total primary energy supply
1. Introduction to the Market

1.1. Aim and Methodology of the Cross Border Market Handbook

The general objective of the Crossborder Bioenergy project is to help SMEs to evaluate bioenergy markets in Europe in view of cross-border investments, thereby making SMEs less dependent on fluctuating domestic market conditions and strengthening the whole bioenergy industry. Five different bioenergy market sectors are considered: biogas, small scale heating, district heating, CHP and biofuels for transportation. The project will contribute to member states’ efforts to reach their targets set in the RES directive, to benchmark national RES action plans, and to implement flexibility projects.

With this project bioenergy companies will get a ‘navigator’ on potential markets in Europe, and get necessary tools to develop a market entry strategy. The GIS-Tool helps bioenergy companies in comparing European markets and, based on this comparison, in defining possible target markets. Following this first step, the market handbooks offer more detailed information about single countries and regions in Europe and, furthermore, describe and explain the situation in different bioenergy markets in Europe. The B2B-plattform supports direct action by facilitating contact and networking between bioenergy stakeholders and companies. In this section of the website, also concrete offers and inquiries can be posted, and a calendar informs about interesting upcoming events.

To achieve these goals the consortium of the Cross Border Bioenergy project undertook a detailed study of five different bioenergy markets in Europe. Under participation and contribution of many international bioenergy companies and stakeholders, the consortium identified about 50 relevant criteria and summarized them in 8 main categories. The 8 categories cover the important factors influencing the bioenergy sectors, namely:

- Basic Country Data
- Energy Policy
- Feedstocks
- Business Case
- Market Environment
- Regulation
- Project Financing
- Readiness for Uptake

The identified criteria are concretized by more than 300 indicators, which are weighted according to their respective importance. By doing so, scores for each indicator, criterion and category as well as an overall sector score were generated. To ensure scientific reliability the Imperial College London was obliged with working out a sound methodology defining the scoring and weighting mechanisms. A method was worked out to process these criteria and to find appropriate indicators, and a comprehensive template was produced.

The results that are presented in this handbook and on the website are based on official statistics, national action
plans, support schemes and furthermore on direct information gathered from bioenergy experts from the single countries in interviews and enquiries undertaken especially for this project. As many different reliable sources have been included in the research process, the results offer a comprehensive picture of the bioenergy markets in Europe.

The full list of categories, criteria and indicators chosen for the biogas sector is available in the small scale heating sector handbook, provided for download at www.crossborderbioenergy.eu under the rubric ‘publications’. The annex furthermore provides a table containing the leading questions on the basis of which the market handbook was built up on.

1.2. Introduction to SCH

The demand for heating accounts for a significant portion of the world’s total energy demand. In 2006, the building sector consumed 35.3% of the final energy demand of which 75% was used for space and domestic water heating.\(^1\) In Europe, the final energy demand for heating (48%) is higher than the demand for electricity (20%) or transport (32%).\(^2\)

Renewable Energy Sources (RES) used for heating and cooling purposes have received relatively little attention compared to those used to generate electricity and transport fuels. This is surprising since firstly, the demand for heat consumes the largest share of the primary energy supply and secondly, RES can offer a practical alternative to fossil fuels under many circumstances. The adoption of the RES directive in 2009 made the heat sector a part of EU legislation for the first time. As a result, the EU member states had to set specific targets for heat in their national renewable energy action plans that were published in 2010.

The EU has set the following objectives for its member states until the year 2020: To reduce GHG by 20% compared to the year 2005, to increase the share of renewable energy by 20%, and to increase the efficiency by 20%. These targets are binding but divided individually among the member states.

Increasingly, it is seen as one of the easiest ways to meet the RES 20% target, in terms of cost efficiency and the amount of fossil energy replaced, to use biomass to generate heat. There has been significant innovation in the field of biomass technology during the past two decades, and modern systems are fully automatic with very low emissions. State of the art technology allows EU member states to increase energy efficiency and to reduce the emissions to a minimum in small scale biomass boilers. The development of new technologies will enable the production of high quality fuels, secure and sustainable supplies, clean and effective combustion processes, as well as optimally-integrated solutions for households. Furthermore, the use of biomass for heating ensures energy independence, supports the forest industry, and is environmentally friendly.

\(^1\) IEA, 2006
\(^2\) EREC, 2006
individual rooms, with typical capacities of a few kW) and boilers (capacities of a few tens of kW for homes up to 500 kW for big heating consumers e.g. schools, supermarkets, etc.). Small-scale heating systems fired with wood logs, chips or pellets are easy to use, have low operating costs and are used to replace oil heating in many European regions.

The availability of data for SSH markets is generally limited due to the decentralized nature of these heat generation-facilities and the problems of measurement that are associated therewith. Due to the wide dispersion of small scale burners and boilers, it is not easy to ascertain the total installed heat capacity, even though the name-plates on the appliances usually provide such information. It is even more difficult to assess the life cycle of

In the Figure ‘Overview’, it can be seen that the EU’s official scenarios for renewable energy supply assume heat production from biomass to be more than double from today’s level of 800 TWh in 2020.

Small scale biomass conversion technologies include stoves (for

Figure 'Overview': Heating potential of renewable energy sources in the EU

![Diagram showing the heating potential of renewable energy sources in the EU.]

Source: RHC platform
boilers by measuring the time frame in which they are actually operational, and to determine whether they are working at full capacity. For biomass used in individual buildings for water heating and space heating, data is also difficult to obtain and is therefore often not covered in national statistics. It is, thus, very difficult to estimate the total value of biomass used for heating with more accuracy.

Biomass’s future development depends to a large extent on the incentives created by the EU member states. The potential of bioenergy technologies to further penetrate the heating market depends on:

- the sustainability of biomass sources
- the competitiveness of energy or other products based on biomass
- the rate of progress of biomass technology

Biomass can come from many sources and it can be converted to many forms of energy. Current sources of biomass include:

- forests, such as fire wood or logging residues
- by-products of the wood industry such as bark, saw dust, shavings, pellets etc.
- agricultural by-products (wood pruning)
- wood Biomass from waste
2. COMPARISON OF EUROPEAN COUNTRIES

2.1. CROSS BORDER SCORES OF EU COUNTRIES

The Top Ten Country Score gives an overview of the ten most attractive countries in the district heating sector. All indicators are included in this overall score, which can be a first indicator of attractiveness.

Source: all tables and figures that are not cited otherwise are based on data from the CBB project: http://www.crossborderbioenergy.eu (November 2011)

The map displays the overall attractiveness of the EU 27-member states’ SCH markets. The darker the green, the higher the attractiveness.
2.2. Basic Country Data

The analysis of the countries' basic data is based on the analysis of the geographical and climatic conditions, demography and logistical infrastructure. The figure below shows the CBB basic data score for all European Countries.

All EU countries have a solid biomass sector that produces energy. The five leading producer countries (France, Sweden, Germany, Finland and Poland) account for 56.1% of European solid biomass-derived primary energy production. A per capita production indicator can be used to demonstrate that the main users of solid biomass are concentrated in Northern Europe and Austria.

Northern Region (Austria, Belgium, Denmark, Finland, Germany, Ireland, Netherlands, Sweden, UK)

The Northern Region contains some of Europe’s more advanced countries (Austria, Germany, Sweden) with regards to biomass powered heat. In some of these countries the share of private households heated with biomass lies over 35%.

Eastern Region (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Slovenia)

In these countries the vast majority of the population and public small-scale heat equipments are operated on natural gas or other fossil fuels. Also the use of firewood in old and very basic heat equipment is very common.

Slovenia seems to be the most advanced country in this region with the largest
amount of wood used for energy purposes by households (76%). Wood biomass was and still is an important source of energy, especially for heat production. The rising prices of fossil fuels in 2007 and the first half of 2008, as well as the gas crisis in early 2009 heightened the importance of wood biomass.

**South East Region (Bulgaria, Cyprus, Greece, Romania)**

Bulgaria and Romania have considerable district heating investments while in Greece and Cyprus district heating applications are very limited.

**South West Region (France, Italy, Luxembourg, Malta, Portugal, Spain)**

Similarly to the Northern Region, the countries of the South West region are relatively advanced. In Italy and France the use of solid biomass in small scale heating appliances is booming.
2.3. Energy Policy

The European Policy category analyzes how ambitious the NREAPs, the appropriate measures proposed by country and the political will to develop the RES-sector, are. On the basis of these results, the Cross Border Bioenergy consortium scores the EU countries as depicted in the graph on the following page.

There is a significant potential for the development of RES in the EU, and the use of biomass to produce renewable heat can substantially contribute to the increase of the share of RES in the EU energy mix. RES used for heating and cooling purposes have received relatively little attention compared to those used to generate electricity and transport fuels. This is surprising, since the demand for heat consumes the largest share of primary energy supply. The adoption of the RES directive in 2009 made the heat sector a part of EU legislation for the first time. As far as biomass for heating production is concerned, it is expected to contribute over 100 TWh/year by 2020. In Austria, about 50% of the total energy consumption is used for heating and cooling. The share of RES in the heat market reached 35% in 2009. If the development of the recent years continues, an increased share of RES in the entire heat market up to 50% is possible by 2020, even if the heat demand of buildings remains constant until 2020. The share of bioenergy in the heating market could increase from 32% in 2009 to 41% in 2020.
Germany aims at having a market share of 14.431 ktoe of RES in the heat sector in 2020, corresponding to slightly more than 14%. For this, pellets will be one pillar in private households and local heating plants.

In Italy the biomass sector plays a strategic role: according to the NEAP biomass is supposed to become the primary RES by 2020, covering 44% of renewable consumption (22.3 Mtoe).

Also in Hungary the National Energy Strategy plans to increase the ratio of RES used for heating from 9% (2010) to 18.9% by 2020.

The Swedish government aims at reaching a share of approximately 50% of RES in final energy consumption until 2020, and a balance of zero net CO₂ emissions by 2050. With the introduction of the carbon tax in 1991, Sweden installed a strong policy instrument that has lead to a large market gain for the cheaper domestic bioenergy.

According to the Danish REAP, the solid biomass utilization for energy generation is expected to grow by 32 PJ or 8.9 TWh until 2020. Solid biomass will therefore continue to be the main RES in Denmark.
2.4. **Feedstock Potential**

This category analyzes the biomass potential for the development of SCH projects. The graph above shows the scores for all EU countries.

The overall potential of biomass for energy in Europe is much bigger than its present use; however, this potential still has to be developed at the local, regional, national and international level.

So far, forest based biomass is the main biomass for energy providers with a maximum potential of 543 million m³ (94.6 Mtoe) in the EU, which covers logging residues that make up 251 million m³ (43.73 Mtoe). Logging residues have the highest potential to increase the forestry fuels used for bioenergy production.

By-products of wood processing industries will also play an important role. For example, refined fuel pellets accounts for 6.6 Mtoe (in 2005 and 7.5 Mtoe in 2007) of which 3.3 Mtoe are used for electricity and 3 Mtoe for heat production.
The wide range of feedstock allows that up to 2020 a target for pellet production of 60-80 million tons seems to be achievable. In 2008, more than 440 pellet plants in Europe produced about 7.5 million tons of pellets per year. The number of plants is increasing continually due to the dynamic market development. Pellets had a 3% share of bioenergy production in 2005. Nevertheless, the production potential by 2020 is much higher and can reach 14% bioenergy production with 25 million tons of pellets (10 Mtoe) used for bio-electricity and 50 million tons (21 Mtoe) for heat production. The agricultural sector bears the greatest potential and could, thus, become the most important energy supplier by 2020. Out of numerous biomass fuels, dedicated energy crops such as willows, poplars, miscanthus, reed canary grass etc. for heating and electricity production have enormous potential to increase biomass use.

\[ \text{NREAP} \text{: Proposed measures for small scale heat in the nREAP (Score between 0 and 10 based on expert interviews)} \]
2.5. **Business Cases**

The section ‘business case’ analyzes the price levels, subsidy guarantees and support schemes that can affect the viability of specific bioenergy technology applications.

The future of the development of biomass depends to a large extent on the incentives created by the EU. The potential of bioenergy technologies to further penetrate the heating market depend on:

- the sustainability of biomass sources
- the competitiveness of energy or other products based on biomass
- the rate of progress of biomass technology

The case of solid biomass generally shows that different types of incentive schemes can be effective.

In Austria, after having experienced...
a continuous growth between 1994 and 2006, the biomass boiler market slumped in 2007 due to low oil prices and a shortage in pellets; however, the market recovered in 2008. In 2010 the sales figures dropped once more, most noticeably for domestic logwood boilers. The underlying causes are the reduction in public support schemes and the delayed effects of the economic and financial crisis. The annual installation rate of tiled stoves fluctuates between 12,000 and 15,000. In Austrian households there are approximately 500,000 installed tiled stoves in total.

In Germany, investments into SCH boilers, in particular into pellet-technology are supported with public budgets. The ‘Market Incentive Program for Renewable Energies’ (MAP) only supports the replacement of heating in the building stock and pays at least €2,000, when a fossil boiler is replaced by a pellet boiler.

In Hungary, the price of natural gas is low compared to European average. Natural gas is supplied to 82.5% of the households. 75% of private households use natural gas for heating, and also district heating systems are mainly based on natural gas.

In Sweden investments into pellet-technology are not supported by public budgets or funding. This means that investments in production capacity and boilers have to be done based on market prices. Due to the high taxes imposed on fossil energy, the investment of changing from oil to pellets is profitable in Sweden.
2.6. Market Environment

The graph below shows the EU countries´scores based on the analysis of the energy market dimensions in these countries. Here, the consortium of the Cross Border Bioenergy project analyzes the energy market, transferable technologies, as well as logistics and access to the customer base through established networks.

Biomass used for heat covers 55% of all RES. Biomass for heat holds a large potential as a source of renewable energy and GHG emission reductions.

In the Figure ‘Final Energy Consumption’ it can be seen that the EU’s official scenarios for renewable energy supply assume heat and power production from biomass to be more than double from today’s level of 800 TWh in 2020.

AEBIOM calculates the share of heat as part of the final energy consumption. About 48% of the final energy demand is heat. According to this data households are the biggest consumer of heat, followed by industry and services. Heat
The sale of new heating household systems is well documented for some countries but reliable data on the existing stock of biomass fired boilers and stoves is especially hard to come by. Therefore, AEBIOM has gathered the following data from many different sources and it is important to point out that there are slight contradictions between different data sources.

The Lot 15 EuP preparatory study on solid fuel small combustion installation (SCIs) done by the European Commission, DG TREN, has estimated the general market shares of majority of appliances subjected to analysis in this study. It can be seen in Figures ‘Boiler Numbers’ and ‘Market Share’ that these shares will not change significantly.

### Table, Final Energy Consumption: Final energy consumption in the EU27 in 2007 and contribution of heat (Mtoe)

<table>
<thead>
<tr>
<th>Sector</th>
<th>Final energy in Mtoe</th>
<th>Of which heat</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mtoe</td>
<td>%</td>
</tr>
<tr>
<td>Industry</td>
<td>323</td>
<td>55%</td>
</tr>
<tr>
<td>Households</td>
<td>285</td>
<td>86%</td>
</tr>
<tr>
<td>Commerce Services &amp; Agriculture</td>
<td>173</td>
<td>76%</td>
</tr>
<tr>
<td>Transport</td>
<td>377</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1158</strong></td>
<td><strong>48%</strong></td>
</tr>
</tbody>
</table>

Source: AEBIOM calculation

### Table, Market Share: Market share changes for different appliances

Source: EuP Preparatory Study Lot15
<table>
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<tr>
<th>Country</th>
<th>Fossil Fuel/Universal</th>
<th>Logwood</th>
<th>Woodchips</th>
<th>Pellets</th>
<th>Others</th>
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</tr>
</tbody>
</table>

Source: AEBIOM
2.7. Regulation

This category refers to additional mandates, rules and authorisation procedures that impact the stability and practicality of operations in the bioenergy industry, such as efficiency standards or pollution limits. This category was only analyzed in those countries that participated in the Cross Border Bioenergy project consortium: Austria, Germany, Denmark, Hungary, Latvia, Finland, Italy, Sweden and Slovakia. Estonia, Lithuania, Slovenia and Romania were also analyzed but in less detail.

In March 2007, the governments of the EU member states adopted a binding target of 20% renewable energy of final energy consumption by 2020. Combined with the commitment to increase energy efficiency by 20% until 2020 and to reduce GHG emissions by at least 20% within the same period (or respectively 30% in case of a new international agreement), Europe’s political leaders paved the way for a more sustainable energy future for the EU and for future generations. In January 2008, the European Commission presented a draft directive for the promotion of the use of energy from RES which contains a series of elements to create the necessary
legislative framework for making 20% renewable energy become a reality. The Directive sets the legislative framework to ensure an increase of renewable energy of the total energy consumption from 8.5% in 2005 to 20% in 2020. If this gets properly transposed into national law, it will become the most ambitious legislation on renewable energy in the world. The RES Directive (DIRECTIVE 2009/28/EC) (EC, 2009) was approved by the European Parliament in December 2008, by the Council at the end of March 2009, in June 2009 it was published in the Official Journal. Subsequently it had to be transposed into national law. By June 2010, member states had to submit national action plans on how they foresee reaching their national targets. In order to reach the binding overall 20% target outlined, the development of all existing RES and a balanced mix of the deployment in the sectors of heating and cooling, electricity and transport are needed.¹

2.8. PROJECT FINANCING

This category addresses elements of export feasibility, such as a good credit market in the country, good conditions as a target for export as reflected in the Euler-Hermes Rating for instance. The graph below shows the scores for all EU countries.

As the result of the financial crisis from mid 2008 onwards, multilateral banks, such as the European Investment Bank (EIB) have filled a void on the project finance market and significantly increased their involvement in supporting RES projects. As an example, the EIB’s loans to the RES sector reached over €4 billion in 2009.

Capital availability in the renewable sector from the banks is influenced by a number of factors:²

1. Capacity of banks to lend long-term to the renewable energy sector;
2. Ability of banks to recycle that loan capital through secondary loan markets to other long term institutional lenders,

such as pension funds, insurance funds or other capital markets (through financial mechanisms through project loan securitizations etc.);

3. Impact of bank regulations on asset-liability mismatches.
2.9. Readiness for Uptake

This category was only analyzed for the countries partners of the CBB project. It includes the availability of support these countries have, such as industry associations and it also reflects the reality of the potential customer base in terms of awareness, willingness to adopt the technology and information about the maturity of the market.

Currently under preparation, the Biofuels Technology Platform in coordination with other Biomass Associations, the EU’s Bioenergy Industrial Initiative is one such tool to secure the long term objectives running in close cooperation with the EU Commission and industry stakeholders. Technological development will be important for the future of the industry, but in the meantime, ways to commercial success must be found by using existing technologies.

The expectancy and readiness for uptake for small scale heat projects in all European countries seems to be good. In several countries the bioenergy market is well organized, as there exists...
at least one specialized association for each market sector.

Renewable energies in general are warmly welcomed in society, and as bioenergy is the largest energy source in Europe, the market is well aware of the importance of bioenergy. It is a traditional way of heating houses and it is regarded as cosy, cost efficient and climate smart.
3. COUNTRY ATTRACTIVENESS - IN DEPTH ANALYSES

3.1. AUSTRIA

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3.1.1. Country Score

Country Score Upper Austria - Small Scale Heat (November 2011)

In the general scoring for sector, Austria - Upper Austria is rated place 30 out of total 81. The underlying categories that influence this result are displayed in the bar chart above.

3.1.2. Basic Data

Austria is a democratic republic and consists of nine federal states (see ‘Map Austria’). The capital and largest city is Vienna. Austria has a land area of 83,879 km² (573 km between the western and easternmost points of Austria, the longest north-south stretch totals 294km), and is thus somewhat smaller than Portugal and Hungary and somewhat larger than the Czech Republic.

Located in the southern part of Central Europe, the republic shares borders with Germany and the Czech Republic in the north, the Slovak Republic and Hungary in the east, Slovenia and Italy in the south, and Switzerland and Liechtenstein in the west.

Austria’s weather is characterized as a

transitional climate. An oceanic climate with moist westerly winds predominates in western Austria. Further to the east the climate is increasingly continental with decreasing precipitation, hot summers, and cold winters.

8.4 million Austrian inhabitants were counted at the beginning of 2011. According to projection, this figure will reach about 9.4 million by 2050. The municipality with the largest population is Vienna, which counted 1.7 million residents at the beginning of 2011. A fifth of Austria’s population, thus, lives in the federal capital, followed by the provincial capitals Graz (262,000 residents), Linz (189,000 residents), Salzburg (148,000 residents), and Innsbruck (120,000 residents).

**Useful links:**
- ÖNACE – Austrian classification of economic activities of companies
- Statistics Austria

### 3.1.3. Energy Policy

According to the EU internal burden-sharing, Austria has to reduce its emissions by 13%. In the year 2009, GHG emissions in Austria reached 80.1 million tons. Thus, the emissions of the year 2009 were 11.3 million tons above the allowable average from 2008 to 2012 of the established Kyoto target. Taking the emissions trading, the project of Joint Implementation and Clean Development Mechanism and the balance from afforestation and deforestation into consideration, the deviation from the target amounted to about 5 million tons of CO₂-equivalents. So, the over-all gap from the years 2008 and 2009 results in 11.9 million tons of CO₂-equivalents. To keep this gap as small as possible the implementation of effective domestic measures is necessary.

Due to the EU requirements, Austria is bound to:
• reduce its GHG emissions in the sectors covered by the emissions trading system, by at least 21%, and in those sectors not covered by the emissions trading system by at least 16%,

• increase the share of RES of the total energy consumption to 34% – the share in the transport sector should be at least 10%

• reduce the energy consumption by 20% of the prognosticated level of the year 2020 by improving the energy efficiency.

In Austria about 50% of the total energy consumption is used for heating and cooling. The share of RES in the heat market reached 35% in 2009. If the development of the recent years continues, an increased share of RES in the entire heat market of up to 50% is possible by 2020, even if the heat demand of buildings remains constant until this year. The share of bioenergy in the heating market could increase from 32% in 2009 to 41% in 2020. Existing support schemes could allow 545,000 households to switch from fossil heating systems to modern biomass heating systems until 2020. To reach this goal, consistent and reliable framework conditions are inevitable.

The most important measures for a further expansion of bio-heat are:

• With regards to private households, the focus should lie on the replacement of fossil heating systems by modern biomass heating systems based on pellets, wood chip and log wood combustion, and biomass district heating. Thus, investment programs for the installation of modern biomass heating systems must be well considered in the budgets of federal countries. In addition to this, a consistent and stable nationwide promotion of small scale heat appliances based on biomass and the connection of biomass district heating needs to be established. Annually 25% of the Climate and Energy Fund (KLIEN) should be used to promote renewable heat.

• Furthermore KLIEN should focus on the optimization of existing biomass (heating check, consulting, training, etc.) appliances. A communication campaign to increase the boiler replacement rate should be run.

• Additionally, the replacing of outdated biomass plants by modern ones should be promoted in the context of federal restructuring campaigns. This promotion should be established as a separate funding program, regardless of entire redevelopments of buildings.

• Existing support measures for commercial (environmental support at home) and agricultural (Rural Development Programme) small scale heating, district heating plants and micro-grids should be continued.

• In order to increase the efficiency and to optimise biomass district heating plants, microgrids and commercial biomass plants, a framework beneficial to the environmental support and the domestic and rural development program needs to be developed and introduced.

• An increased heat extraction from CHP plants should be promoted within the
agriculture and forestry not only forms the backbone of a viable rural community, but also reflects the cultural tradition of the nation. Structural changes to the economy have obviously had an impact on agriculture and forestry: as in most other EU member states, a steady downward trend in the number of operations has been accompanied by a simultaneous increase in the average size of the operations. The total output of agriculture and forestry accounted for €8 billion in 2010. Table ‘Land Use’ shows the distribution of the land use in Austria, subdivided to the federal states. The agricultural sector plays an indispensable role. Among other things, this includes ensuring nutritional produce, preserving the cultural landscape, landscape management and maintaining its function as an energy source. The ability to compete within the context of existing support schemes.

- Research initiatives for renewable heat are necessary to improve efficiency and cost reduction.
- The further education and training of installers, chimney sweepers, architects, builders and planners should be promoted intensively.
- Change of Tenancy Act: Thermal plants based on renewable energy should be considered as conservation measures.

3.1.4. Feedstock

The forest cover is particularly high in Austria: Almost half (47.6%) of the federal area is covered by forest. This reflects 3.99 million ha or 39,926 km² of the Austrian Republic.\(^2\) National Research and Training Centre for Forests, Natural Hazards and Landscape; http://bfw.ac.at

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Table ‘Land Use’: Percentage of land use\(^1\) in Austria 2010

<table>
<thead>
<tr>
<th>Federal state</th>
<th>Area in km²</th>
<th>Agricult. use</th>
<th>Forests</th>
<th>Alps</th>
<th>Inshore waters</th>
<th>Other (^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burgenland</td>
<td>3,962</td>
<td>48.6</td>
<td>30.7</td>
<td>-</td>
<td>7.4</td>
<td>5.7</td>
</tr>
<tr>
<td>Carinthia</td>
<td>9,538</td>
<td>19.6</td>
<td>53.5</td>
<td>12.7</td>
<td>1.9</td>
<td>10.3</td>
</tr>
<tr>
<td>Lower Austria</td>
<td>11,780</td>
<td>42.1</td>
<td>40.0</td>
<td>0.2</td>
<td>1.3</td>
<td>5.0</td>
</tr>
<tr>
<td>Salzburg</td>
<td>14,756</td>
<td>16.0</td>
<td>39.8</td>
<td>25.3</td>
<td>2.2</td>
<td>15.8</td>
</tr>
<tr>
<td>Styria</td>
<td>18,401</td>
<td>23.8</td>
<td>57.3</td>
<td>6.3</td>
<td>0.9</td>
<td>8.5</td>
</tr>
<tr>
<td>Tyrol</td>
<td>12,560</td>
<td>9.1</td>
<td>36.9</td>
<td>26.3</td>
<td>1.0</td>
<td>25.4</td>
</tr>
<tr>
<td>Vorarlberg</td>
<td>2,601</td>
<td>17.0</td>
<td>34.0</td>
<td>25.3</td>
<td>2.6</td>
<td>18.0</td>
</tr>
<tr>
<td>Vienna</td>
<td>83,879</td>
<td>30.3</td>
<td>43.5</td>
<td>9.7</td>
<td>1.7</td>
<td>11.2</td>
</tr>
</tbody>
</table>

\(^1\) Land use per usage type according to Kataster of the Federal Office for Metrology and Surveying; \(^2\) Built-up areas, gardens, vineyards and other areas

the EU is achieved through sustainable agriculture, and through an increasing specialization of agricultural and forestry operations. The coupling of agriculture and forestry with the tourist industry, and the increasing cultivation of energy crops to promote sustainable raw materials, guarantees the conservation of cost-effective, productive, farmer-oriented agriculture and forestry in a functional rural community.\(^3\)

In addition to raw materials from forests and timber processing industries, domestic wastes and agricultural feedstocks will gain more importance. These raw materials can be used for the production of solid biomass, biogas and biofuels. In 2009 about 46,500 ha of arable land and grassland were used for the production of biomass, while energy crops on arable land dominated (46,000 ha). This corresponds to 3.4% of the total arable land in Austria. Until 2020, the cultivation of energy crops as main crop could be extended to 122,000 ha, roughly 80% on arable land and 20% on grassland. This corresponds to 7.2% of the arable land and 1.4% of the grassland. In addition catch crops can be produced on 23,000 ha and harvesting residues can be taken from 150,000 ha. The increased use of biomass wastes and residues from agriculture like dung also provide additional energy potential.

In 2009 about 1000 ha of short rotation wood and 800 ha miscanthus were used energetically in Austria. It is estimated that the area of SRC can be extended to 15,000 ha until 2020. Respectively, energy production could increase from current 0.16 PJ to 3.5 PJ by 2020. For miscanthus an extension up to 3,500 ha is estimated. This corresponds to an energy increase from 0.14 PJ to 0.9 PJ. Currently, agricultural residues are only marginally used for energy production. Until 2020 agricultural residues such as straw, corn cobs or hay from landscape maintenance, will gain importance, since they do not compete with food and feed production. Thus, the use of straw of 15% of the Austrian corn cropland (about 92,000 ha) could produce 3.8 PJ of the primary energy. The energy of corn cobs from 25% of the corn cropland (45,000 acres) is estimated at 0.7 PJ. The hay from 1.5% of extensively used grassland (13,000 ha) could produce 0.6 PJ. Overall in 2020 energy crops and agricultural residues in form of solid biomass could produce 9.4 PJ of primary energy.\(^4\)

### 3.1.5. Business Case

After having experienced a continuous growth between 1994 and 2006 the biomass boiler market slumped in 2007 due to low oil prices and a shortage in pellets, but recovered in 2008. In 2010 the sales figures dropped once more, especially for domestic logwood boilers. The underlying causes are a re-dution in public support schemes and the delayed effects of the economic crisis.


The total turnover of investments in renewable energy technologies reached €5.229 billion in 2010; this was a 5.1% increase to the previous year. The production and service of renewable energy appliances, offered employment for 37.649 people in 2010 – 5.1% more than in 2009. The importance of renewable energies for the national economy, however, goes beyond its turnover and employment effects. The ability to generate energy from domestic sources reduces the need of fossil fuel imports making the national economy less prone to crises. In a longer term the economy will gain sustainability.5

Figure ‘Development Energy Consumption’: Development of final energy consumption of biomass in Austria from 2005 to 2009 and forecast potentials for 2020

3.1.6. Market Environment

The following Table ‘Consumption Bioenergy’ shows the development and the expectations of bioenergy consumption in Austria from 2005 to 2020.

The consumption of bioenergy increased by 30% from 140 PJ in 2005 to 182 PJ in 2009 (Figure ‘Development Energy Consumption’). The heating market is the main sales market for biomass with a share of 79%, followed by the biofuel market with 12.4%, and the green electricity market with a share of 8.6%. Assuming that the full resource potential will be exploited, the final consumption of bioenergy could rise about 31% up to 237 PJ. With estimated 76%, the heating market will still be the primary sector using biomass in 2020. A share of 15%


of biofuels and a share of 9% of green electricity from biomass and biogas are assumed.

The production of heat from biomass sources increased by about 12% from 128.5 PJ in 2005 to 143.5 PJ in 2009, while in 2009 about 83% of the produced heat contributed to small scale heating and 17% arose from district heating (Figure ‘Development Biomass Heat’). During this period, the heat from biomass

Table ‘Consumption Bioenergy’: Consumption of Bioenergy in Austria – Development & Potential from 2005 to 2020

sources nearly doubled from 12.7 PJ to 24.5 PJ. The heat production from small scale heating increased slightly from 115.8 PJ to 119.1 PJ.

The development potential of heat from biomass sources is estimated to increase by 37.3 PJ until 2020 (Table ‘Forecast Potential’) and can, hence, reach 181 PJ in total. The most important resource for a further expansion is wood with 69%, followed by biogas with 15%, and other biomass combustibles with 13%. It is expected, that about 60% of the development potential lies in SCH. The remaining 40% will be covered by district heating, micro-grids and industrial waste heat from CHP-appliances. To reach this goal, heating appliances with a thermal capacity of about 5,050 MW need to be newly installed. Additional 500,000 households with an estimated heat consumption of 10 kW/household could be switched from fossil to biomass heating. Moreover old biomass heating appliances need to be replaced. About 140,000 outdated heating appliances based on wood should be replaced to reach a higher level of efficiency. With the fuel amount saved through the replacement of old appliances, further 45,000 households can be heated.

The average boiler size for installed systems below 100 kW, are 27 kW for log wood boilers, 47 kW for wood chip systems and 22 kW for pellet boilers. Figure ‘Installed Boilers’ shows the number and capacity of annually newly installed biomass boilers < 100 kW from 2001 to 2010 in Austria.

The trend of heating in domestic homes between the heating seasons of 2003/04 and 2009/10 clearly shows a decrease in households using coal-fired systems (dropping from 67,831 to 24,048 households). Also the number of households using heating oil and liquid gas systems has been decreasing significantly from 738,666 to 170,000. There have been no noticeable changes in the domestic use of natural gas and electrical energy. Translated into market shares, the total percentage of households heating with fossil fuels (natural gas, heating oil, liquid gas, coal, coke) dropped from 54.8% in 2003/04 to 47.3% in 2009/10. Figure ‘Consumption Space Heating’ shows the energy consumption from space heating in

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>PJ</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood-based</td>
<td>25.6</td>
<td>68.6</td>
</tr>
<tr>
<td>Black Liquor</td>
<td>1.5</td>
<td>4.0</td>
</tr>
<tr>
<td>Biogas</td>
<td>5.4</td>
<td>14.5</td>
</tr>
<tr>
<td>Other Solid Biomass</td>
<td>4.8</td>
<td>12.9</td>
</tr>
<tr>
<td><strong>Sum</strong></td>
<td><strong>37.3</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>
Figure 'Development Biomass Heat': Development of production of heat from biomass in Austria from 2005 to 2009 and forecast potentials for 2020


Figure 'Installed Boilers': Number and Capacity of annually newly installed Biomass Boilers < 100 kW from 2001 to 2010 in Austria

Source: Chamber of Agriculture, Lower Austria, Biomass Heating Survey; publication: "Basic Data Bioenergy 2012"; published by Austrian Energy Agency and Austrian Biomass Association
Austrian households 2003/04 to 2009/10. Figure ‘Heating Technologies’ shows the heating technologies used in Austrian households 2003/04 to 2009/10.

Figure ‘Consumption Space Heating’: Energy Consumption from Space Heating in Austrian Households 2003/04 to 2009/10


Figure ‘Heating Technologies’: Heating Technologies used in Austrian Households 2003/04 to 2009/10

3.1.7. Regulation

Numerous regulations in Austria affect the operation of heating systems based on biomass.

Both norms, the ‘Emissionsschutzgesetz für Kesselanlagen (EG-K)’ and the ‘Luftreinhalte-VO für Kesselanlagen (LRV-K)’ are regulating the approval, the operation, the air emissions and the monitoring of steam and gas generators.

The ‘Feuerungsanlagenverordnung (FAV)’ applies to subjects under approval and already approved appliances with a capacity of more than 50 kW.

The ‘Abfallverbrennungsverordnung (AVV)’ regulates combustion techniques, emission limits and operation conditions.

The ‘Immissionsschutzgesetz-Luft (IG-L)’ comprises limits and targets for several pollutants.

The target of the ‘Emissions-höchstmengengesetzes Luft (EG-L)’ is the regulation of air pollutants (NOX, SO2, NMVOC and NH3) through the determination of national emission limits.

Useful links:
- **Emissionsschutzgesetz für Kesselanlagen – EG-K**
- **Luftreinhalte-VO für Kesselanlagen (LRV-K)**
- **Feuerungsanlagenverordnung (FAV)**
- **Abfallverbrennungsverordnung (AVV)**
- **Immissionsschutzgesetz-Luft (IG-L)**
- **Emissionshöchstmengengesetzes Luft (EG-L)**

3.1.8. Project Financing

According to outcomes from recognized rating agencies, like Standard & Poor’s and Moody’s⁶, the Austrian market can be considered as ‘safe’ from the perspective of a country risk analysis.⁷ Also the reliability and credit worthiness of the Austrian economy is rated with best scores.

COFACE country risk rating⁸ sees Austria on the fifth place of whole Europe after Luxembourg, Norway, Sweden and Switzerland. According to the Corruption Perception Index⁹ measuring the level of transparency Austria took the 16th position in the world.

The IFC¹⁰ ranks economies according to the ease of doing business. A high ranking on the ease of doing business index means the regulatory environment is beneficial for the starting and operation of a local firm. On this ranking Austria achieved the 32nd place of 183 countries considered. So the ease of doing business is seen to be quite well in Austria although the rank of ‘Starting a Business’ is relatively low due to the very high administrative and regulative requirements.

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⁷ Moodys’s, http://www.moodys.com/
With 1.8%, the average inflation rate for the period from 2005 to 2010 has been one of the lowest within Europe. The European average for the same period has been 2.3%.11

Access to credit is very much dependent on individual project designs as banks assess the reliability of the chosen technology, the security of feedstock supply, and price risks. The development of appropriate measures or strategies for the use of bioenergy is very specific. The optimal solution for the specific situation must consider ecological, economic as well as social aspects.

RENERGIE12 offers support in financing and operation of energy generation facilities using renewable sources, develops projects for renewable power and heat, and realizes the appropriate production plants. The projects are implemented by equity investments in selected European markets.

3.1.9. Readiness for Uptake

The readiness for uptake for SCH projects in Austria seems to be good. However, new projects need to be planned and implemented in a considerate and well adapted way under the participation of local inhabitants and stakeholders.

Biomass district heating has a long tradition in Austria, dating back to the early 1980s. In 2010, about 1,880 plants with a total power-output of 1,600 MW were in operation, supplying 3,200 GWh of heat to their customers.

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12 http://www.renergie.at/en

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Figure 'Newly Installed Boilers': Number of annually newly installed Biomass Boilers > 100 kW Heat Output from 1996 to 2010 in Austria

Source: Chamber of Agriculture, Lower Austria, Biomass Heating Survey; publication: "Basic Data Bioenergy 2012"; published by Austrian Energy Agency and Austrian Biomass Association
million tons of wood residues, bark and woodchips annually to supply this heat. Currently, a shift from big capacity units in the many MW-range towards smaller units in the range of several 100 kW can be observed. Figure ‘Newly Installed Boilers’ shows the number of annually newly installed biomass boilers > 100 kW heat output from 1996 to 2010 in Austria.

In 2010, the sales figures for biomass-heated cooking- and logwood stoves differed only slightly from those of 2009. 3,273 additional pellet stoves were sold, which amounted to a plus of 18.3%, as compared to the previous year (Figure ‘Stoves Sold’). The annual installation rate of tiled stoves fluctuates between 12,000 and 15,000. In Austrian households there are approximately 500,000 installed tiled stoves in total.

The growth of the renewable energy sector is a success story that will develop further, also in spite of the increasing energy consumption. Energy independence – 100% energy supply from domestic and renewable sources – is the objective for Austria by 2050. RES have a special status in Austria. In recent years big efforts were made to promote green energy. As a result, 30.8% of the Austrian energy consumption came from RS in 2010. The measures which are divers in nature range from initiatives sensitizing the public to energy issues (e.g. ‘klima:aktiv’), to support schemes, such as subsidies and the establishment of feasible framework conditions to promote renewable energies.13


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Figure ‘Stoves Sold’: Biomass Stoves (a stove is a heater, and in comparison to a boiler not used for the operation of a central heating system) sold in Austria between 2008 and 2010

3.2. Germany

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3.2.1. Country Score

Country Score Bavaria - SCH (November 2011)

In the general scoring for sector, Germany - Bavaria is rated place 35 out of total 81. The underlying categories that influence this result are displayed in the bar chart above.

3.2.2. Basic Data

Germany is with 357,104 km² land area one of the largest countries in Europe, located in a temperate climate zone with average temperatures of 0,5 degree Celsius in January and 17 degree Celsius in July. At least for half of the year a heating system for space heating is necessary. In 2011 155,000 registered pellet heating systems used 1.8 million tons of pellets.¹

Of the German surface area, 52.3% is used for agriculture, which offers a great theoretical potential for agricultural feedstock supply for the pellet industry, for example to grow short rotation coppices.

¹ Data Source: www.depv.de
A huge saw mill industry delivers sufficient raw materials for the pellet production. Considering a total population of 81 million inhabitants, 2,300 m² farm land are available per capita (including grassland), and 1,460 m² arable farm land (without grassland) per capita respectively.

While GDP real growth rate stagnated slightly with -0.1% between 2008 and 2010, GDP in 2010 was still €118 per capita, which makes Germany to one of the strongest economies in Europe with solvent inhabitants.

With 229 inhabitants per km², the population density can be considered as attractive, providing sufficient sales potential even on the regional scale. There are, however, differences in real terms since the population density is lower in eastern and northern parts of Germany compared to western and southern regions.

Useful links:
Facts and Figures:
- Federal Statistical Office
- EUROSTAT

2.2.3. Energy Policy

Germany aims at having a market share of 14.431 ktoe RES in the heat sector in 2020, corresponding to slightly more than 14% RES. For this, pellets will be one pillar in private households and local heating plants. In view of an already existing market share of pellets in private households of about 530 ktoe,² market potential to place further amounts of pellets is quite big.

An economic and ecologically balanced and secure energy supply is of eminent importance for the German Government. In pursuit of national and international targets, e.g. climate protection, and due to the decision to phase out nuclear power, the federal government gives greater priority the efficient use of renewable energies. A major focus of the Federal Office of Economics and Export Control (BAFA)³ is to implement the program to promote renewable energies of the Federal Environmental Ministry. It is BAFA’s task to give grants and, thereby, to promote the increasing use of renewable energies in order to conserve the limited resources of fossil fuel and to contribute to environmental and climate protection. Assistance is provided for solar thermal units, photovoltaic units in schools and biomass units. Under the program ‘Local consultations to save energy’ BAFA gives grants for consultations of home owners by qualified engineers. The reduction of heat consumption in buildings as a

³ Bundesamt für Wirtschaft und Ausfuhrkontrolle: www.bafa.de
The key support scheme for pellets in Germany within this organizational structure is the ‘Renewable-Energy-Heat-Law’ and the integrated ‘Market Incentive Program for Renewable Energies’ (MAP). The ‘Renewable-Energy-Heat-Law’ was established in 2009 with the aim to increase the market share of RES in the heat sector. The law orders that house owners have to cover a part of their heat demand with RES. This law applies for residential buildings and non-residential buildings for which the building application has been handed in after the 1st of January 2009.

The house owner decides which RES will be used in this newly built house. Important is that a certain percentage rate of the heat demand is covered by RES. The percentage rate depends on the energy form. If no RES are applied at all, different compensating measures must be undertaken.

The ‘Renewable-Energy-Heat-Law’ has been amended in May 2011. Since then, the obligation to use RES not only applies for newly built houses, but also for public buildings. The law includes all public authority buildings, whether owned by the authorities or just rented.

The design of the law allows every house owner to find an individual, customized and cost-saving solution. Therefore, different combinations of RES and fossil fuels are allowed.

Concomitant to this law, the federal government continues its so-called ‘Market Incentive Program for Renewable Energies’ (MAP). The MAP, however, only supports the replacement of heating systems in the building stock. The MAP-program pays at least €2,000, when a fossil boiler is replaced by a pellet boiler. Unfortunately, the increase of new installations of pellet boilers slowed down last year. A reason for this is the irregular support by the federal government. The support by the market incentive program is negotiated on a year-by-year-basis and is therefore not always reliable. A pause of the program in summer 2010 has caused massive uncertainty among potential pellet heaters and installers which resulted in a massive slowdown in sales. The market has until now not fully recovered yet.

Furthermore, credits with reduced interest rates are granted to house owners, communes, companies, etc (see chapter 2.1.5. Business Case). Wood pellets are taxed with only 7% VAT instead of 19%. Moreover, federal states offer various programs for renewable heating.

Useful links:
Laws and Ordinances:
National Renewable Energy Action Plan:
- **BMU (National Aktionsplan)**
- **Biomasseaktionsplan**
- **EU Transparency Platform (Action Plan)**

4 Erneuerbare-Energien-Wärmegesetz (EEWärmeG): www.bmu.de
5 Markzanreizprogramm (MAP): www.bafa.de
Renewable-Energy-Heat-Law:
- BMU (Erneuerbare Energien)
- Gesetze im Internet

Market Incentive program for Renewable Energies:
- Bafa (Energy Index)
- Bafa (Biomasse Index)

Institutions:
- Renewable-Energy-Heat-Tax => Federal Ministry for Environment, nature conversation and nuclear safety
- Federal Office of Economics and Export Control (BAFA)
- Pellets F&E and Marketing => Federal Agency for Renewable Ressources

Associations:
- German Wood Fuel and Pellet Association (DEPV)
- German Pellet Institute
- BBE, German Bioenergy Association

3.2.4. Feedstock

In Germany, 56% of forest area is owned by public bodies and 44% is in private hands. More than 50 million m³ of wood is used for electricity and heating purposes annually (see Figure ‘Pellet Production’). Out of all RES used

6 Source: German Wood Fuel and Pellet Association: www.depv.de

Figure ‘Pellets Production’: Increase of production of pellets from 2005 - 2011 in Germany in tons

Source: www.depv.de) Grey bar: production capacity / orange bar: real production / white bar: Consumption in Germany
for heating, wood adds up to 70% (wood chips, wood pellets, firewood etc.). From its 3.6 billion m³ of wood emerges a growth of 120 million m³ every year, including bark. Only 60% of the growth is used – meaning, that forests are growing constantly. 70 million m³ of log wood is cut every year. From this amount, around 30% residues (saw dust, wood chips, saw mill residue) can be used for pellet production theoretically. Right now, only 4 million m³ are used for pellets by 70 production sites.

A constant growth of production capacity up to 2.7 million tons (in 2011)\(^8\) shows that there are still feedstock capacities left. According to the growth of the theoretical production capacity of the pellet producers the real production increased up to 1.8 million tons (2011). In fact the consumption in 2011 was just 1.4 million tons. 400.00 tons are exported to other European countries like Holland, Italy or Denmark.

Although the demand for wood pellets has increased in the last years, German forests are not even close to overexploitation. Moreover, the supply with sawdust suffices for a stable pellet production in the next couple of years, even if the number of boilers increases. Even so, pellet producers are already exploring alternatives for raw material, especially from SRC with cottonwood or willow (see Figure ‘SRC’). In 2011, the cultivated area for energy wood added up to 6000 hectares. The total potential for SRC is calculated to be 500,000 ha.

\(^8\) Data source: German Wood Fuel and Pellet Association (DEPV): www.depv.de

**Useful links:**

**Facts and figures:**
- DEPV - German Wood Fuel and Pellet Association
- DEPI - German Pellet Institute
- FNR - Federal Agency for Renewable Ressources
- DBFZ - German Biomass Research Center
- AMI - Agricultural Market Information Company
- BMELV Federal Ministry for Food, Agriculture and Consumer Protection
3.2.5. *Business Case*

The price for wood pellets has experienced only a moderate increase since 2002. The average annual rate of the price increase was between 3.1% (2002-2011), which corresponds to the European inflation ratio. The German market for wood pellets is independent of the international energy markets and speculations. It is moreover based on the basic mechanism of supply and demand. As to the vast number of small- and medium-scale producers as well as traders and the high amount of pellets offered, prices are likely to stay at the bottom level of the price range.

In 2010, the average price of wood pellets in Germany amounted to €225/ton, and to €233/ton in 2011. The price advantage of pellets compared to fossil fuels (natural gas or heating oil) ranges between 40 and 45%. The annual low in prices usually occurs in the summer as the supply of pellets is high but the demand relatively low.

Investments into pellet-technology are supported with public budgets. The MAP only supports the replacement of heating in the building stock. The MAP-program pays at least €2,600, when a fossil boiler is replaced by a pellet boiler.

The Federal Office of Economics and Export Control (BAFA) supports private households:
- pellet heating 5 to 100 kW without buffer storage
- solar heating for a combined hot water and heating system
- combination of pellet boiler with solar heating system
- wood chip plant 5 – 100 kW

Pellet boiler and pellet stoves have to meet general support demands:
- energy efficiency of the boiler/stove has to be at least 89%.
- dust emissions have to be less than 50 mg/cbm
- emissions of carbon monoxide have to be less than 250 mg/cbm

A basic promotion is paid for pellet boilers and stoves with a nominal heat output between 5 – 100 kW during a house renovation in the building stock:
- €36 per kW installed nominal heat output
- minimum of €2,000 for a pellet boiler
- minimum of €2,500 for a pellet boiler with new buffer storage > 30l/kW
- minimum €1,000 for a pellet stove with water bag > 5kW

An additional promotion is paid for the following facts:
- combination bonus of €500 with concurrent installation of solar heating system
- efficiency bonus 0,5* basic promotion when pellet boiler/stove is installed in a building with low primary energy demand
- innovation support: €500 for arrangements to increase the heat output by flue gas condensation or by separation of particles contained in the flue gas.
The problem concerning the MAP is its unreliability caused by the fact that the program is negotiated on a year-to-year-basis. This led to a slowdown in market growth last year, which has not yet been fully overcome.

The KfW-Bank supports communes and companies

KfW and the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) subsidize facilities using renewable energies. With the MAP-Premium-Program the BMU wants to promote the acquirement and the operation of pellet and wood chip heating systems with low interest credits from KfW and with amortization subventions. These subsidies are placed at disposal for communes and small and medium-sized companies which are grouped under the exemption regulation.

Eligible are:

- Automatically loaded facilities with a capacity > 100 kW nominal heat output for the burning of solid biomass.
- Facilities for the burning of solid biomass in combined heat and power generation
- Local heat grids which are energized with heat from renewable energies
- BMU and KfW grant up to 100% of the investment cost, but not more than €10 million for each project. Project proposals from companies and private persons have to be handed in before the project kick off by their house bank. Communes have to hand in their application directly to the KfW.

The promotion by KfW officially starts with the conclusion of a contract of delivery or a measurement contract. Already before the application, applicants are allowed to engage in engineering work.

In addition to the MAP, there are special promotional programs for communes, companies, house owners, etc. (see Table ‘Promotions’):
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<th>German State</th>
<th>Promotional program</th>
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<th>Who is promoted?</th>
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<td>Wohnen mit Zukunft</td>
<td>Heating systems in private houses</td>
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<td>Heizen und Wärmenetze mit regenerativen Energien</td>
<td>Biomass heating systems combined with local heat grid</td>
<td>Communes and township</td>
<td>€50 per ton of CO₂-emission avoided. Counted by service life of the plant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wood pellet heating systems</td>
<td>Municipal buildings</td>
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</tr>
<tr>
<td>Bavaria</td>
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<td>Bayerisches Modernisierungsprogramm</td>
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<td>IBB-Energetische Gebäude-sanierung</td>
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<td>Renovation of the heating system after the KfW-program 156 (<a href="http://www.kfw.de">www.kfw.de</a>)</td>
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<td><strong>Bremen</strong></td>
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<td>Boilers between 80 kW and 1 MW</td>
<td>Firms and Companies</td>
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</table>
| Hamburg | Förderprogramm Erneuerbare Wärme | Pellet heating systems and local heat grids fired with renewable energies | Companies, Municipal facilities, private persons and associations | Building stock: €1250 plus €45 for every kW nominal heat output above 30kW  
New building: €1000 plus €30 for every kW nominal heat output above 30kW  
Building stock: €45 for every kW nominal heat output up to 500kW  
New building: €45 for every kW nominal heat output up to 500kW  
For bigger plants the grant is defined individually  
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<td>Mecklenburg-West-Pomerania</td>
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<tr>
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<td>Heating systems and cogeneration of heat and power</td>
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<td></td>
<td>Energetische Sanierung von Wohneigentum (31.12.2015)</td>
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<td>SME; Housing industry; Non-profit donations; Associations</td>
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<td>Lower Saxony</td>
<td>Energetic reconstruction of residential property</td>
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<td>North Rhine Westphalia</td>
<td>Progress.nrw Combined pellet and solar heating system up to 250 kW</td>
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<td>Rhineland-Palatinate</td>
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<tr>
<td></td>
<td>Biomass heating systems</td>
<td>Communes and townships; Companies and private persons</td>
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<tr>
<td>Modernisation</td>
<td>Modernisation of residential property</td>
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<td>Promotional Program for energy-efficient buildings</td>
<td>New building of energy-efficient residential buildings as passive house; Energy-efficient restoration of residential buildings as low energy house in the building stock</td>
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<tr>
<td><strong>Saarland</strong></td>
<td><strong>ZEP kommunal</strong></td>
<td><strong>Wood-fired heating systems from 6 kW – 1 MW</strong></td>
<td><strong>SMEs; Communes; Public-law institutions; Local authorities of Saarland</strong></td>
<td><strong>Partial financing:</strong> Maximum 39,62% <a href="http://www.saarland.de">www.saarland.de</a></td>
</tr>
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</tr>
<tr>
<td><strong>Klima-Plus-Saar (Until 31/12/2014)</strong></td>
<td><strong>Installation of pellet boiler</strong></td>
<td><strong>Energetic restoration of club houses and cultural institutions</strong></td>
<td><strong>Partial financing:</strong> Grant</td>
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<tr>
<td><strong>Modernization of flats and self-used home ownership</strong></td>
<td><strong>Measures to reduce water and energy consumption</strong></td>
<td></td>
<td><strong>Credit up to 80% of the costs, but not more than €80,000</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th><strong>Saxony</strong></th>
<th><strong>Energie und Klimaschutz</strong></th>
<th><strong>Automatically loaded pellet boiler from 5 – 100 kW</strong></th>
<th></th>
<th><strong>New building:</strong> €25 per kW - Minimum: €1500; With buffer storage of at least 30l/kW: €1875 Building stock: €34 per kW – minimum: €2000; With buffer storage of at least 30 l/kW: €2500**</th>
</tr>
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<td>Saxony-Anhalt</td>
<td>Richtlinie zur Gewährung von Zuwendungen zur energetischen Sanierung 2007</td>
<td>Pellet boiler</td>
<td>Natural persons</td>
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</tr>
<tr>
<td>Saxony-Anhalt</td>
<td>Sachsen-Anhalt MODERN</td>
<td>Energy-efficient restoration</td>
<td>Private persons; Housing Association; Commercial or private renter</td>
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</tr>
<tr>
<td>Schleswig-Holstein</td>
<td>Energetische Nutzung von Biomasse im ländlichen Raum (until 31/12/2013)</td>
<td>Heating and hot water supply with renewable energies</td>
<td>Natural and juridical persons; public Authorities</td>
<td>Grant: Up to 40% of the costs</td>
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<tr>
<td>Thuringia</td>
<td>Modernisierung von Mietwohnungen (until 31/12/2012)</td>
<td>Heating systems with renewable energies; Increase of energy-efficiency</td>
<td>Flat owner, Companies; Communes; Public Buildings</td>
<td>Grant: Up to €600/m². Buildings older than 1949: Up to €800 per m². Personal contribution at least 15%</td>
</tr>
</tbody>
</table>

Source: www.depi.de

Useful links:
Facts and figures:
- DEPV - German Wood Fuel and Pellet Association
- DEPI - German Pellet Institute
- FNR: www.fnr.de/www.bio-energie.de
- Federal Ministry of Economics and Technology
- BMELV - Federal Ministry for Environment, Nature Conservation and Consumer Protection
- KfW - KfW-Bankengruppe
3.2.6. Market Environment

Germany offers excellent geographical and infrastructural framework conditions for investments into pellet production facilities and technology development, despite the facts that the domestic market seems to be saturated at the time being and pellet production plants have overcapacities and run at low efficiency of approximately 70%. Therefore a market entry for new manufacturers will not be easy. In Germany, 60 companies with around 70 production sites for wood pellets have a production capacity of 2.7 million tons per year. In 2010, 1.75 million tons of pellets were produced in Germany by which one quarter had to be exported because of insufficient domestic sales. About 85% of pellets were produced of saw rest wood. 15% of the raw materials were made up of industry wood (round wood, which cannot be sawed). Most pellets produced in Germany are certified (ENplus/DINplus). In 2010, 83% were certified A1 for private use, of which 15% were sold bagged and 68% in bulk. 17% of the total amount was sold as industry pellets. In 2011, they produced an estimated amount of 1.8 million tons from which 1.4 million tons were used in the country. The high inland production results in a security of supply even in long, cold winters as in 2009/2010 and 2010/2011. Additionally, prices are stable at a low level. The average price for wood pellets was 225 €/t in 2010 and 233 €/t in 2011.

Since pellet heating systems have been sold in Germany for over ten years, the
demand and the supply has increased steadily (see Figure ‘Pellet Heating Development’). The annual growth rate for pellet boilers installed was between 12 and 58%. The turn towards renewable heating is supported by federal and local governments which offer various programs for financial support and facilitation.

Most production sites are located in the densely wooded low mountain ranges in Germany. For the production of pellets mainly residues from the sawmill industry, such as sawdust and wood chips, are used (85%) whilst only 15% account for round wood that cannot be sawed. Softwood is mainly used to produce better pellet qualities. Fast growing woods from agricultural production land are not widely used yet. Around 1.4 million tons were used domestically in 2011. Hence, around one quarter of the overall production had to be exported since 2007. The broad availability of pellets is a good base to raise the number of pellet heating systems.

Due to the surplus production, pellet traders are able to raise their stock up to 10 to 15% of the yearly production volume. As pellet distributors are located all over the country, security of supply does not pose problem anymore. More than 600 traders sell wood pellets: large energy suppliers, specialized pellet traders and small-scale traders which added wood pellets to their assortment.

Demand concentrates almost exclusively on A1 quality for private use. As the single amounts traded are therefore small, there is no stock trade for wood pellets and the price is not influenced by speculations (see Figure ‘Pellet Price’). Moreover, the geopolitical situation does not influence the market.
3.2.7. Regulation

Starting in September 2011, the new European Standard for solid biomass replaced all existing norms (e.g. DIN 51731 for wood pellets). With the certification scheme ENplus, the EN 14961-2 has been implemented in Germany since autumn 2010 by the German Pellet Institute (DEPI). In addition to the standards set by the European Standard, ENplus also certifies pellet traders in order to document the whole supply chain for wood pellets. Pellet producers and traders have accepted ENplus quickly and use the opportunity to underline quality and competence to their clients. By the end of 2011, 16 pellet producers and 40 pellet traders, among these some big trading companies, are certified. This means, that customers can buy ENplus pellets everywhere in Germany. The German Pellet Institute (DEPI) supported the market launch of ENplus with press and media works. It also offered marketing support to all certified companies.

In 2011, 1.8 million tons of pellets were produced in Germany. About 85% of the pellets were produced of saw rest wood. 15% of the raw material was industry wood (round wood, which cannot be sawed). Most pellets produced in Germany are certified (ENplus/DINplus). In 2011 83% of all pellets produced were high quality A1 pellets destined for private use. 1.55 million tons were certified with ENplus. By the end of 2011, the German Energy Wood and Pellet Association (DEPV) expects more than two third of the overall production to

Figure ‘Pellet Price’: Pellet average prices from 2003 – 2011 in Euro

Source: Solar Promotion/DEPI

9 Source: www.depv.de

10 Source: www.depv.de
come from ENplus-certified production sites. More than half of the domestic trade volume in Germany is already certified according to ENplus.

Within the ENplus certification scheme, pellet producers have to give proof about their sources of raw material and inform the certification body about raw material from certified sources like FSC or PEFC once a year. In a next step pellet producers will have to proof that a certain amount of raw material comes from certified sustainable sources. Moreover, in 2012, pellet producers also have to provide information on carbon dioxide emissions caused during the production process. The European Pellet Council’s standard figures can be used for this, but it is also possible to collect individual data for energy consumption of the pellet production plant and the energy source used. The First Ordinance for the Implementation of the Federal Immission Control Act (‘Small combustion plants ordinance’)\(^\text{11}\) entered into force on the 22\(^{\text{nd}}\) of March 2010. This ordinance applies to wood-fired heating systems, stoves and other small combustion plants fired with solid fuels. This small combustion plants ordinance refers to pellet heating plants below 1 MW. Wood is a RES and therefore an appropriate fuel for heat generation in terms of climate protection. However, burning wood in small combustion plants indoors releases various air pollutants such as particulate matter and leads to unpleasant odours – and this to an increasing extent. The new limit values will reduce air pollutants directly at the source. The amendment to the First Ordinance on the Implementation of the Federal Immission Control Act (1. BImSchV) adapts the provisions governing stoves and heating systems fired with solid fuels such as wood to the technological progress achieved with regard to reducing pollutant emissions (see Table ‘Dust Emission Thresholds’).

Limit values have also been set for existing combustion plants. If compliance with these limit values can be proven either by a manufacturer certificate or by an on-the-spot-measurement, these firing systems can be operated for an unlimited period. Only if compliance is not possible, a retrofitting or replacement by low emission plants must be undertaken between 2014 and 2024.

So-called masonry heaters, cooking stoves, baking ovens, bathing furnaces, fireplaces and stoves installed before 1950 are excluded from the retrofitting program. Stoves which do not serve as additional heating systems but as the sole heating system for flats or houses are excluded as well.

The combustion plant itself is not always to blame if clouds of smoke appear out of a chimney. Many users do not have the necessary knowledge and experience to operate their combustion plants properly. Therefore the 1. BimSchV stipulates that operators must be advised on the proper handling of such combustion plants and the solid fuels to be used. In addition, wood fuel will be checked regularly.

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\(^{11}\) 1. Bundesimissionsschutzverordnung (1. BImSchV): www.bmu.de
for quality in the framework of other monitoring tasks.

Pellet boilers with a nominal heat output of more than 1 MW are regulated in the Fourth Ordinance for the Implementation of the Federal Immission Control Act.\textsuperscript{12}

DEPV and NABU, one of the oldest and largest environment associations in Germany (Nature and Biodiversity conservation Union), have agreed in a position paper on sustainable forests not to use wood from very old trees, valuable biotope structures or clear cutting. Sustainability gains importance in public discussions about energy wood and energy turnaround. Most people are not aware that an overexploitation of German forests is forbidden by law. The Bundeswaldgesetz (BWaldG – Federal law for forests)\textsuperscript{13} states sustainability as a major principle for all German forests. All foresters have to oblige to the law. The German Bundeswaldgesetz is often referred to as best-practice worldwide, as it combines sustainability with ecological and economic requirements.

**Useful links:**

Facts and figures:

- BMU - Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
- BMELV - Federal Ministry for Food, Agriculture and Consumer Protection
- DEPV - German Energy Wood and Pellet Association
- DEPI - German Pellet Institute
- Laws in the internet
- NABU - Nature and Biodiversity conservation Union

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\textsuperscript{12} 4. Bundesimmissionschutzverordnung (4. BImSchV): www.bmu.de

\textsuperscript{13} Laws in the internet: www.gesetze-im-internet.de

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**Table ‘Dust Emission Thresholds’: Allowed dust emissions for pellet stoves and boilers below 1 MW referred to The First Ordinance for the Implementation of the Federal Immission Control Act (“Small combustion plants ordinance”)**

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<tr>
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<td>0,03</td>
</tr>
<tr>
<td>Pellet stove (water-formed)</td>
<td>0,03</td>
<td>0,02</td>
</tr>
</tbody>
</table>

Source: www.bmu.de
3.2.8. Project Financing

Germany is regarded as a ‘safe’ country for foreign investments. Its ratings of well-known organizations like Standard and Poor’s show best scores with a triple A in 2011. Also COFACE index attests German markets a low country risk concerning payment failures, same is true for the market transparency which is seen to be very good as measured by the Corruption Perception Index. However, easiness of starting business in Germany is assessed by IFC World just as moderate due to its sophisticated regulatory environment.

Banks are familiar with financing bioenergy projects with view on biogas and biomass projects, but also in terms of pellet heating systems. The KfW-Bank supports heating systems with a nominal heat output of more than 100 kW (please see Chapter 3.2.5. Business Case). Different regional banks (please see Table ‘Promotions’) also offer cheap credits and loans for biomass heating systems and connected district heating grids. In addition, the Federal Agency for Renewable Resources FNR supports R&D-activities.

The market perspectives, political framework conditions and economic parameters are usually well-known to decision makers. A special focus when deciding about credits and loans is put on a reliable, sustainable and long-term feedstock supply as well as on a sound concept for the sales of the product.

3.2.9. Readiness for Uptake

The bioenergy market is excellently organized in Germany, as there is at least one specialized association per market sector, organized under the roof of the German Bioenergy Association (Bundesverband BioEnergie BBE). Amongst these associations there is one main organisation in charge of wood pellets (DEPV). This allows single associations to clearly deal with technology related issues and to represent the diverse interests of the different stakeholders (pellet producers, traders, manufacturers, etc.) in the best way, while when it comes to an overall policy, the association speaks with one voice.

Renewable energies, in general, are warmly welcomed in the German society. Especially wood pellets are beheld in a very positive way. Technical concerns, like dust emissions of pellet stoves and boilers, have been mitigated. The biggest concern remains the raw
material supply for the production of pellets. Theoretically, there is more than enough raw material available. A big challenge for the acceptance of pellets would arise, if there was more co-firing with industrial pellets, like it is already done in England or Denmark. In this case the concern of insufficient raw material provision for the pellet production, would also impair the good name of pellets in Germany.

In addition to concerns regarding the difficulties of supply, customers got anxious concerning the sustainability and environmental benefits of biomass due to manifold and aggressive, partly dubious campaigns of environmental and clerical NGO.

**Useful links:**

**Associations:**
- BBE - German Bioenergy Association
- DBV - German Farmers Union
- DEPV - German Wood Energy and Pellet Association
- DEPI German Pellet Institute

**Institutions:**
- Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
- Federal Ministry of Food, Agriculture and Consumer Protection
3.3. Italy

Associazione Italiana Energie Agroforestali (AIEL)
Annalisa Paniz
Viale dell’Università 14
I-35020 Legarno
Tel.: +49-88 30 772
Email: paniz.aiel@cia.it

3.3.1. Country Score

Country Score Central Italy - CHP (November 2011)

In the general scoring for sector, Italy - Central is rated place 10 out of total 81. The underlying categories that influence this result are displayed in the bar chart above.

3.3.2. Basic data

Italy, officially the Italian Republic, is a unitary parliamentary republic in south-central Europe. In the north, Italy borders with France, Switzerland, Austria, and Slovenia along the Alps. Southern Italy is made up of the Italian Peninsula, Sicily, Sardinia – the two largest islands in the Mediterranean Sea – and many other smaller islands. Italy is spread over some 301,338 km² and is characterized by a temperate seasonal climate. With 60.6 million inhabitants, Italy is the fifth most populous country in Europe, and the 23rd most populous country in the world. The population density, which amounts to 201 people per km² (520/
Market Handbook Small Scale Heat

In 2009, Italy was the world’s seventh largest exporter. Italy’s closest trade ties are within the European Union, where 59% of its total trade is conducted. Its largest EU trading partners, in the order of market share, are Germany (12.9%), France (11.4%), and Spain (7.4%).

Nowadays, the Italian economy suffers from numerous problems. After a strong GDP growth of 5–6% per year from the 1950s to the early 1970s, and a progressive slowdown in the 1980s and 1990s, the last decade’s average annual growth rates performed rather poorly at 1.23%, whereas the average annual growth of the EU was at 2.28%. The stagnation of economic growth, and the political efforts to revive it with massive government spending from the 1980s onwards, eventually produced a severe rise in public debt. According to the EU’s statistical office, Eurostat, Italian public debt rose to 116% of GDP in 2010, resulting in the second biggest debt ratio after Greece (with 126.8%).

However, a major difference between Greece and Italy constitutes the fact that the biggest share of Italian public debt is owned by national subjects. Furthermore, Italian living standards are marked by a considerable north-south divide. Whilst the average GDP per capita in the north exceeds the EU average by far, many southern regions lie significantly below this average. Italy has often been referred to as the sick man of Europe, characterised by economic developments.
stagnation, political instability and problems in pursuing reform programs.

More specifically, Italy suffers from structural weaknesses which are due to the geographical conformation, and the lack of raw materials and energy resources: in 2006, the country imported more than 86% of its total energy consumption (99.7% of solid fuels, 92.5% of oil, 91.2% of natural gas, and 15% of electricity). The Italian economy is weakened by its high public deficit as well as its lack of infrastructural development, market reforms, and investment into research. On the Index of Economic Freedom of 2008, the country ranked 64th in the world and 29th in Europe - the lowest rating in the Eurozone.

Italy suffers from an inefficient state bureaucracy, low property rights protection, high levels of corruption, heavy taxation, and public spending that accounts for about half of the national GDP. In addition, the most recent data show that Italy’s spending in R&D in 2006 was equal to 1.14% of GDP which is significantly lower than the EU average of 1.84%.

Regarding the national road network, there were 668,721 km (415,524 mi) of serviceable roads in Italy in 2002, including 6,487 km (4,031 mi) of motorways which are state-owned but privately operated by Atlantia. In 2005, about 34,667,000 passenger cars (590 cars per 1,000 people) and 4,015,000 goods vehicles circulated on the national road network.

In 2003, the national railway network, which is state-owned and operated by Ferrovie dello Stato, extended to 16,287 km (10,120 mi) of which 69% are electrified. 4,937 locomotives and railcars are circulating on this network. In 2002, the national inland waterways network comprised 1,477 km (918 mi) of navigable rivers and channels.

3.3.3. Energy Policy

The biomass sector plays a strategic role in the Italian policy for RES: according to the National Energy Action Plan (NEAP), approved in June 2010 following EU Directive 28/2009, biomass is supposed to become the primary RES by 2020, covering 44% of renewable consumption (22.3 Mtoe) — 20% in electric power generation, 58% in thermal power generation and 84% in the production of biofuels (see Figure ‘NEAP’). The final energy consumption was approximately 132.7 Mtoe in 2009 and estimates predict its increase to 145.6 Mtoe by 2020.

Up to now, the development policies in favour of renewable energy have almost been exclusively focused on electric power generation; although, by 2020, 48% of total energy consumption in Italy is supposed to be made up of thermal energy (see Figure ‘Distribution Consumption’). By the year 2020, biomass will have reached a record of 54% among renewable sources of the total thermal energy produced (10.5 Mtoe). Nevertheless, there are no specific incentives or subsidies in favour of thermal energy production in place.
at the moment. Structural policies are urgently needed.

The Italian nREAP sets targets for the use of solid biomass in order to meet the binding targets set for 2020 and the provisional contribution to the indicative trajectory for the shares of energy from RS. In 2005, the production of thermal energy based on RS was estimated at 2.4 Mtoe.¹ The target set by NEAP for 2020 is 5.2 - 5.4 Mtoe (see Table ‘RES Heat Consumption’, Figure ‘Trend Heat Consumption’ and Figure ‘Consumption Thermal Energy’).

¹ Source: ENEA

3.3.4. Feedstock

The use of solid biomass, represented mainly by wood, has been assigned a primary role as a RES. According to the estimate reported in the National Forests and Carbon Inventory,² the Italian forest area amounts to 8.8 million hectares, with a potential availability of 874 Mt (dry basis) corresponding to 1,270 million m³ per year. The wood stock is 145 m³/ha, and the current annual increment is 36 million m³, corresponding to average current increment of 4.1 m³/ha. The arable land under SRC is about 5,000

² www.infc.it
Table 'RES Heat Consumption': Gross RES heat consumption in 2008 and forecasts for 2020

<table>
<thead>
<tr>
<th></th>
<th>Gross production RES-H [ktep]</th>
<th>RES production share [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geothermic</td>
<td>213</td>
<td>7%</td>
</tr>
<tr>
<td>Solar</td>
<td>67</td>
<td>2%</td>
</tr>
<tr>
<td><strong>Biomass:</strong></td>
<td><strong>1.875</strong></td>
<td><strong>58%</strong></td>
</tr>
<tr>
<td>solid</td>
<td>1.854</td>
<td>57%</td>
</tr>
<tr>
<td>biogas</td>
<td>16</td>
<td>1%</td>
</tr>
<tr>
<td>bioliquid</td>
<td>4</td>
<td>0%</td>
</tr>
<tr>
<td>Heat pumps</td>
<td>1.083</td>
<td>33%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3.238</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Gross production RES-H [ktep]</th>
<th>RES production share [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomass:</td>
<td>5.670</td>
<td>54%</td>
</tr>
<tr>
<td>solid</td>
<td>5.254</td>
<td>50%</td>
</tr>
<tr>
<td>biogas</td>
<td>266</td>
<td>3%</td>
</tr>
<tr>
<td>bioliquid</td>
<td>150</td>
<td>1%</td>
</tr>
<tr>
<td>Heat pumps</td>
<td>2.900</td>
<td>28%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10.456</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Figure 'Trend Heat Consumption': Expected trend of gross heat consumption from biomass
68

production can be estimated to account for 1.2 million fresh tons per year.

At national level there is no reliable data regarding the exploitation of forest logwood as well as the imports for the firewood market. However, a recent

The area felled in 2007 amounted to approximately 5.5 million m$^3$, of which 3.6 million m$^3$ was logwood for domestic heating purposes, and 2 million m$^3$ were destined for the wood processing industries. The internal wood chips production is not recorded by the national statistics office yet; nevertheless, based on the plants’ consumption and the amount of chips imported, the

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3 ISTAT 2007
study has estimated a yearly forest exploitation of 5.65 million m$^3$ and an import of 0.9 million m$^3$ of logwood. The logwood imports mainly originate from Eastern European countries (Slovenia, Croatia, Romania, etc.) making Italy one of the biggest importers of logwood in the EU.

In 2011, the domestic wood pellet production has not exceeded 520,000 tons compared to a consumption of over 1.8 million tons. In order to meet the high demand, Italy must have imported at least 1.2 million tons of pellets in 2011, making Italy the most important European pellet consumer and a major net importer.

In conclusion it is important to note that, for various reasons, forest statistics are underestimated and characterized by a certain level of uncertainty.\(^4\)

### 3.3.5. Business Case

Although prices for fossil energy carriers in the heat market have steadily been on the rise over the last years, break-even points for bioenergy have not been reached so far due to an increase in the production costs of bioenergy caused by rising feedstock prices (Figure ‘Price Development’).

An important aspect of any economic evaluation is the calculation of final

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\(^4\) Pettenella, 2009

Figure 'Price Development': Price development for energy production in €/MWh.
energy costs including investment and operating costs. In Table ‘Cost and Consumption’ costs and consumption for wood fuels for small-scale heating systems are summarized.

The cost of energy output can vary depending on several factors:

- Investment costs
- Nominal power output
- Costs of input material (wood fuel), etc.

Generally speaking, the energy output cost can vary from 45 to 75 €/MWh for wood logs boilers, up to 65 €/MWh for wood chips boilers, and even up to 85 €/MWh for pellet boilers.

The Table ‘Cost Wood Fuels’ shows a comparison between energy costs for various fuels (January 2012).

Since 2009, the market price for pellets has shown a relatively high level of stability opposed to the strong fluctuations from 2003 to 2008 when the

### Table ‘Cost and Consumption’

<table>
<thead>
<tr>
<th>Technologies</th>
<th>Investment costs (€)</th>
<th>Wood fuel consumption (t/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log wood boiler</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to 35 kW</td>
<td>6-15,000</td>
<td>5-10</td>
</tr>
<tr>
<td>35-100 kW</td>
<td>15-30,000</td>
<td>10-25</td>
</tr>
<tr>
<td>Woodchips boiler</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35-150 kW</td>
<td>18-50,000</td>
<td>10-35</td>
</tr>
<tr>
<td>150-300 kW</td>
<td>50-150,000</td>
<td>50-100</td>
</tr>
<tr>
<td>300-500 kW</td>
<td>150-250,000</td>
<td>100-150</td>
</tr>
<tr>
<td>Pellet boiler</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to 35 kW</td>
<td>7-15,000</td>
<td>5-7</td>
</tr>
<tr>
<td>Pellet stove</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to 12 kW</td>
<td>1,500-4,000</td>
<td>2-3</td>
</tr>
</tbody>
</table>

### Table ‘Cost Wood Fuels’

<table>
<thead>
<tr>
<th>Moisture content (%)</th>
<th>Price (€/t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood chips</td>
<td></td>
</tr>
<tr>
<td>25%</td>
<td>121</td>
</tr>
<tr>
<td>35%</td>
<td>94</td>
</tr>
<tr>
<td>Wood pellets</td>
<td></td>
</tr>
<tr>
<td>10%</td>
<td>260</td>
</tr>
<tr>
<td>Wood logs</td>
<td></td>
</tr>
<tr>
<td>20%</td>
<td>150</td>
</tr>
</tbody>
</table>
logwood consumption has amounted to 16 million tons. 4.4 million households use log wood as an energy source, annually consuming an average of 4.3 t of firewood mainly for heating purposes. 73% of logwood is burnt in low-efficiency domestic heating systems like open fire places and traditional wood stoves. Only 7.5% are used in modern heating appliances (innovative stoves). 42% of end-users produce the amount of logwood that they consume themselves, while 32% buy at the non-conventional local market.

Across the most developed regions, there are 8,700 log/chip/pellet boilers of which the great majority (90%) has a capacity of less than 100 kW. The total installed power output is 630 MWt with a consumption of 530,000 tons/year of wood fuels.

The comparison of data from different sources leads to the conclusion that the forecasts reported in NEAP are strongly underestimated. The total amount of energy that has to be produced from solid-biomass by the year 2020 (5.2 Mtoe) has probably already been reached. A rough estimate of the total energy derived from solid biomass in 2010 reached about 6.7 Mtoe, of which about 6.3 Mtoe were consumed by small scale domestic devices (up to 500 kW). (Table ‘Consumption Estimates’ and Figure ‘Consumption Wood Fuel Types’).

Small scale heating systems in Italy are mainly fuelled with log wood (87%) and wood pellets (11%). Just 2% of small scale boilers use wood chips.

3.3.6. Market Environment

In Italy the final heat consumption is of a great importance; in 2007, it accounted for 144 Mtoe. 30% of the heat is used in the domestic sector (45 Mtoe). In 2004, 15 million of methane and oil boilers were installed at the domestic scale consuming 18 Mtoe. Only 5% of those boilers were classifiable as high-efficiency heating systems.

Recently, the estimation of internal market had not yet been fully mature. A significant increase in the price of pellets on major European markets between 2006 and 2007 was caused by an enormous increase in demand which was not matched by an increase in pellet supply. Consequently, the prices sharply rose by 40% (Figure ‘Price Trend Pellets’).

Figure ‘Price Trend Pellets’: Trend of the wholesale price for pellets (2003-2011)

Source: AIEL

Figure ‘Price Trend Pellets’: Trend of the wholesale price for pellets (2003-2011)
The pellet sector in Italy has been growing steadily and it has become of increasing importance to the national economy. Present data shows its major role in the renewable energy market. Our estimates of the Italian market confirm the following:

- Over 3,500 companies are entirely dedicated to this sector
- More than 1.8 million tons of pellets consumed in 2011
- More than €470 million worth of pellet are consumed in Italy per year
- The sector currently employs over 19,000 persons
- The annual turnover of the sole pellet stove segment exceeds €10 million5

Wood pellets are the second most commonly used wood fuel in Italy, covering approximately 9% of the total wood fuel consumption. At present, there are 23 pellet producers in Italy, which constitutes a decrease compared to previous years. The past and present difficulties of the wood processing industry has a negative impact on pellet production and resulted in the decrease of production. The domestic production in 2011 did not exceed 520,000 tons compared to a consumption of over 1.8 million tons. In order to meet this high demand, Italy must have imported at least 1.2 million tons of pellets (see Figure ‘Geographical Spread’). Italy is certainly the most important European pellet consumer and also a major net importer. Only 28% of the demand is met by domestic production.

<table>
<thead>
<tr>
<th>District heating</th>
<th>Mt</th>
<th>M (%)</th>
<th>N (MWh/t)</th>
<th>C</th>
<th>V</th>
<th>TWh</th>
<th>Mtoe*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0,41</td>
<td>40</td>
<td>2,81</td>
<td></td>
<td></td>
<td>1,2</td>
<td>0,1</td>
</tr>
<tr>
<td>Small district heating and boilers up to 500 kW</td>
<td>0,38</td>
<td>30</td>
<td>3,4</td>
<td></td>
<td></td>
<td>1,3</td>
<td>0,1</td>
</tr>
<tr>
<td>Domestic consumption (pellet included)</td>
<td>18,00</td>
<td>20</td>
<td>3,98</td>
<td></td>
<td></td>
<td>71,6</td>
<td>6,2</td>
</tr>
<tr>
<td>Power plants</td>
<td>1,8</td>
<td>50</td>
<td>2,23</td>
<td></td>
<td></td>
<td>4,0</td>
<td>0,3</td>
</tr>
<tr>
<td>Total</td>
<td>20,59</td>
<td></td>
<td>78,1</td>
<td></td>
<td></td>
<td>6,7</td>
<td></td>
</tr>
</tbody>
</table>

Table ‘Consumption Estimates’: Consumption estimates of energy generated from wood-biomass

Source: Pettenella D., 2011

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5 CECED, 2007
Almost all pellets that are traded in Italy are packaged in 15 kg bags even though the share of pellet sold loosely is rapidly growing. It is estimated that the amount of loose pellets delivered by silo trucks amounts to 91,000 tons.

From 1999 to 2011 pellet consumption increased by an average rate of 56% per year. Our estimates show that pellet consumption amounted to 1,852,700 tons (732.80 ktoe) in 2011, of which 89% (1,652,300 tons) were consumed by single household stoves and inserts, whilst only the remaining 11% (200,400 tons) were consumed by small-scale heating networks (see Figure ‘Annual Pellet Consumption’). Over one and a half million families are presently using pellet-fuelled domestic heating systems. The remarkable success of pellet stoves in Italy, as opposed to other European countries, was not due to specific subsidies but rather due to the high price of traditional fossil fuels.

According to estimates, which are based on the assumption that the sales of pellet stoves and boilers settle at the levels of the last four years, the number of heating appliances installed by 2020 will exceed 3,670,000 units, resulting in a consumption of over 4 million tons of pellets per year.

Using heat from RS, Italy will generate a net income of over €89.6 billion in the
period of 2008-2030, since over 9 billion m$^3$ of natural gas will be substituted. Another important effect is related to the employment and industrial sector: the development of renewable heat will generate over 130,000 new employees compared to 2011. Furthermore, the use of RS will save over 17 million tons of CO$_2$ emission annually, thereby playing an active and important role in climate change mitigation.

3.3.7. Regulation

Biomass heat has been supported since 1998 under the Financial Law 449/97 tax reduction scheme. Further tax credits were approved in 2000, although they were delayed to 2002 due to administrative complications. Moreover, wood fuels benefit from a VAT reduction of 10% (DPR n. 633/72 e s.m.i.).

For small and medium scale, the existing support measures are almost exclusively focused on investment (see Table ‘Support Schemes’).

Another investment incentive is the fiscal leverage scheme which is applicable to increases in the energy efficiency of existing houses and buildings through isolation and the production of the renewable energy, such as wood energy. The main idea behind this scheme is to increase the global efficiency of buildings in order to reduce the primary energy used by 20% by isolating the building or by improving its energy system in a different way. Considering the fact that wood is classified as zero input of primary energy, the installation of a wood boiler can fulfill these conditions. After having defined and fulfilled given administrative, technical, and quality requirements for existing buildings, the beneficiary who e.g. substitutes an oil boiler with a wood pellet, wood log or woodchip boiler, may deduct 55% of the total investments (eligible expenses) over a period of ten years (1/10 per year) in the annual tax return declaration.

Moreover, for wood pellet stoves it is also possible to deduct 36% of total...
3.3.8. Project Financing

Banks are familiar with financing biogas and biomass projects. The market perspectives, political framework conditions, and economic parameters are usually well-known to decision-makers. In the process of granting loans and credits a particular focus is put on the evaluation of the long-term reliability and sustainability of feedstock supply as well as on a good sales plan to market the product.

3.3.9. Readiness for Uptake

generally, DH can be said to be accepted by the public. Due to the high costs of fossil fuels used for heating purposes, the use of wood biomass heating systems has been growing steadily, which made them of increased importance to the national economy (see Figure ‘Comparison Primary Costs’).

Nevertheless, biomass combustion remains to a relevant source of particle emission. Due to the fact that combustion particles are a health concern and PM10 emission thresholds are exceeded...
Figure 'RES Heat Consumption': Gross final consumption of RES for heat production obtained by incentive measures

Table 'Emission Limits': Emission limits on the basis of EN 303-5 for boilers up to 500 kW
regularly - especially in winter - some region have initiated measures to limit the use of biomass.

**Useful Links:**

**Facts and Figures:**
- nREAP
- *Inventario forestale delle foreste e del carbonio - National Forest and Carbon Inventory*
- ISTAT – *Istituto nazionale di statistica*

**Associations/Institutions:**
- APAT Lombardi
- REF Ricerche SRL
- CECED Italia
- Agriforenergy/Technical Review

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**Figure 'Comparison Primary Costs':** Comparison of primary energy costs (€/MWh) produced by fossil and wood fuels

<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Primary Energy Cost (€/MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood chips M30</td>
<td>30</td>
</tr>
<tr>
<td>Wood logs</td>
<td>34</td>
</tr>
<tr>
<td>Loose pellets</td>
<td>50</td>
</tr>
<tr>
<td>Pellets in small bagas</td>
<td>57</td>
</tr>
<tr>
<td>Natural gas</td>
<td>80</td>
</tr>
<tr>
<td>Heating oil</td>
<td>108</td>
</tr>
<tr>
<td>LPG</td>
<td>168</td>
</tr>
</tbody>
</table>
3.4. Hungary

Hungarian Bioenergy Competence Centre (HBCC)
Imre Németh
4 Tessedik Road
HU - 2100 Gödöllő
Tel.: +36 28 420 291
Email: obekk@invitel.hu

3.4.1. Country Score

Country Score Hungary Central Transdanubia - CHP (November 2011)

In the general scoring for sector, Hungary - Central Transdanubia is rated place 62 out of total 81. The underlying categories that influence this result are displayed in the bar chart above.

3.4.2. Basic data

Compared to other European countries, Hungary’s size of 93,303 km is relatively small. It is located in Europe’s continental zone with moderate climate (see Figure ‘Map Hungary’). The annual mean temperature as an average of the past years is 11.2 °C, the mean temperature in January is -1.7 °C, and in July it is +22.5 °C. The annual absolute minimum is -16.7 °C, and the absolute maximum is +35.9 °C. The population of the country is 9.986 million, and the average population density is 107 people per km². 69.6% of the population lives in urban areas, including 17.4% that live in the country’s capital, Budapest.
Accordingly, 30.4% of the total population live in rural settlements. The total number of settlements in Hungary amounts to 3,154,286 (89.6%) of these are rural (village) settlements, 304 (9.6%) are rural towns, and 23 (0.73%) are cities. The number of households in Hungary is 4,348,955. 19.8% of these households are located in the capital, 50.4% in rural towns, and 29.8% in villages.

**Useful links:**
- Hungarian Central Statistical Office
- Ministry of National Development

### 3.4.3. Energy policy

The energy policy related to public and small-scale heat equipment is controlled by the following aspects:

- reduce the use of energy imports (natural gas),
- reduce GHG emissions,
- reduce the public heating bill.

Hungarian energy policy has implemented the following EU directives into national law: 2009/28/EC; 2010/31/EU; and 2006/32/EC.
During the next decade the planned energy efficiency measures will be offset by the population growth and increased consumption levels; hence, the energy consumption per person in Hungary will remain stable at most. Even though an increase in the electricity consumption is to be expected, the consumption of heat energy will be slightly reduced.

As a result of the policies that are currently in place the following tendencies will become stronger in the future:

- the ratio of local energy production units will increase,
- the technical level of district heating service will improve,
- the ratio of RES will increase, also with regards to individual and district heating services,
- the energetic use of biomass will only be implemented if strict sustainability criteria are met,
- the switch from fossil to RES will be implemented, and the insulation of buildings will be modernised,
- licensing procedures and regulations will be facilitated,
- more efficient incentive systems will be introduced.

The NREAP envisages to increase the ratio of RES used for heating from 9% in 2010 to 18.9% by 2020. Hence, a part of the gas boilers of the public and small-scale heating systems will be replaced by boilers operating on biomass. This process could result in the doubling of biomass-based heating by 2020.

Efficiency requirements under the MOT (mandatory off-take of electricity generated from renewable energy sources) scheme / source NREAP)

**Useful links:**
- [Ministry of National Development](#)
- [Hungarian Energy Office](#)
- [Energy Centre Non-profit Ltd](#)

<table>
<thead>
<tr>
<th>Condensation technology</th>
<th>Efficiency requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomass fuelled plant unit</td>
<td>30%</td>
</tr>
<tr>
<td>Biomass fuelled plant unit using mixed fuel</td>
<td>32%</td>
</tr>
<tr>
<td>Biogas fuelled plant unit over a capacity of 500 kW</td>
<td>35%</td>
</tr>
<tr>
<td>Biogas fuelled plant unit below a capacity of 500 kW</td>
<td>32%</td>
</tr>
<tr>
<td>Biogas fuelled plant unit using mixed fuel</td>
<td>40%</td>
</tr>
</tbody>
</table>
3.4.4. Feedstocks

The amount of biomass made up of crops and woody plants usable for combustion purposes in Hungary is 8-10 million tons per year, this is equal to 160-180 PJ energy. 37% of the feedstock comes from corn straw and corn stalks (corn in the ear, summer rape, maize-stalk), 26% are made up of energy wood, and 25% originates from wood from plantations that have been planted for this purpose. The rest is made up of energy crops (energy grass, energy reed, etc.) that are grown for heating purposes, pruning residuals, and cuttings from vineyards and fruit trees. Major potential comes from wood plantations that are specifically planted for energy generation; however, these plantations are only planted slowly and their present area is 2500-3000 ha. Hungary is also indued with considerable reserves of forest biomass. The country has 2 million hectares of forests, of which two-thirds are used by the forestry sector. The use of agricultural land for energy crops is depicted in Table ‘Land Use Energy’.

The current pellet usage in Hungary is considered to be at a moderate level (60-70 tons per year). The vast majority of the pellets produced is being exported. According to the prognosis of the Hungarian Pellet Association, the domestic pellet production could be increased to three and a half times the amount that is presently being produced, taking the basis of available raw material into consideration. This increase would be made up of wood and agripellets. Technologies for the production are available. According to the Association, a 7% switch of small-scale heat units to pellet combustion could save 715 million m³ natural gas, an equivalent of 18.8% in the population sector. An increase in the use of pellets would furthermore be accompanied by the establishment of further pellet plants creating 1600 new workplaces. Also, a substitution of natural gas would lead annual CO₂ savings of 1.4 million tons and a reduced dependency of natural gas imports.

The annual wood increment of Hungarian forests is 12.0 million m³ (8 million tons per year). The average wood harvesting index of the past years is 7.1 million m³/year (4.8 million tons per year). Out of the total harvest, 3.6 million m³/year

<table>
<thead>
<tr>
<th>Current agricultural land used for the production of crops dedicated to energy</th>
<th>Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land used for short rotation trees (willows, poplars, etc.)</td>
<td>401</td>
</tr>
<tr>
<td>Land used for other energy crops such as grasses (Miscanthus) and sorghum</td>
<td>2122</td>
</tr>
</tbody>
</table>

Source: NREAP
(2.4 million tons per year) is used for energy purposes. The annual level of harvesting of wood (59%) is low with regards to the wood increment level. This could be increased (even to 75%) according to the forest use and wood plantation technologies; therefore, the amount of wood of energetic recovery could be expanded by 15%. Overall it is important to note that wood bioenergy sources (firewood, wood chips, wood pellets) in Hungary could be doubled in a short period of time.

**Useful links:**
- Ministry of Rural Development
- Union of Biomass Product Line
- Hungarian Biomass Competence Center
- Hungarian Biomass Association

3.4.5. Business case

Compared to European average, the price of natural gas is low in Hungary (147 HUF/m$^3$; 4.32 HUF/MJ). The relatively low price can be explained by the population’s load-bearing capacity. Natural gas is supplied to 82.5% of the households. 75% of private households use natural gas for heating, and also district heating systems are mainly based on natural gas. Due to the fact that an extensive rise in the price of natural gas and district heating would lead to a disproportional cost increase for households, the government provides gas subsidies to households according to their social situation. The price of the gas is officially set in the universal consumer category. A progressive increase of the price level functions acts as an incentive for consumers to seek ways to reduce their gas consumption.

The cost of using 1 MJ of oil, which currently constitutes the most expensive fuel for heating, is more than double the costs of natural gas. The own sources of wood pellet and wood briquette is equal to almost 60% of the heat produced from natural gas. The specific own sources of the heat produced from brown coal burnt in a compound heating boiler is cheaper than that of a cake made of wood. Heat energy by the lowest own financing can be produced from log-like firewood and wood chips. The cost related to natural gas is only 29-34%. The cheapest way

<table>
<thead>
<tr>
<th>Fuel Material Type</th>
<th>Used Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lignite</td>
<td>106,00 t</td>
</tr>
<tr>
<td>Brown Coal</td>
<td>240,000 t</td>
</tr>
<tr>
<td>Mineral Carbon</td>
<td>396,000 t</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>3,625,600 m$^3$</td>
</tr>
<tr>
<td>PB Gas</td>
<td>110,000 t</td>
</tr>
<tr>
<td>Firewood</td>
<td>1,334,000 t</td>
</tr>
</tbody>
</table>

The distribution of fuel materials used by the population for heating in 2010
to produce heat energy in Hungary is to use corn straw. It is important to note that the ratios described above slightly change if comfort factors (live labour need) are taken into account. Investment costs change in a nearly inverse proportion to fuel costs. A gas boiler necessary for an average household costs €1000-2000, whilst a boiler of similar capacity using pellet or wood chips costs €2000-3500. Taking comfort factors into account, automated straw combustion equipment becomes the most expensive heat source.

The significant rise of gas prices has led to an increasing trend amongst the public to switch to biomass heating, in order to realize potential savings of 30 to 40%. However, this process is hindered by the lack of funds to cover the initial investment costs, the lack of appropriate subsidy schemes, and difficulties with regards to obtaining credits. The bad condition that the economy has been in in recent years has also lowered the willingness of people to engage in to larger investments. Only rising gas prices and/or more favourable economic conditions can accelerate the switch to biomass based heating.

Regarding the costs for gas, investments for network improvements and connections have to be taken into account. For the cost calculation of biomass combustion, the expenses related to material storage as well as handling mechanisms have to be considered.

The number of natural gas consumers in the population, and gas consumption per region

<table>
<thead>
<tr>
<th>Region</th>
<th>Total number of consumers (thousand)</th>
<th>Household consumer (thousand people)</th>
<th>Gas consumption (mill. m3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>from this heating</td>
<td>Total</td>
</tr>
<tr>
<td>Central Hungary</td>
<td>1,235</td>
<td>1,170</td>
<td>917</td>
</tr>
<tr>
<td>Central Trans-Danubian</td>
<td>320</td>
<td>305</td>
<td>266</td>
</tr>
<tr>
<td>West Trans-Danubian</td>
<td>333</td>
<td>313</td>
<td>260</td>
</tr>
<tr>
<td>South Trans-Danubian</td>
<td>263</td>
<td>248</td>
<td>218</td>
</tr>
<tr>
<td>Northern Hungary</td>
<td>412</td>
<td>389</td>
<td>342</td>
</tr>
<tr>
<td>Northern Great Plain</td>
<td>507</td>
<td>475</td>
<td>450</td>
</tr>
<tr>
<td>Southern Great Plain</td>
<td>530</td>
<td>496</td>
<td>428</td>
</tr>
<tr>
<td>Total</td>
<td>3,601</td>
<td>3,396</td>
<td>2,880</td>
</tr>
</tbody>
</table>
Useful links:

- [Hungarian Development Bank](#)
- [Union of Biomass Product Line](#)
- [Hungarian Biomass Competence Center](#)
- [Green Investment System](#)

3.4.6. Market Environment

There is mains gas supply in 91.2% of Hungarian settlements. The number of households with mains gas supply is 3,396,000 (82.5%). The average monthly gas consumption of a household is 89 m³/month. 33.9% of the total electric energy is consumed by households. The electric energy consumption per household is 181.1 kWh/month. The ratio of district heated households is 14.9% related to the total number of households. In Budapest this ratio is 26.6%, and in rural towns it is 18.6%, while in villages it is 0.22%. 70% of the district heated households have poor energy efficiency.

The vast majority of the population and public small-scale heat equipments are operated by natural gas, consuming 37.8% of the total annual gas supply. The second most important fuel of small-scale heat equipment is firewood: 1.33 million tons are used each year by households and public small-scale heating systems. A considerable part of the wood is coming from the forests for energetic recovery. 1.5 million m³ (1.02 million tons) are used by large thermal power plants for producing electricity. However, due to the low energetic conversion efficiency (30-34%), the use of forest wood in large thermal power plants is not supported by professional circles. Firewood can be used for heat production among the population with an efficiency of 80-90%. Fuel-oil heating has actually disappeared; the use of coal for heating is confined. Only a small ratio of 8-9% of the heat producing equipment used by private households and small communities operate on biomass based fuels. Combustion wood chips are typical for small community (mainly at local governments and companies) heat-centres. In agricultural plants, the stables and greenhouses are typically heated by wood chips. Rarely the combustion of straw bales can also be observed.

40% of the total energy consumption in Hungary is used for heating/cooling purpose which is equal to 440 PJ. 60% (264 PJ) are used by the population, and the tertiary sector. A major part of small capacity heating system operates using natural gas. Expenses related to heating cover the largest part of overhead costs of the population and the public sector. According to the energy strategy, the demand for heating energy of private households and common buildings will decrease by 84 PJ - that is by 30%- until 2020. This reduction will be achieved by improving the energy efficiency of buildings, by increasing the ratio of renewable energy used, and by reducing the use of natural gas. The strategy has furthermore positive spill over effects.
since it reduces GHG emission, creates new workplaces, and reduces the overhead costs paid by the population and the public sector. The ratio of renewable energy in the heating sector would then increase by a greater ratio (from 9% to 18.9%) than the ratio of RES within the total energy use (from 7.4% to 14.65%) by 2020.

Calculations assume that if technical requirements were fulfilled, and if the population was to receive appropriate incentives to replace natural gas, the amount of biomass that will be available for heating purposes by 2020, will cover 38.6% of the country’s demand for heating energy, and 55.3% of the needs of the population and the tertiary sector respectively. These calculations assume the energetic recovery of corn straw to range from 20-25%. Energy recovery from energy forests is assumed to double compared to today’s output.

Service providing organizations (E-ON, EDF, ENI, etc.), which are partly in foreign possession, supply gas to the population and small-scale heat units. Due to the significant size of the interim storing capacity, there have been no gas supply problems so far. There is a wide range of different gas-operated heat units and gas boilers available on the market featuring differences in quality and prices. The demand of the public for energy saving (condenser-type) equipment has been on the rise. The range of biomass combustion equipment is smaller than that of the gas-operated boilers. However, due to the increase in market demand the supply is expected to expand. The market of biomass boilers is partially supplied with domestic as well as European products (typically: German, Austrian, Polish). The price of Eastern European models is generally more favourable than that of the Western European ones.

In contrast to the advanced logistic systems of gas supply, the population and public supply of biomass-based fuels can be considered as undeveloped. Currently the distribution and supply logistics centres and networks are missing. A significant part of the consumers procures pellets and wood chips directly from the producers. The purchase of firewood is significantly easier as the owners of the forests as well as the entrepreneurs dealing with wood harvesting are located in close proximity to the users. Moreover, distributors of building material traditionally sell firewood.

In Hungary, pellet combustion is neither considerable. Whilst there are approximately 1300-1400 pellet boilers consuming 60-70 thousand tons of pellets per year, the 12 pellet plants located in Hungary produce 320-340 thousand tons of pellets, and export most of their produce (80%).

Based on the opinion of the Hungarian Pellet Association, an increase of the price of natural gas will heighten the importance of pellet combustion. According to their survey, the ratio of pellet combustion in the population sector may reach 7% between 2020 and 2030, which might be equal to 21 PJ. Such an
increase would require the production of 1.2 million tons of pellets, and it would replace the use of 700 million m³ natural gas. Moreover, it would save 1.4 million tons of CO₂ emissions.

**Useful links:**
- Union of Biomass Product Line
- Hungarian Biomass Competence Center
- Hungarian Association of Renewable Energy Sources
- Energy Centre Non-profit Ltd

### 3.4.7. Regulations

In order to place heat-producing equipment on the market, manufacturers and distributors need to acquire a type certificate. Firstly, standards and safety requirements have to be met. Requirements concerning the efficiency and contaminant emission rates of heat-producing equipment with an output below 300 kW are furthermore set out by the standard MSZ EN 303-5;1999, and the decree No. 23/2001-(XI 13) of the Ministry of Environment. Combustion equipments are qualified according to these norms. Several EN and ISO requirements are related standards mentioned above, which include requirements concerning the boilers’ material and construction. Standard EN 304 sets out requirements with regards to efficiency.

Requirements concerning environmental protection are regulated by the governmental decrees No. 316/2010 (XII 23), No. 4/2011 (I 14), No. 5/2011 (I 14) and 6/2011 (I 14) of the Ministry of Rural Development.

National requirements are generally consistent with EU norms. In some cases they are even stricter, as for example in case of the air-pollution limits concerning 150-300 kW capacity boilers.

In case of the different energy sources the measures set out the amount of solid materials in the fume (mg/m³), and the emission limits of carbon-monoxide (CO), nitrogen-oxides (NOₓ), sulphur-dioxides, and sulphur-trioxides (SOₓ).

Also standards concerning energy efficiency and the efficiency of combustion equipment are strict. Combustion units which operate on biomass-based fuels for instance are required to display an efficiency level of 85-95%.

Besides combustion equipment, also biomass based fuels have to comply with strict standards. Requirements concerning their composition, classification, and testing are set out by the standard MSZ EN 14961-1:2010, in relation with several EN, CEN/TS directives.

Biomass-based solid fuels on the market must have a classification document (Certificate) certifying the compliance with the standards.

**Useful links:**
- Ministry of National Development
- Hungarian Energy Office
- Energy Centre Non-profit Ltd
3.4.8. Project Financing

In Hungary private households and small communities mainly finance small-scale heat equipment with bank credits based on own funding. In certain periods non-refundable subsidies can be obtained from the EMVA fund for biomass equipment supplying heat to greenhouses and animal keeping facilities established in agriculture, and from the KEOP for alternative heating of community buildings owned by local governments. These support mechanisms provide occasional incentives for investments.

However, the lack of a continuous and synchronized subsidy system hinders the acceleration and the increase of investments, and makes the implementation of biomass-based heat producing systems neither schedulable nor computable.

Since the constructions built with EU co-financing do not consider investments of private households, they have to rely on subsidies from the national budget besides professional aspects. Therefore, national subsidies are expected to become available on a wider scale after the national budget has recovered to a decent state. Taking the present financial situation of the population into account, it does not seem probable, even in case of further gas price increase, that there will be massive investments if no non-refundable subsidy of sufficient intensity is installed. The existence of such a stable and calculable subsidy might also trigger an increased availability of bank credits. With regards to biomass energy related loans, banks primarily consider the rate of return of the investment with regard to the credit period.

According to domestic practices, the replacement of gas heating of an average family house by biomass combustion translates into a cost-saving of approximately 30%. Without any subsidy, the amortization rate of these types of investments exceeds 10 years. A subsidy could help to facilitate the spread of modern biomass combustion.

Useful links:
- Hungarian Development Bank
- Hungarian Economic Development Centre

3.4.9. Readiness for Uptake

In Hungary the vast majority of the population and local governments operate small-scale heat equipment based on natural gas in order to heat individual buildings. In rural settlements where the population and local governments generally are in a relatively bad financial situation, the opportunities for being employed are more restricted. In most cases it is possible to constantly provide for biomass raw material in their surroundings, and they are more definitely inclined to use alternatives.

In order to support conversion, several scientific and educational institutions, research-development organizations, professional associations, and clusters provide professional material and spread information.
An obstacle in the way of speeding up the process is the unfavourable financial conditions. The government shows a more and more determined intention to convert the heating systems of the local government community buildings, where these intentions are synchronized by public labour projects.

According to the opinion of professional experts, the conversion to biomass combustion in national projects should only be incentivised in the context of more complex projects which also encompass investments in the energy efficiency of the buildings at hand. Besides the replacement of the combustion technology equipment, also the controllability of the system and the appropriately economic nature of heat intermediation should be ensured. Moreover, the presence of long-term, safe, and economic raw material supply are crucial criteria of project development. For this an adequate amount of readiness for co-operation is found from the side of agricultural and forestry entrepreneurs.

**Useful links:**
- Union of Biomass Product Line
- Hungarian Biomass Competence Center
- Hungarian Association of Renewable Energy Sources
3.5.2. Basic Data

The Kingdom of Denmark (excluding Greenland and the Faroe Islands) has a mainland area of 43,098km² and shares a small land border with Germany to the south. Its closest Nordic neighbour is Sweden to which it is connected by bridge. The bulk of Denmark is the peninsula Jutland and the rest of the country consists of 406 islands, of which 78 are habited, and the largest

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1 Energy Policies of IEA countries, Denmark 2011 review

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two islands are Zealand and Funen. Denmark also exercises sovereignty over the Faroe Islands in the North Atlantic and Greenland, which is part of the North American continent, both of which enjoy autonomous self-rule. The topography of Denmark is relatively flat with few hills, its highest point being no more than 173 metres above sea level.

The population of Denmark was 5.5 million in 2010 with 126 inhabitants/km². Almost half of the population lives on the islands of Zealand and Funen. Nearly 87% of the population lives in urban settlements.

3.5.3. Energy Policy

The Danish government aims at reaching a share of RES in the final energy consumption of approximately 30%, and 50% of the energy consumption in the electricity sector is to come from wind by 2020. The RES-share in Denmark’s final energy consumption shall be rising to 100% in 2050. Due to its characteristics as a storable feedstock and a flexible energy supply, bioenergy will play a key role in this strategy.

The 2010 Finance Act earmarked €53.77 million (DKK400 million) for the scrappage of inefficient oil-fired boilers. The scrappage of oil-fired boilers would release a subsidy for the purchase and installation of an energy efficient heating system.

In the new energy agreement issued on the 22nd of March 2012 the parties agreed to support the phasing out of oil-fired burners in existing buildings. From 2013 a moratorium on installation of oil and natural gas in new buildings will be enforced. An exemption for buildings with no suitable alternatives is available. From 2016 onwards, it will no longer be possible to install boilers in existing buildings in areas where district heating or natural gas exist as an alternative. In areas that have no district heating or natural gas grid available boilers can still be installed. To support the shift from oil and natural gas boilers in existing buildings to heating systems based on renewable energy in 2012-2015, a fund of €5.65 million (DKK42 million) has been allocated to promote initiatives and the preparation of analyzes for energy efficient alternatives.

3.5.4. Feedstock²

According to the NREAP, the solid biomass utilization for energy generation is expected to grow by 32 PJ or 8.9 TWh by 2020. Solid biomass will therefore continue to be the main RES in Denmark in the future. In 2009, biomass from domestic sources represented 58% of the total renewable energy portfolio in Denmark and imported biomass an additional 14%. Woody biomass clearly dominates among the biomass assortments with a total share of 61 %. It is followed by waste with a share of 21% and straw with 16 %. Fish oil stands for the remaining 2 % of the total.

² PÖYRY Management Consulting, evaluation of options to enhance the Nordic cooperation in the field of solid biomass for energy purposes
Firewood is the single largest biomass assortment used with a total domestic demand of 6.9 TWh. It is consumed mainly by private households. Most of the firewood volumes are domestically sourced, but approximately 0.5 TWh are imported. Hence, the firewood potential is practically exhausted.

62% of Denmark’s total area is used for agriculture offering a great theoretical potential for agricultural feedstock supply for the biogas sector (see Figure ‘Energy Crops’). The potential for producing bioenergy from biomass is without any particularly negative impact on the production of animal feed and foods. Estimates show that it is possible to raise Danish agricultural production of biomass for bioenergy four to five times through greater exploitation of straw at CHP plants, slurry for biogas, animal fat for biodiesel and perennial energy crops as well as grass from low-lying areas. It will, however, be necessary to include parts of the former set-aside land in the production of perennial energy crops. It is a matter of technical potential, which may not necessarily be realised within the economic framework that applies today.3 The Danish agricultural sector’s contribution to bioenergy production is already relatively high, as 12% of Danish energy consumption is covered by the use of residual products such as straw, wood chips and slurry. This is, in particular, a result of the use of these residual products in the CHP sector.4

3 Ministry of Food, Agriculture and Fisheries, Report on Biomass
4 Energy Policies of IEA countries, Denmark 2011 review
3.5.5. Business Case

The prices for wood pellets have increased significantly during the 1997-2010 period. This development has been driven by the increase in wood prices and also by the increase demand. Prices for straw and woodchips have been more stable. It can also be noted that woodchip prices have consistently been above straw prices (see Figure ‘Biomass Prices’).

The price trends for the different biomass assortments are expected to be similar in the coming 20 year period (see Figure ‘Biomass Price Prognosis’).

Wood markets in Denmark are well-established, and well-functioning with regards to logs and pulpwood; however, the energy assortment markets are less structured and transparent. The energy wood markets in Denmark operate to a large extent through intermediaries. The private forest ownership is small-scale which creates space for harvesting companies and traders as volume aggregators. There are two large trading companies that dominate the private forestry markets. Also direct sales from forests to end-users do occur, however, less frequently. Consequently, the market transparency for the forest owner is reduced, as it is the trader that contracts deliveries with the end-user. Traders also act as risk mitigators by taking on the short and medium term supply contracts, whereas the wood markets are still very much spot market based.
Since the market is relatively young, there have been particular challenges related to the measurement systems in place. The energy sector is looking to procure MWh, whereas the forest sector has traditionally been selling in volumes measures, mainly in m³. Hence it can be difficult for forest owners to compare values between the different assortments in order to make sales decisions. The district heating association ‘Dansk Fjernvarme’ collects and publishes price
information on the different biomass assortments regularly and is the main source for price information.\(^5\)

Funding will be allocated for the spread of smaller capacity electricity-producing installations, generally solar cells, wave power and biogas installations that use technologies that have significance for the future production of electricity from RS. Support is provided from a fund comprising DKK 25 million per year for four years, from 2008 to 2011. Finance is provided to promote the introduction of installations onto the market including, to a lesser extent, support for pilot projects. Support is conditional on the installation being network-connected.

Support is also provided for the establishment of installations, the operation of installations for a given period, or information on the energy properties of installations. Support for the establishment and operation can be granted together with the price subsidy for other renewable energy installations.\(^6\)

The generation of RES-H is supported through tax exemptions. In CHP plants, the heat produced from biomass and biogas is exempt from energy taxes. Biomass in general is non-taxable. Since it is also considered as being CO\(_2\) neutral, it is exempt from CO\(_2\) duty.\(^7\)

Useful links:

- [Danish Energy Agency](#)
- [Danish ministry of Climate, Energy and buildings](#)
- [Danish District Heating Association](#)

### 3.5.6. Market Environment

In 2010, TPES amounted to 19.7 million tons of oil equivalent (Mtoe). Energy production amounted to 23.2 Mtoe, which was below 2009 levels and indicative of falling oil and natural gas production over the past six years.

Denmark is expected to remain a net exporter of oil and natural gas at least until end 2018 referring to oil and 2020 for gas. Energy exports were 17.2 Mtoe in 2010, while imports were 13.8 Mtoe. The share of renewables, mainly made up of wind and biomass, in TPES is relatively high at 20.7%. In 2010, oil accounted for over half (54%) of Denmark’s domestic energy compared to 64% in 2004 when domestic oil production peaked. The share of natural gas in total energy production was 31% in 2010 compared to 34% in 2008. In 2009, the remaining 15% of indigenous energy production came mainly from biomass (12%) and wind power (3%). Denmark generated 38.6 TWh of electricity in 2010, largely from coal (44%), natural gas (20%) and wind power (20%). In 2010, Denmark imported 10.6 TWh of electricity mostly from Norway and Sweden, and exported 11.7 TWh mostly to Germany. The significant changes in the composition of energy consumption by energy type

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\(^5\) PÖYRY Management Consulting, evaluation of options to enhance the nordic cooperation in the field of solid biomass for energy purposes

\(^6\) Energy Policies of IEA countries, Denmark 2011 review

\(^7\) ECOFYS, Renewable energy policy country profiles
reflect the alterations of the composition of heating installations in private households. Until the mid-1980s, oil-fired boilers clearly dominated the market, after which district heating became the most common source of heat. In the late 1980s and during the 1990s, the number of district heating installations and natural gas boilers continued to increase substituting oil-fired boilers.9

Denmark has one transmission system for gas, owned and operated by Energinet.dk, on behalf of the Danish State. Transmission tariffs are based on an entry-exit model and the same tariffs apply to all entry and exit points. The natural gas transmission system consists of upstream pipelines in the Danish part of the North Sea and onshore transmission pipelines. The transmission pipelines go north-south (Aalborg-Ellund) and west-east (Nybro-Dragør). The natural gas transmission system also includes a gas treatment plant (Nybro) and two underground gas storage facilities (Stenlille and Lille Torup). The Danish gas transmission grid is connected to the German gas transmission grid at Ellund on the Danish/German border and to the Swedish gas system at Dragør. Sweden is solely supplied with gas via the Danish gas system.

The electricity transmission system in Denmark is separated both operationally and geographically into two parts, the west (Jutland and Funen) and the east (Zealand). In 2005, Energinet.dk was established, as a single state-owned transmission system operator, by merging two system operators: Elkraft in western Denmark and Eltra in eastern Denmark. Geographical separation ended in 2010 when the Great Belt Power Link connecting western and eastern areas with 400 kV direct current (DC) cables was commissioned. Despite separation within Denmark, the eastern area was already connected with Sweden and the western area was connected with Norway and Sweden. Therefore, both areas had been able to trade electricity through the Nordic market even without the Great Belt Power Link. The 6 300 km-long Danish transmission system consists of 400 kV and 150/132 kV lines. Energinet.dk is the owner of the 400 kV facilities, as well as part of the 132 kV facilities, the Great Belt Power Link and interconnection lines with Norway, Sweden and Germany. Most of the 150/132 kV transmission facilities are owned by nine regional grid companies.

As of 1 January 2011, the total of 2.75 million heating installations are as follows: District heating installations 61.7%, natural gas boilers 15.2%, oil boilers 13.3%, and other installations, including log wood boilers and electric heating, 9.8% (see Figure 'Installations Homes').9

3.5.7. Regulation

Danish local authorities are the central players in the public heat supply; they develop heating plans and bear the responsibility for expanding district heating and for implementing any

8 Statistics Denmark

9 Statistics Denmark
Market Handbook Small Scale Heat

The obligations to use RES in new buildings are applied on the energy system level. Municipalities are obliged to set up heat plans based on feasibility studies. The heat supply system for a building is chosen according to the heat plan of the area. The rules concerning the feasibility study of alternative/RES systems are determined by the Act on Heat Supply. The objective of this Act is to promote the most socio-economic and environmentally friendly utilization of energy for heating buildings, supplying them with hot water and reducing the dependency of the energy system on oil. In certain areas there is an obligation for buildings to connect to a district heating system, which is mostly the case in bigger cities. Newly built low energy buildings are omitted from this obligation.

The emission limits are regulated by the Environmental Protection Agency. Emission limits for small combustion plants are set in the ordinance for fireplaces (Bekendtgørelse om regulering af luftforurening fra brændeovne og brændekedler samt visse andre faste anlæg til energiproduktion). This ordinance applies to combustion plants with a rated thermal input of less than 300 kW. The Ordinance came into force on the 1st of January 2008 and sets limit values for particles from space heaters (10 g / kg by measuring the dilution tunnel or 75 mg/Nm³ at 13% O₂ measured directly in the flue gas duct). The Ordinance also contains values for

![Figure 'Installations Homes': Heating Installations in Homes](image)
CO, particulates and hydrocarbons from central heating boilers.

All installations that are covered by specific regulations and those that are not must comply with the limits set out in the Danish air quality guideline.

### 3.5.8. Project Financing

Investments in Danish markets are considered to be ‘safe’ from a country risk perspective, according to established rating agencies. Reliability and credit worthiness of the Danish economy is rated with best scores at Standard & Poor’s\(^\text{10}\) and Moody’s. COFACE country risk rating\(^\text{11}\) sees Denmark at the top of the score same as the Corruption Perception Index\(^\text{12}\) for the level of transparency. The ease of doing business is seen to be quite favorable in Denmark by IFC World Bank.\(^\text{13}\)

When the Maastricht Treaty was concluded in 1992, Denmark obtained an exemption clause or ‘opt-out’ under which it does not need to enter the third stage of Economic and Monetary Union (EMU) or therefore introduce the euro. The Danish Krone has remained within the EMS and has been part of the new exchange-rate mechanism (ERM II) since the introduction of the Euro. It may fluctuate within a 2.25% range on either side of the Euro. The average inflation rate in the period 2006 to 2010 was 2.1%. Inflation is not expected to stay within the euro target area of just below 2% in 2011. For 2011 and 2012 inflation is expected to be 2.6 % and 1.8% respectively.\(^\text{14}\)

The easiness of getting a credit from banks is dependent on individual project designs as the reliability of the technology chosen, the security of feedstock supply, and associated price risks are being assessed. Most banks offer some kind of guidance and favorable loans for energy improvements in houses.

### 3.5.9. Readiness for Uptake

**Key institutions:**\(^\text{15}\)

The Danish Ministry of Climate, Energy and Building (previously known as the Ministry of Climate and Energy), established in November 2007, was created as a part of the government’s increased efforts to promote a greener and more sustainable society. The ministry is responsible for national and international efforts to mitigate climate change, as well as for energy, national geological surveys in Denmark and Greenland, and for meteorology.

\(^{10}\) Standard & Poor’s, http://www.standardandpoors.com/ratings/en/eu/


\(^{13}\) IFC, Doing Business Index, http://www.doingbusiness.org/rankings


\(^{15}\) Energy Policies of IEA countries, Denmark 2011 review
The Danish Energy Agency (DEA) was established in 1976, and is an agency under the Ministry of Climate, Energy and Building. It is responsible for all tasks related to the production, transmission and utilisation of energy, and its impact on climate change. Its principal function is to ensure the legal and political framework for reliable, affordable and clean supply of energy in Denmark.

Energinet.dk, the transmission system operator, is an independent public enterprise owned by the Danish State represented by the Ministry of Climate, Energy and Building. It owns the natural gas transmission system and the 400 kV electricity transmission systems and is the co-owner of the electricity interconnections to Norway, Sweden and Germany. It is responsible for maintaining security of supply and ensuring the smooth operation of the market for electricity and gas. Energinet.dk was established in 2005 following a merger between Eltra, Elkraft System, Elkraft Transmission and Gastra.

The Danish Energy Saving Trust is an independent body established in 2010 as a trust under the auspices of the Ministry of Climate, Energy and Building, replacing the Danish Electricity Saving Trust. The scope of the previous organisation’s work has been expanded from electricity savings to cover savings and more efficient use of all forms of energy in every sector other than transport.

The Danish Energy Regulatory Authority (DERA) oversees the electricity, natural gas and district heating markets. DERA is an independent authority and its board members are appointed by the Minister of Climate and Energy. Its decisions can be appealed to the Danish Energy Board of Appeal.

The independent Danish Commission on Climate Change Policy was established by government in 2007 and was charged with the task of identifying the long-term climate and energy policies needed to achieve independence from fossil fuels. The Climate Commission’s proceedings were attended by the Ministry of Climate, Energy and Building, the Ministry of Economic and Business Affairs, the Ministry of the Environment and the Ministry of Finance. The Commission published its findings in September 2010 and ceased activities in November 2011.
3.6. Sweden

Swedish Bioenergy Association
(Svebio)

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3.6.1. Country Score

Country Score Sweden Middle Norrland -SCH (November 2011)

In the general scoring for sector, Sweden - Middle Norrland is rated place 3 out of total 81. The underlying categories that influence this result are displayed in the bar chart above.

3.6.2. Basic Data

Sweden is one of the most northern states of the EU. Since its lands are stretched over the Arctic Circle, the agricultural gradient of the country is a steep one. Sweden consists of eight NUTS2 regions. With a surface of 450,295km², Sweden is the third largest country in the EU; however, with a total population of about 9.4 million it is only the fourteen most populated one. On average, 21 inhabitants live per square kilometre whereas the population is
mostly concentrated in the southern half of the country. About 85% of the population lives in urban areas. Sweden’s capital city is Stockholm, which is also the largest city. The country is characterised by its long and narrow shape with the main part of the population spread over the middle and southern parts of the country.

**Useful links:**

Facts and Figures:
- [Swedish Energy Agency](#)
- [Swedish Board of Agriculture](#)
- [Swedish Board of Forestry](#)
- [Official Swedish Statistics](#)
- [EUROSTAT](#)
- [PIR - The Swedish Pellets association](#)
- [Info site Pellets](#)

3.6.3. **Energy policy**

The Swedish government aims at reaching a share of RES in final energy consumption of approximately 50% in 2020, and a balance of zero net CO₂ emissions by 2050. The fact that feedstock used for the production of bioenergy is storable, makes bioenergy a flexible energy supply that will play a key role in this strategy. Sweden has had targets and policies in place to support renewable energy for a long time. Since 1980 Sweden has focused on the development of bioenergy and hydro energy, whilst the last ten years have also seen a larger focus on wind and solar energy. Today, bioenergy is the largest energy source in Sweden, and the third largest electricity source after hydro and nuclear power. The renewable energy share in 2011 was 48.9%, putting Sweden well on its way to meet the 2020 target. With the introduction of the carbon tax in 1991, Sweden installed a strong policy instrument that, together with high and fluctuating fossil fuel prices, has lead to a large market gain for the cheaper domestic bioenergy. Policy incentives and high fossil fuel prices, in combination with high political ambitions incentivising many municipalities to invest in district heating in the period of 1980-1990, has lead to a large heat market for bioenergy. The introduction of Green electricity certificates furthermore introduced a large investment trend in CHP facilities. As these have been of considerable profitability, almost all larger biomass-based energy production plants have installed electricity generation.

All bioenergy fuels are exempted from the energy and carbon tax. Biomass is furthermore viewed as carbon neutral in the ETS system.

A policy that affects the small scale heating market is the energy declaration legislation,¹ forcing all house owners to declare the energy status of their house when they sell their properties. This declaration is also supposed to include a suggestion to the house owner of how the energy consumption of the house can be improved. Unfortunately, these suggestions have been proven disad-

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vantegousforthebioenergy development, since heating pump systems are often deemed more energy efficient by these evaluations.

**Useful links:**

Laws and Ordinances:
- [Energy Tax Law](#)

Institutions:
- [Swedish Energy Agency](#)
- [Swedish Board of Agriculture](#)
- [Swedish Board of Forestry](#)
- [Swedish National Board of Housing, Building and Planning](#)
- [Swedish Association of Local Authorities and Regions, Sveriges kommuner och landsting](#)

Associations:
- [Swedish bioenergy association](#)
- [PIR - The Swedish Pellets association](#)
- [Energy Consulers Energirådgivare](#)

3.6.4. Feedstock

In Sweden, agricultural practices and available feedstock differ amongst regions. Also energy needs, energy dependence, and/or limitations of the transportation of goods and people differ significantly amongst the regions. The Figure ‘Energy Biomass Potential’ compares the supply of biomass for energy generation of 2009 with the estimated demand in 2020.

Of the total surface area, 6.5% is used for agriculture. The total surface area covered by forest is 63% (or 48% productive forest lands) making forest based fuels the biggest biomass source for bioenergy. Forest fuels are therefore the most common feedstock for energy and electricity production in Sweden.

As Sweden is a forest rich country, forest biomass has traditionally been used for energy production. There is only a minor use of agricultural crops. Used wood materials are also a growing

Figure 'Energy Biomass Potential': Svebio has estimated the potentials of biomass supply that will be available in 2020 and compared it to the utilization of energy biomass in 2009. The largest remaining potentials lie in agriculture and forestry.
market in Sweden. Although the demand for wood chips has increased over the last years, Swedish forests are far from overexploitation. The supply of wood chips is sufficient for a stable supply of CHP-plants for a couple of years, even in the case that the number of plants was to increase.

The major feedstock for the pellet production in Sweden consists of sawdust and residue from saw mills, linking the market closely to the timber industry. During the last economic recession the sale of saw dust actually helps several saw mills to stay in operation, offering an additional revenue stream. Tests have been conducted to try new raw material and to grind whole logs into pellets. This has, however, not been cost competitive with saw dust so far.

The increased import of pellets and the high sawdust price, caused by the market fluctuations in the saw mill industry, have lately made it rather difficult for domestic pellets producers to realize a good market growth. Some plants have even shut down. There has also been an increased competition from heating pumps, which have gained a large market share. However, prices have been stable during the last years (see Figure ‘Wood Pellet Prices’).

**Useful links:**

**Facts and figures:**
- [Swedish Energy Agency](#)
- [Swedish Board of Agriculture](#)
- [Swedish Forest Agency](#)
- [Official Swedish Statistics](#)
- [EUROSTAT](#)

Figure ‘Pellet Prices’: Prices of wood pellets have been steady in recent years and much lower than the equivalent prices of heating oil and electricity for heating.

Prices in SEK per kWh
3.6.5. Business Case

Investments into pellet-technology are not supported with public budgets or funding. This means that investments in production capacity and boilers have to be done based on market prices. Due to the high taxes imposed on fossil energy, the investment of changing from oil to pellets is profitable in Sweden. This holds true for the private market in particular since it is subject to a very high carbon tax (3,92 SEK/litre 2012), energy tax (0,82 SEK/litre 2012), and an additional 25% VAT relative to industrial applications. The industrial sector currently merely pays 30% of the domestic tax; however, in 2015 it will be raised to 60%. The carbon tax on fossil energy increased price competitiveness of bionenergy significantly. An investment made by households to switch from oil to small-scale pellets bioheat amortizes in less than two years.

The market share of pellets for the domestic market has decreased in the field of household heating, whilst heat pumps have increased their share in the small-scale market. In Sweden there is a close collaboration between solar energy and pellets called 100% förnybart. Since the majority of oil heated houses have already undergone the switch to bionenergy, the sector of electrically heated houses that lack water carried heat, has become the target. The investments costs for the change, however, are much higher, and hence the barrier for altering the heating systems is also elevated. This

has opened up a market for secondary bioheat through stoves functioning as a complementary energy source in both electrical and heat pump heated houses.

As Sweden’s pellet boiler and stove market is mature, there are a variety of different brands on the market increasing its level of competition and its openness for new market actors with a good product. In the stove market, design has become an important factor since stoves are much more visible than other heating systems. The Figure below depicts pellet production units in throughout Sweden.

Figure ‘Pellet Production Map’: Pellets production units in Sweden

The map is available for download on www.svebio.se. It is also possible to order printed copies.
Useful links:
Facts and figures:
- Swedish Energy Agency
- Official Swedish Statistics
- Swedish bioenergy association
- Swedish pellets association
- All about pellets stoves
- Energy shift

3.6.6. Market Environment

Sweden is a leading user and producer of wood pellets in Europe. 650,000 of all 1.9 million single homes use biomass (firewood, pellets or chips) often in combination with electric heating. Wood pellets have a relatively large market share amongst the houses that are not connected to the district heating system. However, traditional wood fuels, such as logs and wood chips are also used. The fuels are not only the primary energy source for heating, but they are also used for secondary heating in houses that are primarily warmed by electricity or heat pumps, in order to reduce energy costs and to provide an additional energy boost during periods of cold temperatures.

In 2011, a relatively warm year, the sales of pellets for the small scale sector amounted up to 550,000 tons (to be compared 2010 785,000 tons) in Sweden. Sweden’s total pellets usage in 2011 amounted to 1,883,000 tons and to 2,280,000 tons in 2010. This difference can be attributed to the fact that 2010 was marked by much lower temperatures than 2011 which can be considered as a relatively warm year. The small scale heating market for pellets was 549,500 tons in 2011 compared to 785,000 tons in 2010. Out of the 1,344,000 tons that were domestically produced in 2011, 127,000 tons were exported. The imports for 2011 account for 665,000 tons. The large share of domestic production can be attributed to the quality demands of this market. As seen above, in fig UU pellet prices have been stable over the last years. The aim of producers has been to be cost competitive with other heating sources.

Today, there are around 80 pellet production units in Sweden (see fig UU). This indicated that the market is relatively mature with a stable logistic and service provider system in place. However, several plants have experienced financial difficulties during the last recession when the timber and forest industries lowered their production. The price level of the pellet market for mid and large size industrial applications is furthermore affect by industrial trade. Feedstock constitutes the biggest cost in pellet production in Sweden.

Throughout the country there are logistic networks that deliver both bulk and bags of pellets to households, which can simply be ordered online by customers. There is also a good network of service engineers all over Sweden that provide all the services needed by small-scale bioheat users.

Due to the fact that pellets constitute such an important commodity in Sweden and since the market depends
on imports, there are several harbours that are equipped to accept long haul sea transports of pellets providing on-site storage facilities that can be rented.

The price for wood pellets has undergone only moderate price increases. The Swedish market for wood pellets is independent of the international energy markets and their speculations. The market, however, is affected by changes in the timber industry since feedstock price constitute a large part of production costs. Up to now, it is still not profitable to use whole wood as feedstock in Sweden. It is furthermore important to note that the market is based on the basic mechanism of supply and demand. Thus, due to the vast number of small- and medium-scale producers, traders and large amount of pellets offered, prices are likely to remain at the bottom level of the price range.

3.6.7. Regulation

The approval of solid biomass plants by authorities is not perceived as a barrier. Nevertheless, approval periods can vary from authority to authority, depending on their work load, skilled personnel and local conditions. For the approval, several emission and noise thresholds have to be fulfilled.

Emission thresholds and regulations differ according to the size of the installations. The larger the plant, the stricter are the environmental demands. The Swedish Environmental authority provides local and regional authorities with recommendation of how to set environmental permit thresholds. The constraints (permit provisions) in environmental permits also vary to great extent dependent on the feedstock used. Here, waste incinerations plants and operations based on used wood have much stricter operation conditions. All permitting authorities in Sweden are knowledgeable of bioenergy installation as these are very common in all regions of the country. The general public is also used to bioenergy installations. Hence, the permitting process is often a relatively straight forward process, even though permit provisions, especially with regards to air and water emissions are being tightened and thresholds are being lowered. As in all permitting processes, it is generally beneficial to initiate a dialog with stakeholders and neighbours early in the process.

All plants under an environmental permit in Sweden must verify that they meet their permits emission thresholds and other conditions. The proof of compliance has to be verified regularly and should be available if/when there is an inspection from the permitting authority. Moreover, larger installations (>500 kW installed bioenergy capacity) are often required by their permitting authority to hand in an annual report. This environmental report is obligatory for larger plants (> total installed bioenergy capacity 20 MW). For the largest plants (>50 MW), the demands of reporting are even higher and more information is required to be given to the authorities.

Biomass boilers that produce more than 25 GWH annually are also required to
pay NOx taxes. The NOx tax is designed as a bonus malus system: plants with the lowest NOx emissions per energy unit produced receive an annual refund, whilst plants with a high NOx emission per energy produced used are forced to pay an additional penalty fee. The refund as well as the penalty for all plants are determined on an annual basis according to emission data and median emissions.

For installations of pellet stoves or boilers that are smaller than 500 kWh this generally requires that municipalities are being informed. However, in some local areas of cities local governance rules restricting biomass heating due to their air emissions have been installed. Information regarding local restrictions can be given by local energy advisors (rådgivare). The installing of new chimneys also requires a building permit. However, if you sell pellet stoves that do not require chimneys, no building permit is needed.

All new pellet boilers and stoves installed in Sweden need to be in accordance with the Swedish emission thresholds according to the building rules BFS 1993:57 for domestic heating including chains up until BFS 2006:12 of the Swedish National Board of Housing, Building and Planning. Thus, all stoves and boilers have to be labelled with a TG product certificate.

Pellets sold in Sweden follow the Swedish standard SS 18 71 20, which differs from the European pellet standard (EN plus) to a certain extent. The standard is divided in three groups, of which group 1 is targeted at small-scale users. Accordingly, pellets sold on the domestic market have to be of higher quality than those targeted at other EU countries. The EN plus standard has, however, diminished this difference in quality standards between Sweden and the EU.

Useful links:

Facts and figures:
- Swedish National Board of Housing, Building and Planning, building
- Swedish energy agency
- Swedish environmental protection agency
- All about pellets stoves
- Bioenergi portalen

### 3.6.8. Project Financing

According to established rating agencies, investments into Swedish markets are ‘safe’ from a country risk perspective. Reliability and credit worthiness of the Swedish economy is rated with best scores at Standard & Poor’s and Moody’s. Also COFACE country risk rating sees Sweden at the top of the score.

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6 [www-v2.sp.se/energy/CertProd/pannor/pannor_new.htm](http://www-v2.sp.se/energy/CertProd/pannor/pannor_new.htm)

The same holds true for the Corruption Perception Index measuring the level of transparency.\(^9\) Whilst the ease of doing business in Sweden is regarded as quite well by IFC World Bank, starting a business is ranked relatively low due to high administration and regulation requirements.\(^10\)

Although Sweden is not a member of the Eurozone, and therefore currency exchange risk have to be taken into consideration, the Swedish krona and the Swedish state budget follow the ordinates of the EU leading to only minor currency fluctuations.

Banks are familiar with financing bioenergy projects with view on solid biomass plants and biomass projects. Improved profitability due to carbon and energy taxation generally makes these investments easy to finance.

The market perspectives, political framework conditions and economic parameters are usually well-known to decision makers. A special focus when deciding about credits and loans is put on a reliable, sustainable and long-term feedstock supply, as well as a sound concept for the sales of the product.

Market entry for non Swedish producers is relatively easy as nowadays there are no specific market benefits for domestic producers.

**Useful Links:**

**Facts and figures:**
- **Swedish National Board of Housing, Building and Planning, building**
- **Swedish energy agency**
- **Swedish environmental protection agency**
- **All about pellets stoves**
- **Bioenergi portalen**

**Rating agencies**
- **Standard & Poor’s**
- **Moody’s**
- **COFACE**
- **Corruption Perception Index**
- **IFC Doing Business**

**Project financing institutions:**
- **Swedish Board of Agriculture**
- **Swedish Energy Agency**

**3.6.9. Readiness for Uptake**

As bioenergy is the largest energy source in Sweden, the market is well aware of the importance of bioenergy. Annual surveys conducted by the Swedish Energy Association on the share of bioenergy used in Swedish energy system shows that this share is consequently drastically underestimated. Nevertheless, biobased small scale heating is generally viewed as positive in Sweden. It is a traditional way of heating houses and it is regarded as cosy, cost efficient and climate smart. The Swedish Pellets association and the Energirådgivarna (energy advisors) give...
out regular information on biobased small scale heating.\textsuperscript{11} There are also several internet forums where small-scale heat users exchange information making information regarding pellets easily accessible for consumers. All municipalities and/or region offer local energy counsellors for small scale energy users. These agencies are put in place to aid house owners to switch to sustainable energy systems. They inform house owners about different energy options and helping them to find the best solution according to their needs.

The bioenergy market is mature with a stable price situation for biomass and several trading actors. The Swedish Pellet Association (Pelletsindustrins Riksförbund)\textsuperscript{12} produces a monthly price index providing customers with a transparent cost assessment. Most Swedes, who enjoy an open fire or pellets stove, consider wood as climate and environmentally friendly. A more disadvantageous side is that biobased small scale heating is considered more burdensome by some users than the geothermal or air driven heat pumps that have recently gained a bigger market share. Additional burdens on the user side occur since pellets must be purchased and the pellet boiler or stove must be serviced by the user (ash handling and refilling of pellet storage or feed in system) on a regular basis. With regards to wood log based heating, the fuel is often bought on the private market through contacts. Without such private contacts it is relatively difficult to acquire wood logs – at least in comparison with the well developed pellet market. Wood for decorative burning in an open fire place, however, is sold in many grocery stores or gas stations. The lack of access to wood log is often mentioned as one of the barriers for new users of biobased small scale heating. The Swedish pellet association together with the local and regional Energy rådgivare (advisors) disseminate information, showing that as technology has advanced, more effective boilers with self service and fully automatic feed in systems are available making the use of biobased heating very simple and easy.

In Sweden, the forest industry has been the major producer of bioenergy which has been used as a domestic fuel for a long time. The historic debate and concerns from the forest industry regarding the price effects emanating from the bioenergy development is minor in Sweden. Bioenergy is actually seen as a profitable side market for forest owners, paper and saw mills. However, lately there has been a public debate regarding Swedish forestry which might affect the public perception of bioenergy.

\textsuperscript{11} http://www.energiradgivarna.com/ to find your local counsuler look at this site http://energimyndigheten.se/Hushall/Energiradgivare/
\textsuperscript{12} Please note that the Pelletsindustrins riksförbund changes its name to Pellets förbundet during the fall of 2012.
Useful links:

Associations:
- **Swedish pellet association**
- **Svebio - Swedish Bioenergy Association**
- **SBBA - Swedish Heating Boilers and Burners Association**

Institutions:
- **Swedish Energy Agency**
- **Swedish Board of Agriculture**
- **Swedish Board of Forestry**
- **Swedish National Board of Housing, Building and Planning, Building**
3.7. Latvia

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3.7.1. Country Score

Country Score Latvia - SCH (November 2011)

In the general scoring for sector, Latvia is rated place 81 out of total 81. The underlying categories that influence this result are displayed in the bar chart above.

3.7.2. Basic Data

Latvia, officially the Republic of Latvia, is a country in the Baltic region of Northern Europe. It is bordered to the north by Estonia, to the south by Lithuania, to the southeast by Belarus and has a maritime border with Sweden to the west. Latvia is a unitary parliamentary republic and it is divided into 118 administrative divisions of which 109 are municipalities and nine are cities. The capital of Latvia is Riga; about one third of the country’s
population lives there. The official language is Latvian and the currency is called Lats (Ls).

Latvia has a humid semi-continental climate characterized by warm summers, freezing winters and frequently high levels of humidity and precipitation. Latvia’s weather conditions are influenced by the proximity of the Baltic Sea.

Latvia has four pronounced seasons of near-equal length. Winters, starting in mid-December and lasting till mid-March, have average temperatures of around – 6°C and they are characterized by stable snow cover, bright sunshine, and short days. Severe spells of winter weather with cold winds, extreme temperatures of around – 30° and heavy snowfalls are common. Summers, starting in June and lasting till August, are usually warm and sunny with cool evenings and nights. Summers have average temperatures of around +19°C with extremes of +35°C. The weather in spring and autumn is fairly mild.

Latvia has hundreds of kilometres of seashore lined with pine forests, dunes, and continuous white sand beaches. There are three major ports in Latvia – Liepaja, Riga and Ventspils, as well as seven smaller ports – Skulte, Mersrags, Salacgriva, Pavilosta, Roja, Lielupe, and Engure, which are situated along the entire coastline of Latvia.¹

There are five planning regions of Latvia: Kurzeme, Latgale, Riga, Vidzeme, and Zemgale regions. The planning re-

1 Latvia in brief. Latvian Institute. www.latvia.eu/content/latvia-brief

3.7.3. Energy Policy

The Energy section of Latvia’s Sustainable Development Strategy for 2030 identifies several goals: renewable and safe energy, reduced dependency on energy imports, the use of local RS, increased energy efficiency and the formation of a joint regional energy market.

Pursuant to Annex I(A) to Directive 2009/28/EC, Latvia’s target is to increase the use of RES from 32.6% of GFEC in 2005 to 40% in 2020. The total amount of RES to be utilized in 2020 is 1918 ktoe. Latvia’s RES targets by 2020 and beyond are the following:

1) By 2020, the share of renewable energy in total gross final energy consumption has to reach at least 40%. Thereafter this share is to be increased gradually.

2) By 2020, the share of renewable energy in the transport sector must reach at least 10% of gross final energy consumption for transport and it has to be increased gradually thereafter.²

The Law on Renewable Energy still has not been passed by the Saeima. The draft Law on Renewable Energy specifies measures and targets for renewable energy generation and the total final energy consumption that must be achieved by 2020. Furthermore, it provides financial instruments to promote the use of renewable energy.

Although since 2000 equal distribution of cogeneration power plants has been observed in Latvia, one of the goals of the Latvian power policy as currently defined by the guidelines, is to increase energy generation using effective cogeneration. Hitherto the main cogeneration potential was observed in the existing district heating that quickly developed in the last years, while the amounts of power generated by boiler houses of district heating systems decreased gradually.

Latvia is aware of the need to satisfy the existing demand for energy using the maximum possible amount of local energy resources as well as eco-friendly and sustainable technologies. Therefore it is still essential to replace existing thermal energy generating units by cogeneration units using local energy resources. Their assessed replacement together with the use of effective energy resources makes a significant contribution to the reduction of greenhouse gas emissions.

### 3.7.4. Feedstock

Most of Latvia is composed of fertile lowland plains and moderate hills. A typical Latvian landscape is a mosaic of vast forests alternating with fields, farmsteads, and pastures. Agricultural land occupies 39% of Latvia’s territory. Available farmland is 2,429,800 hectares: 1,805,500 hectares are cultivated and 624,300 hectares are abandoned lands.³

The main solid biomass source is wood (see Figure ‘Shares RES’). In 2006 has been estimated that approximately 55% of the total area of Latvia is covered by woods.

Latvia is the fourth most forested country in Europe - only Finland (77%), Sweden (76%), and Slovenia (63%) are


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Figure ‘Shares RES’: Share of separate renewable energy sources in the total consumption of renewable energy sources in 2010, %
endued with more forests. According to the data of the Central Statistical Bureau, the forest area in Latvia in 2008 was 3,221 thousand ha, 1,522 thousand of which were national forests. About 50% of Latvian forests belong to the state, 47% to private owners, 2% to municipalities, and 1% to other owners. 5,030,000 m³ of firewood were used for energy generation in 2010 (data of the Central Statistical Bureau). As forest areas have been constantly increasing in Latvia in the last 20 years, the amount of wood accumulated in forests or the wood yield has grown significantly. 93% of forested areas or 3,155,000 hectares with the total wood yield of 592 million m³ were available for wood production in 2010. The figure ‘Wood’ shows the annual natural increase in wood and felling volumes by years (in million m³).

If we summarize the energy wood potential in Latvia, it is forecast up to 30 TWh per year.

The volume of production of wood chip pellets has been continuously increasing. It is promoted by the commissioning of new production facilities. A major part of the produced amount is exported to other countries. About 650,000 tons of pellets were produced in 2010, and about 800,000 tons in 2011.

The Latvian State Forest Research Institute ‘Silava’ is main centre of forest science in Latvia and one of the leading establishments of scientific ideas in forestry and the related research and development in the country.

The principal tasks to be performed by LSFRI ‘Silava’:
- research on forest ecosystems and their components;
- giving recommendations for sustainable forest management and a rational and effective utilisation of forest resources and forest products.

If we summarize the energy wood potential in Latvia, it is forecast up to 30 TWh per year.


5 Latvian State Forest Research Institute "Silava". http://www.silava.lv

Figure 'Wood': Annual natural increase in wood and felling volumes by years, in million m³
3.7.5. Business Case

A trend to supplement gas and liquid fuel boiler houses with modern firewood and pellet heating boilers has been observed in the last years.

The average age of stoves is 29.9 years. While the average age of district heating boilers using woodfuel is 14.4 years.

The average costs of energy resources of households in 2010 were as follows:\(^6\)

- Natural gas – 0.317 ls/m\(^3\)
- Firewood – 16 ls/m\(^3\)
- Wood briquettes – 103 ls/t
- Wood pellets – 103 ls/t

Figure ‘Price Comparison’ shows the price developments of natural gas and wood from 2009 to 2011.


3.7.6. Market Environment

A trend to supplement gas and liquid fuel boiler houses with modern firewood and pellet heating boilers has been observed in the last years. The share of RES has traditionally been significant in Latvia’s energy supply and in 2008 it comprised 29.9% of the total final energy consumption. In the consumption structure for electricity, the RES segment is made up of hydropower plants, wind power plants, biogas power plants, and biomass power plants, as well as cogeneration stations utilizing RES. Heat supply to Latvian consumers is ensured by district heating systems, local heating and individual heating.

According to the information provided by the database of the Central Statistical Bureau, there were about 928,2 thousand houses in Latvia in 2010,
23.4% of which were private houses. 525,1 thousand houses receive heat from an external supplier. Owners of heating stoves mainly use firewood, as well as wood cut-offs, briquettes and pellets for heating. In 2010 88.6% of all woodfuel was firewood, 6.1% wood cut-offs, 4.6% wood briquettes and 0.7% wood pellets. Latvian housing facilities and buildings are generally old, large number of buildings were built in 60-70ies of the last century. Energy efficiency of these buildings is at a low level, therefore an increasing number of building owners turn to energy efficiency improvement measures to improve the building structure and microclimate inside them as well as to reduce thermal energy costs.

In DH, local and individual heating wood and its derivatives are mostly used as renewable resources. Households not connected to district heating mainly use firewood, pellets, and briquettes.

The use of energy resources by households in 2010 is as follows:
- Firewood – 4,323,000 m³;
- Wood briquettes – 19,972.2 tons;
- Wood pellets – 13,973.4 tons;
- Wood cut-offs – 117,600 tons.

In 2011 the total number of houses with installed boilers was 663 (see Figure 'Boiler Houses'):

In 2011, 130 of all 663 houses with installed boilers used firewood, 85 wood chips, 16 pellets, 1 briquettes, 1 wood cut-offs, and 1 straw. A very large number of boiler houses – 309 – still use natural gas.

The implemented energy policy has made the increase in efficiency of energy generation a priority. Hence, the ratio of district heating energy generated by boiler houses to district heating energy generated by cogeneration plants has changed, and the amount of thermal energy generated by boiler houses decreased from 19.83 PJ (62.2%) in 2000 to 11.84 PJ (41.3%) in 2010.

About 22% of thermal energy required by users is generated by district heating systems, while 78% of thermal energy is generated by heat supply systems other than district (local and individual) (see Table 'Energy Generated'). In 2010 about 70% of the end use of district heating was consumed by households. Amounts of energy generated by boiler houses of district heating systems gradually increased in the last years.
3.7.7. Regulation

Currently there are no specific laws that encourage or limit any use of energy resources in households with the exception of the ‘Law On Value Added Tax’. According to this law, pellets and firewood for households are taxed with 12% VAT, whilst gas, oil and coal are taxed with 21%.\(^7\)

\(^7\) Law On Value Added Tax. www.vcc.gov.lv

7.8. Project Financing

In 2010 an additional support scheme for small scale heat systems replacing natural gas heat system was launched. The total amount of financing accounted for approximately €17 million (LVL12 million). Nowadays, no support is available anymore.

There are credit facilities for households to install biomass boilers in Latvia.

<table>
<thead>
<tr>
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<td>35.18</td>
<td>36.84</td>
<td>35.13</td>
<td>29.85</td>
</tr>
</tbody>
</table>

3.7.9. Readiness for Uptake

The Investment and Development Agency of Latvia (LIAA) is a state institution subordinate to the Ministry of Economics of the Republic of Latvia. The LIAA offers assistance throughout the process of setting up operations in Latvia, acting as a first point of contact and as a ‘one-stop-shop’ in assisting investors and in developing tailored solutions to meet their specific needs. The LIAA has its own regularly updated database of Latvian enterprises to facilitate partner searches for investment projects and for exporting or subcontracting businesses. The LIAA offers a matchmaking service, enabling potential investors and project partners to find suitable Latvian companies interested in M&A and joint venture opportunities.8

The Latvian biomass association ‘LATbio’ was established on the 25th of February in 2008 as a nonprofit organization. The main aims of the association are:

1. To popularize usage of local RES in energy production in order to achieve higher economic and energetic independence of Latvia;

2. To spread information about the availability of local RES and their usage aspects;

3. To promote the development of scientific works in the field of renewable energy and research of optimal harvest technologies.9

3.8. Finland

**Bioenergy Association of Finland (FINBIO)**

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Tel.: +358 40 7182026
Email: mia.savolainen[at]finbio.fi

### 3.8.1. Country Score

In the general scoring for the small scale heating sector, Finland - South is rated place 34 out of total 81. The underlying categories that influence this result are displayed in the bar chart to the left.

### 3.8.2. Basic Data

Finland is a democratic republic in Northern Europe situated between the 60 and 70 degrees north latitudes. It is the seventh largest country in Europe with a total territory area of 338 424 km² (of this 69% forest, 10% waterways, 8% cultivated land and 13% other). The total population is 5.4 million. The capital and largest city is Helsinki (with 1 million inhabitants living in the capital area). The population is mostly concentrated in the southern and central part of the country. About 80% of the population lives in urban areas.

Finland is the coldest country in the EU. Latitude is the principal influence on the country’s climate. On average, winter
with snow lasts from mid December to mid March in the south and from October to early May in the north. The vegetation zone mainly consists of boreal forest. The mean daily temperature in the capital Helsinki is in January minus 4 degree Celsius and in June plus 18 C. In Northern Finland - “Lapland” - temperature may be down to minus 25-35 degree in mid winter. However, because the Gulf Stream and the North Atlantic Drift Current moderate the climate, and because of the relatively low elevation of the land area, Finland contains half of the world’s arable land north of 60° north latitude.

Finland is world famous for its large boreal forest area, lakes and peatlands, and also for its globally operating forest industry. Forestry land (incl. protected areas) is 228 000 km², of which 52% is owned by private families, 35% by the state, 8% by companies and 5% by others. Peatlands cover about 30% of Finland’s territory. Peat is growing annually more than used for energy purposes, about 25 TWh per year. Most often peat is mixed with wood based fuels or coal at power or CHP plants. It is a good quality, indigenous and low price fuel.

Finland has 2.3 million hectares arable farm land. Wheat, barley and oat are the most-produced crops in agriculture, also potato and other root vegetables are produced to a large extent. About 0.5-0.7 million hectares can be used for energy purposes.

The road- and railway network is quite large (main roads: 460 000 km and in addition dense forest road network, railroad net: 5 800 km), and dense water transport systems and routes on the seaside and lakes exist.

Finland is also one of the world leaders in the utilization of wood based energy and the development of biomass combustion technologies and efficient fuel supply chains from on-farm size plants up to the world’s biggest biomass plant. A cold climate, long distances and energy intensive industry explain why Finland has relatively high demand for energy. The specific energy consumption per capita is high; industry uses about half of the energy generated. An efficient and balanced energy system is crucial. However, 70% of energy used in Finland is imported and only 30% indigenous. Until today, significant indigenous energy sources are limited mainly to wood fuels, peat and hydropower, but the range will be widened with wind, biogas, agricultural biomass, biofuels for transport and heat pumps. The use of wood fuels is growing the most.

Finland’s economy is quite positive and serves reliable frames for living and business. Living standards are high. GDP per capita is 38 000 € (2011). Finland is:

- Number one in World Economic Forum 2005 Competitiveness Rankings (www.weforum.org).
- One of the Least Corrupted Nations in the World (number one in 2007 and number two in 2011 / Transparency International).
- The Best Country in 2010 by
Newsweek (indicators: education, healthiness, quality of life, economical dynamics and political frames).


Useful links:
- Finland Official Statistics: www.stat.fi
- Common information: www.visitfinland.com
- Energy Statistics: www.energia.fi

### 3.8.3. Energy Policy

Finland is one of the world’s leading users of renewable sources of energy, especially bioenergy. Renewable energy sources provide one fourth of Finland’s total energy consumption and account for more than one fourth of its power generation. The country’s most important renewable sources include bioenergy – wood and wood-based fuels in particular – hydropower, wind power, ground heat and solar energy. Also peat is important domestic fuel for district heat and power production.

Finland’s national target is to increase the use of renewables by 9.5% units to totally 38% in 2020. This reflects an increase of approximately 40 TWh compared to 2005 levels. One particular target within this national action plan is for renewables to account for at least 20% of transportation fuels by 2020, taking into account the double counting referred to in the RES Directive. The overall renewable energy target is to use 124 TWh of RES in 2020 (85 TWh for heating and cooling, 33 TWh for electricity and 6.5-7 TWh in traffic) of which bioenergy makes up 105 TWh. The key targets are to increase wind power from 0.2 TWh (2005) to 6 TWh by 2020 and the annual use of wood chips in CHP production and separate heat production from 6 TWh (2005) to 25 TWh/90 PJ by 2020. Some 14 TWh/7.5 million m3 (solid) wood chips were used in 2011. Another ambitious target is to increase the biofuel use in the transport sector up to 5.3 TWh by 2020 (20% of the total use). Other targets are to decrease the greenhouse gas emissions by at least 16% until 2020 and to increase energy efficiency by 20% until 2020. Total carbon dioxide emissions from the production and use of energy amounted to 50 million tons in 2011, which reflects a large decrease compared to almost 70 million tons in 2002.

The anticipated use of renewable energy sources for heating amounts to 34.6 TWh in 2020. This represents an increase of 16 TWh compared to 2005. Of this amount, 9.5 TWh would be used for district heating, in which wood would account for 6.6 TWh. A total of 25.1 TWh would be used to heat individual houses.¹

For the small scale heat sector, the energy strategy targets a use of firewood

¹ FINBIOs Publication 46, 2010
of at least the present level, which is 12-13 TWh annually, and the use of wood chips is planned to be growing from 1.4 TWh to 2.5-3 TWh (wood chips total to 25 TWh). In addition the use of pellets will increase from 0.1 TWh to 2 TWh by 2020 in small houses and energy plants.

Useful links:
- Ministry of Employment and the Economy: www.tem.fi
- Association Bioenergia with its members: www.bioenergia.fi
- Motiva Ltd: www.motiva.fi
- Benet Ltd: www.benet.fi
- Josek Ltd: www.josek.fi
- Forest Centres: www.metsakeskus.fi
- Finnish Energy Industries: www.energia.fi

<table>
<thead>
<tr>
<th>Usage Targets for Renewables by Sector (target 40%), TWh</th>
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<td></td>
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<tr>
<td>Electricity from biomass</td>
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<td>Industry</td>
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<tr>
<td>Transport</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

The use of transportation biofuels amounts to 4.5 TWh. Since 2 TWh of this amount is so-called second generation biofuels, which is eligible for a double counting, this would correspond to 6.5 TWh.
3.8.4. Feedstock

In Finland the largest biomass reserves are based on forest wood. Forest industry utilizes forest and that is why there are lot by-products, sawdust, bark and other by-products. Another important by-product from forest industry is the black liquor from pulp mills. Wood is the most important source of bioenergy, 86 TWh wood energy was used in 2011 (liquid 37 TWh and solid 49 TWh), which makes up 22% of the total energy consumption. Most of the wood-based energy (56%) is recovered from industrial by-products and residues, and the rest directly from the forests. District heat and power plants used solid wood fuels 16.8 million m³ (32 TWh) in 2011, the amount increased 3.4 million m³ from the year 2009. In addition 6.7 million m³ (17 TWh) went to the separate office, industry and small houses for energy purposes, mainly as firewood, chips and pellet. There is huge forest energy potential still to use. Almost 70% of the area is covered by forest. The total volume of growing stock is 2.205 million m³ (solid), of which 50% is pine, 30% spruce and 20% non-coniferous. The annual growth is over 100 million m³ (solid) and annual fellings for industry purposes is 55 million m³ (solid). Total drain is 71.5 million m³ (solid). These numbers are industrial round wood contents, without branches, tree tops, unmerchantable round wood and stump and root wood, which adds volumes around 20-40% more. Almost 95% of the forest area is certified by the Finnish Forest Certification system (FFCS) which based on the PEFC system. Also Forest Stewardship Council’s (FCS) certification is largely used.

According to the estimation surveys, the theoretical maximum production potential of forest wood fuel is 45 million m³ per annum. This potential corresponds to approximately 90 TWh. However, the practical target is that the annual use of wood chips will be increased to 25 MWh (to 13.5 million m³) and in the small scale heat the use of firewood will be at least the present level 12-13 TWh by 2020. This is equivalent to 25 TWh/90 PJ of fuel. Some 7.5 million m³ (solid) of wood chips were used in 2011. Most of the forest chips today are produced from logging residues and small-sized trees. Also the amount of wood fuel made from stumps and roots increases. Nowadays forest chips stem from logging residues (36%), small-diameter energy wood (29%), stumps (15%) and roundwood (20%).

52% of forest area is own by private families. Over 50% of the wood fuels for small houses, 3.1 million m³, is coming from owner’s own forestland. 25% is received from neighbour’s forestland and 1.1 million m³ is usually bought from the market. The different types of firewood that are used are mainly split log wood and felling residues, and wood chips and pellets are bought on the market. At the end of 2010, there were 28 wood pellet mills in operation. The total production capacity of the pellet mills was approximately 650 000 tons/year, but production was only around 300 000 tons, 60% of which was

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2 Finnish Forest Research Institute (www.metla.fi)
exported. The domestic consumption of wood pellets has increased little by little and amounted to 160,000 tons in 2010. The number of private small-scale pellet users is estimated at 25,000, and it will increase more rapidly in future. About half of the domestic consumption of pellets in Finland took place in small pellet boilers and stoves, the thermal output of which was less than 25 kW.³

Peatlands cover around 30% of Finland’s territory. The amount of peat that is growing annually is more than that used for energy purposes, which is about 25 TWh per year. Most often peat is mixed with wood based fuels or coal at power or CHP plants. The use of mixed wood-peat pellets is currently being tested at large scale plants, and might also be an option for smaller plants.

The total use of agricultural residues and energy crops has been minor. Finland has 2.3 million hectares of arable farm land, of which 1.17 million hectares are used for food crops and 0.64 million hectares for fodder. Approximately 0.1 million hectares are used for cultivating oil plants. About 0.5-0.7 million hectares could be used for energy purposes without posing threat to food production. If 0.5 million hectares is thus used and assuming that the harvest yield is 20 MWh/ha, this would correspond to a potential of 10 TWh. Currently agricultural residues are only marginally used for energy production. Up today maximum 20,000 hectares are used (reed canary grass etc.). However, potential is quite large, for instance straw potential. It is estimated that 2.5 TWh can be easily taken and 7 TWh when taking 20% of straw potential into energy use. In addition, the waste and recycled fuels and biogas potentials for energy use are relatively large.

Useful links:
- Finland Official Statistics: www.stat.fi
- Energy statistics: www.energia.fi
- Forestry statistics: www.metla.fi www.smy.fi
- Agricultural statistics: www.mtt.fi
- European Bioenergy statistics: www.aebiom.org

3.8.5. Business Case

The share of renewable energy sources in the total power production was 33% and in district heating 22% in 2011. The share of wood fuels was 22% of the total energy consumption. The energy industry has been the biggest investor of all industries in Finland for years. 57 new cogeneration plants were completed in 2000-2009, which considerably increased the use of domestic fuels forest energy and peat. Hydropower capacity is also much increased, new hydropower output was about 300 MW. According to the Pöyry investment survey, the situation will remain unchanged. Total investments were about 2 billion euros

³ Market of biomass fuels in Finland – an overview 2009, (www.eubionet.net)

Residential houses used 6.7 million m³ (solid), 15 TWh, of wood fuels in 2008, compared to 17 TWh today. Two thirds was wood split logs (4.9 million m³) and one third wood chips (0.5 solid m³), felling residues (0.9 million m³) and waste wood (0.4 million m³). Single-family houses used 60%, farm houses 30% and summer houses 10% wood fuels for their heat supply. The average consumption per house was 3.8 m³ per year; single-family-houses: 3.2 m³, farm houses: 14.5 m³ and summer houses: 1.8 m³. In every 8th residence (200 000) at least 10 m³ wood fuel was used annually. Firewood has always been an important fuel in the heating of buildings in Finland. At present, wood stoves and fireplaces are commonly used as auxiliary heat sources in detached houses. About 60% of single-family houses use wood for heating, and today almost 95% of new small house builders take a heat-retaining stove as an auxiliary heat source. Efficient heat-retaining stoves have become popular during the years, and they are currently the most common type of stoves. The total number of stoves and fireplaces for firewood is 2.9 million, of which 1.55 million are situated in single-family houses. Wood is also commonly used as the main fuel in central house heating systems in farms and larger buildings in sparsely populated areas, and about 250 000 systems of this kind exist in the country. Most of the systems use wood chips and split logs, whereas wood pellets are burnt in approximately 20 000 small pellet boilers, summing up to 160 000 tons per year. It is expected that the domestic use of pellet will increase quite rapidly in the future. Annually 70 000 new fireplaces for wood fuels are implemented: boilers, stoves and fireplaces.

For biofuels the availability and prices of biomass raw materials, logistics and other production costs play an important role as they are competing with fossil fuels prices. The efficiency of wood sales will be constantly improved by developing price statistics systems to guarantee a more up-to-date, precise and comprehensive information flow. Market information is produced through internet based market places, which allow stakeholders to access price

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4 www.metla.fi

5 Market of biomass fuels in Finland – an overview 2009, (www.eubionet.net)
information on raw wood and fuel wood almost in real time. More precise, up-to-date price information will help the wood market to function further.


So, also biomass production and handling technologies and logistic system markets will offer huge possibilities to the stakeholder’s crossborder businesses. The rapid development of technologies will enable the production of high quality fuels, energy security, sustainable supplies, clean and effective combustion processes and optimally-integrated solutions for the inhabitants of the communities (households, offices, shops, service buildings and industry).

Broad long-period practical experience and knowledge about forest fuels, pellet and peat procurement, logistics and combustion (Scandinavian fuels) is existing in Finland. But biofuels are also traded internationally more and more. The fuel trade is global and the trend is to use different kinds of mixed fuels: Scandinavian fuels, miscanthus sinensis, eucalyptus, bagasse, rice husk, straw, willow and other energy feedstock. In general the major challenges with “new” biomass fuels lie in fuel feeding and burning properties: stability of fuel mass
flow, ash behaviour due to high alkaline content, chlorine etc. Special boiler design for those fuels will be the future challenge – but is definitely feasible.

Pellets heating technology is comparatively new, also in Finland. The use of pellets has increased more slowly than expected. There are over 20 000 small pellet boilers in use. About 60% of the pellets which are produced in Finland are exported. The pellet price for private small-house consumers was 250 €/ton or 5.27 cents/kWh (quality one, 5 tons, including transportation max. 100 km radius) in late 2011.

Also the burning of split logs will increase in small scale systems in the future. 33 cm to 100 cm long logs will be used to offset peak loads, especially in winter time in electrically and oil heated buildings, and for comfort (fireplaces, stoves and in saunas). The particle and hydrocarbon emissions of heat retaining stoves have been reduced and their efficiency was improved significantly.

Usefull links:

- Finnish Energy Industries: [www.energia.fi](http://www.energia.fi)
- Association Bioenergia with its members: [www.bioenergia.fi](http://www.bioenergia.fi)
- Ministry of Agriculture and Forestry: [www.mmm.fi](http://www.mmm.fi)
- Statistics Finland: [www.stat.fi](http://www.stat.fi)
- Motiva Ltd: [www.motiva.fi](http://www.motiva.fi)
- Finnish Forest Research Institute: [www.metla.fi](http://www.metla.fi)
- VTT Technical Research Centre of Finland: [www.vtt.fi](http://www.vtt.fi)
- The Bioenergy Development Center BDC: [www.jamk.fi/english/research/currentprojects/bioenergy](http://www.jamk.fi/english/research/currentprojects/bioenergy)

### 3.8.6. Market Environment

The total energy consumption in 2011 was 1.386 PJ (386 TWh). Finland is net-importer of energy, 70% of the energy used in the country today is imported and 30% is indigenous. Coal, oil and natural gas are all imported. Today wood based energy is the most important renewable energy source in the total energy consumption (22%) and it is expected to be growing also in the near future. 86 TWh of wood energy was used in 2011 (liquid 37 TWh and solid 49 TWh). Solid wood fuels were used in energy plants (32 TWh/16.8 mill. m3 (often mixed with peat)) and in small houses (17 TWh/6.7 mill. m3). Carbon dioxide emissions from the production and use of energy today lies around 50 million tons (compared to almost 70 million tons in 2002). Total energy consumption by sources in 2011 was the following: oil 24%, wood fuels 22%, nuclear energy 18%, coal 11%, natural gas 10%, peat 6%, net imports of electricity 4%, hydro and wind power 3% and others 3. Final energy consumption by sectors was: industry 46%, transport 24%, district heating 17% and others 13%.6

6 [www.stat.fi](http://www.stat.fi) and [www.energia.fi](http://www.energia.fi)
About half of buildings in Finland have an own separate heating systems (about 800,000 buildings: single houses, farmhouses and office, commercial and industry buildings). In buildings without district heating the heat sources were electricity (37.6%), wood fuels (24.5%), light fuel oil (18.1%), heat pumps (14.8%), heavy fuel oil (2.6%) and natural gas (2.4%) in 2010. Small houses used 6.7 million m³ (solid), 17 TWh, wood fuels in 2008. Two thirds of this was wood split logs (4.9 million m³) and one third wood chips (0.5 solid m³), felling residues (0.9 million m³) and waste wood (0.4 million m³). These figures show that there still room for improvements because until now 240,000 separate buildings are heated with light fuel oil and 665,000 with electricity, which are not the optimal carriers for heating. Reasons for the popularity of investing in electrical heating in the 1970-1990’s were cheap capital costs when investing electrical heater systems and of course low electricity prices. Heating with electricity is no more profitable, and also oil price has increased remarkably and it continues. In addition, there are 490,000 free-time residences (“summer houses”) and about 1.6 million saunas at homes and in summer houses where firewood is the main heat source and 40% are estimated to be using electricity. Half of the buildings have their own separate heating systems (about 800,000 buildings: single houses, farmhouses and office, commercial and industry buildings). In buildings without district heating the heat sources in 2010 were electricity (37.6%), wood fuels (24.5%), light fuel oil (18.1%), heat pumps (14.8%), heavy fuel oil (2.6%) and natural gas (2.4%).

According to the bioenergy associations’ and VTT’s estimations, the current annual domestic consumption of wood pellets (300,000 tons) could be raised to 1–1.5 million tons (17.5–26 PJ) by replacing a part of the consumption of light fuel oil with the use of pellets. In addition, a remarkable potential use for pellets lies in substituting coal in power plants. Coal-fired power plants using pulverized combustion, e.g. in the Helsinki metropolitan area, could increase their use of pellets to even 2–3% of their fuel use without great technical changes in the burning systems if pellet use becomes economically competitive with coal or local green political values will order so. Even these small steps would result in an increase of pellet burning by many hundred thousand tons annually.

Useful links:
- Association Bioenergia with its members: [www.bioenergia.fi](http://www.bioenergia.fi)

### 3.8.7. Regulation

The Finnish Government has set regulations, new tools and funds for research and development projects,
energy taxation, tax relief, production subsidies for electricity and forest chips and investment subsidies as financial measures to implement the energy policy. However, new and stronger public incentives to promote the use of renewables in the small scale heat sector will be needed.

In Finland there is a feed-in tariff (FIT) for renewable electricity annually financed from the State budget (Act 1396/2010). The FIT is available for large and medium power plants fuelled with wind, biogas, forest chips and wood-based fuels. Energy plants which participate in this system will receive a subsidy (feed-in tariff) for a maximum of twelve years. The target price for electricity produced is €83.50 per megawatt hour. The FIT varies on the basis of a three-month electricity market price or the market price of emission allowances. The producer is paid a feed-in tariff, which is the difference between the target price and the spot market price (last 3 months’ average) in accordance with the amount of electricity produced in a wind power plant and a power plant using biogas or wood-based fuels. The level of the feed-in tariff for forest chips plants is based on the market price of the emission allowances and the maximum price is set to 18 €/MWh. If the market price of electricity is less than 30 €/MWh, the feed-in-tariff is calculated as follows: target price – 30 €/MWh. In forest chips plants the feed-in-tariff will be 18 €/MWh, if the 3 months average emission allowance price is maximum 10 €. The level of the feed-in tariff is based on

association Finnish Energy Industries. But more powerful incentives to promote the use of RES in small scale heat sector will be needed. Private persons still to pay the full 23% VAT, both for the heating investments and for the biofuel they are using. Companies on the other hand, have the possibility to get the VAT back.

For small scale heating systems of residential buildings, the government provides investment grants of additional €30 million. Introduction of primary heating systems based on renewable energy sources is supported by maximum 20% of the eligible investment costs. This subsidy came into force in 2011. But it needs more financial and taxation tools for increasing RES-use in separately heated buildings. Taxation is a powerful public tool. The government changed the structure of fuel taxes for heat and power and fuels for transport in 2011. The taxation now takes into account the energy content, carbon dioxide emissions and local/particle emissions that have adverse health effects. In addition to the energy tax, a security of supply fee is charged on energy products. CO2 levels for fossil fuels used in combined electricity and heat production were lowered by 50%. This was done to avoid overlapping carbon dioxide steering and to improve the competitiveness of combined heat and electricity (CHP) production relative to separate heat production. The electricity tax for industry (tax class II) has been raised from €0.263 c/kWh to € 0.703 c/kWh, electricity tax class I is for private customers. Together with this, the tax subsidies for renewable electricity production (e.g. electricity produced from forest chips still get subsidies along with wind power, small hydro, biogas, and recycled fuel (REF)) were discontinued.

In Finland’s domestic market there are not so tight standards for bioboilers or stoves as EN 303-5 standard (Heating boilers for solid fuels, hand and automatically stoked, nominal heat output of up to 300 kW). The standards also apply to split logs, chips, wood pellet and briquettes and sawdust. But the CEN/TC 335 standards for solid biomass fuels including EN 14961 standards for wood fuels are used already in Finland in medium and large scale markets, and it will also be more and more applied in the small scale heat sector. For international boiler and fuel trade, standards are highly important. One modern EN 3030-5 audited boiler test laboratory exists: the Bioenergy Development Centre (BDC) in Central Finland, co-operated by VTT and JAMK University of Applied Sciences, which tests boilers of 0-100 kW, 100-1500 kW and 500-1000 kW capacity, and also combined heat systems up to 3.0 MW.9

9 www.jamk.fi/english/research/currentprojects/bioenergy
Energy taxes related to traffic and heating fuels and electricity consumption as of January 2011

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<td>Diesel oil para</td>
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<td>Light fuel oil, without sulfur</td>
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<td>Heavy fuel oil</td>
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<td>Coal</td>
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<td>64.64</td>
<td>72.37</td>
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<td>Natural gas*</td>
<td>EUR/MWh</td>
<td>7.70</td>
<td>5.94</td>
<td>0.06</td>
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<td>Electricity, class I</td>
<td>c/kWh</td>
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<td>0.013</td>
<td>1.773</td>
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<tr>
<td>Electricity, class II</td>
<td>c/kWh</td>
<td>0.097</td>
<td>0.013</td>
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<tr>
<td>Tar/CO</td>
<td>c/kg</td>
<td>18.79</td>
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<td>18.79</td>
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<tr>
<td>Fuel price **</td>
<td>EUR/MWh</td>
<td>3.50</td>
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<td>3.50</td>
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</table>

** Energy tax for fuel price is 1.90 €/MWh during 2011-2012 and 2.50 €/MWh during 2013-2014.
R = product includes renewable raw material according directive 2001/77/EU.
T = product includes renewable raw material according directive 2001/77/EU and it produced from waste or residues which are not suitable for food like lignocelluloses material.
3.8.8. Project Financing

Finland is member of the Eurozone, and therefore the currency exchange risk for investors coming from other Eurozone member countries is low. Finland’s economy is rated one of the best scores at Standard & Poor’s and Moody’s. In addition Finland was number one in the World Economic Forum 2005 Competitiveness Rankings\(^\text{10}\) and one of the Least Corrupted Nations in the World: number one in 2007 and number two in 2011\(^\text{11}\). Finland’s credit rating is AAA, and the GDP per capita is 38,000 € (2011). Common VAT is 23% but companies have possibilities to get them back.

There are plenty of international and national banks situated in Finland. Loan interest levels are rather low but variable. The easiness of getting a credit by banks is very much dependent on individual projects. Banks are familiar with bioenergy, and projects with renewables are highlighted in the bank sector and state funding. Different kind of R&D, demonstration and invest programs exist in the state level but also in the counties.

The Finnish Funding Agency for Technology and Innovation - Tekes is the main public fiscner of technology R&D. Renewable energy technologies, belonging to sustainable development solutions, are in the strategic focus of Tekes. Various national programmes and demonstration projects have involved RES technologies during the last decades, the main focus being on bioenergy.

The specific energy project financing institution is the Ministry of Employment and the Economy. It offers different kinds of support in financing investment and development projects dealing with renewable sources in Finland. However, mainly for large scale energy production. The maximum energy subsidy granted by the Ministry of Employment and the Economy is 40% when invested into new technology or energy saving appliances for plants using renewables and 30% when invested into ordinary technologies and 30% when invested into technologies that are decreasing environmental disadvantages. In practice, typical public energy grants are 10-15% for heating plants, 15-20% for landfill gas plant, 10-20% for wood chips or industrial waste wood production machineries etc. The Ministry of Agriculture and Forestry offers develop programs and funds for forestry and agricultural missions and especially for the projects in farm sector.

Useful links:
- Ministry for Foreign Affairs of Finland: [www.formin.finland.fi](http://www.formin.finland.fi)
- Ministry of Employment and the Economy: [www.tem.fi](http://www.tem.fi)
- Ministry of Agriculture and Forestry: [www.mmm.fi](http://www.mmm.fi)
- Motiva Ltd: [www.motiva.fi](http://www.motiva.fi)
- Association Bioenergia with its members: [www.bioenergia.fi](http://www.bioenergia.fi)
- Benet Ltd: [www.benet.fi](http://www.benet.fi)
- Josek Ltd: [www.josek.fi](http://www.josek.fi)

\(^{10}\) [www.weforum.org](http://www.weforum.org)
organization Statistics Finland, and are published on special electrical market places, and 6 times per year in the “Bioenergia” magazine. So called PIX-Index made by FOEX Indexes Ltd shows the monthly prices of wood fuel chips, pellet, pulp, paper, paperboard etc. in the Nordic markets.

Most cities and municipalities have energy programs and funds for use, too. More information can be obtained via the related associations and regional biomass organizations.

The Ministry for Foreign Affairs of Finland serves a good way to get knowledge and information about trade and partnership possibilities for national and international business cases. By international comparison concerning the number of investment agreements, Finland ranks among the middle group together with Sweden, Denmark, Austria and Belgium. At the moment the number of valid agreements is somewhat over 50. Germany, Great Britain and Switzerland have the most comprehensive networks of agreements, each with well over one hundred agreements. In the small scale sector the information and developing center Motiva Ltd is specializing in the energy systems, building requirements, funds and energy efficiency questions for small and larger buildings.

Partnership with Finnish companies is also worthwhile. Finpro, a trade supporting organization has 400 professionals in almost 50 countries. It opens up future business opportunities by understanding changes in international markets. It

3.8.9. Readiness for Uptake

Finland is one of the world’s leading users of renewable sources of energy, especially in wood energy sector. You can see modern bioenergy production and technologies everywhere in practice, from farm size up to the world’s biggest biomass power plant. Many universities, institutes, schools and private companies provide education and training in energy and bioenergy know-how and technology, from the practical field courses to the highest level of scientific research. Finn-made combined heat and power plants, all scale boiler technologies, and modern harvesting and transport technologies for biomass are known worldwide.

For firewood in small scale use sector there exist many internet based market places. The customer can get up-to-date information about local wood fuel sellers, products and prices. Interested foreign companies will do best by first contacting the related energy and bioenergy associations. Average fuel prices have furthermore been collected by official

- Forest Centres: [www.metsakeskus.fi](http://www.metsakeskus.fi)
- Finpro: [www.finpro.fi](http://www.finpro.fi)
- Tekes: [www.tekes.fi](http://www.tekes.fi)
- Finnish Energy Industries: [www.energia.fi](http://www.energia.fi)
- Statistics Finland: [www.stat.fi](http://www.stat.fi)
- Fuel PIX-Indexes: [www.foex.fi](http://www.foex.fi)
serves clients by enabling them to be in the right markets at the right time with a competitive concept and offering.

Useful links:

Facts and Figures:
- Common information: [www.visitfinland.com](http://www.visitfinland.com)
- Energy Statistics in Finland: [www.energia.fi](http://www.energia.fi)
- European Biomass Statistics: [www.aebiom.org](http://www.aebiom.org)
- European Forestry Statistics: [www.efi.fi](http://www.efi.fi)
- Forestry Statistics in Finland: [www.smy.fi](http://www.smy.fi)
- Price indexes for wood based fuels and forestry products in Nordic: [www.foex.fi](http://www.foex.fi)
- European Biomass Supply Chains: [www.eubionet.net](http://www.eubionet.net)
- Renewable Heating and Cooling - European Technology Platform: [www.rhc-platform.org](http://www.rhc-platform.org)

Associations and main biomass development organizations in small scale sector:
- Association Bioenergia: [www.bioenergia.fi](http://www.bioenergia.fi)
- Finnish Energy Industries: [www.energia.fi](http://www.energia.fi)
- Finnish Biogas Association: [www.biokaasuyhdistys.net](http://www.biokaasuyhdistys.net)
- Motiva Ltd, small scale use: [www.motiva.fi](http://www.motiva.fi)
- Benet Ltd, Central and Southern Finland: [www.benet.fi](http://www.benet.fi)
- The Bioenergy Development Center BDC: [www.jamk.fi/english/research/currentprojects/bioenergy](http://www.jamk.fi/english/research/currentprojects/bioenergy)
- Forestry R&D in Finland: Finnish Forest Research Institute: [www.metla.fi](http://www.metla.fi)
- Energy R&D in Finland: VTT Technical Research Centre of Finland: [www.vtt.fi](http://www.vtt.fi)
- Agriculture Statistics and R&D in Finland: [www.mtt.fi](http://www.mtt.fi)
- Forest areal projects: [www.metsakeskus.fi](http://www.metsakeskus.fi)

Institutions:
- Ministry of Agriculture and Forestry: [www.mmm.fi](http://www.mmm.fi)
- Ministry for Foreign Affairs of
Finland: [www.formin.finland.fi](http://www.formin.finland.fi)

- State level R&D: Tekes [www.tekes.fi](http://www.tekes.fi)

Companies:

- There are hundreds of energy and bioenergy producing companies and technology manufacture companies. Internet addresses exist under Associations links.
4. **Annex**

Leading questions of the SCH-Market Handbook:

1. Country profile (geography, demographics, logistics, etc.)

   1.1 Geography and Climate
   - Total land area
   - What is the average winter temperature across regions in target country over the last 10 years?
   - Total number of inhabitants
   - Total number of households in the country
   - Population density
   - Household density

1.2 Wealth/economic status of population
   - What was the average GDP real growth rate between 2008 - 2010?
   - GDP per capita for 2010

1.3 Logistics - road and rail network
   - What is the density of rail-network? (for goods/biomass transportation)
   - What is the density of road-network? (for goods/biomass transportation)
   - What is the density of water ways-network? (for goods/biomass transportation)
   - What is the density of the electricity transmission and distribution networks?
   - What is the density of the gas transmission and distribution networks?

2. Energy Policy (political will, nREAP, etc.)

   2.1 The nREAP is ambitious and proposes appropriate measures
   - There are high-volume targets for RES (Difference in ktoe 2010 - 2020)
   - There are high-volume targets for solid biomass for heat (Difference in ktoe 2010 - 2020)
   - There are high-volume targets for heat consumed in households (Difference in ktoe 2010 - 2020)
   - Proposed measures for small scale heat in nREAP are appropriate and convincing
2.2 A political will to develop the RES-sector is clearly recognisable and stable
- Does the government provide an appropriate budget for the targeted market growth for SCH?
- Have the support schemes/framework conditions for investments in heat changed within the last 2-4 years?
- Is a revision of the framework conditions announced, which could affect the small-scale heat market development?
- What is the period of time before the next general (national) elections.

3. Feedstocks

3.1 The solid biomass potential is sufficient to realise small scale heat/CHP/DH projects?
- To what extent will the domestic availability of wooden biomass of forestry change by 2020?
- How large is the wood for energy potential from forests today?
- How large is the wood for energy potential from industrial residues today?
- What is the total forest wood potential (irrespective of use)?
- What is the % of forest area owned by public bodies?
- What is the difference between fellings and increment (net growth)?
- What is the % of fellings dedicated to energy purposes?
- How much of the wood for energy potential from forests is already utilised?
- How much of the wood for energy potential from industrial residues is already utilised?
- What is the amount of solid biomass feedstock used in competing sectors (e.g. fiber board industry) currently?
- Share of the total yearly wood demand fulfilled by imports on latest available year

3.2 Feedstocks are available for biofuel production
- Extra information

4. Economic instruments (prices, support schemes/guarantee, subsidies, etc.)

4.1 Financial support schemes can be claimed for investments
• What proportion of the investment in small heating appliances can be claimed in subsidies (cumulative, including tax advantages)?
• When does the scheme end granting funding for small heating appliances?

4.2 Financial support schemes can be claimed for operation
• How high is the legally guaranteed price for heat from small scale heat-only appliances?
• How long is the guaranteed duration of the small heating support scheme?
• Is the small heating support scheme threatened by a maximum public spending budget?

4.3 Prices of biomass fuels/raw material are reasonable and stable
• What is the price of wood logs?
• What is the price for pellets sold in bulk?
• What is the price for a pellets sold in retail by bag?
• What was the price volatility of wood logs over 1 year period?
• What was the price volatility of pellets sold by tonne over 1 year period?
• What was the price volatility of pellets sold by bag over 1 year period?
• What is the price volatility of competing fossil fuel prices for the last year?

4.4 Prices of fossil fuels are high and heavily taxed
• What was the average price of coal for households over the last year (2010)?
• What is the price per kWh of gas for households?
• What is the price of oil for small scale consumers?
• What is the price development of heating oil of the last 4 years?
• What is the tax on heating oil (CO2, energy, excluding VAT or ‘normal’ taxes)?
• What is VAT on biomass?
• What is VAT on gas?
• What is VAT on oil?
• What is VAT on coal?
• Is there any application/technology-driven support for the use of oil/gas e.g. Public subsidy or support by oil/gas companies
• What was the average price of electricity for private households over the last year (2010)?

5. Market aspects (volume, access to grid, etc.)

5.1 The energy sector is large and expected to grow
• Amount of coal used by small scale consumers (2010)?
• Expected growth in small-scale use of coal from 2009 to 2020
• Amount of gas used by small scale consumers (2010)?
• Expected growth in small-scale use of gas from 2009 to 2020
• Amount of oil used by small scale consumers (2010)?
• Expected growth in small-scale use of oil from 2009 to 2020
• Is the grid operator obliged to connect all renewable energy installations?

5.2 The heat market offers good opportunities
• What is the total amount of energy consumed by the small heating sector?
• What is the average age of the stock of domestic heating appliances

5.3 The heat market in the target country provides promising growth perspectives
• What is the rate of the additional heat demand until 2020 (overall, not only RES)? ((2020-2009)/2009)
• What is the growth rate of pellet heating appliances in the heat market over the last 4 years? CAGR
• What is the cumulative amount of pellets used for small-scale heat in the last available year?

5.4 The Framework conditions for fossil fuels do not impair market development
• What is the contribution of imported natural gas on the primary energy supply in real terms?
• What is the percentage contribution of imported natural gas on the primary energy supply?
• What is the contribution of imported oil to primary energy supply in real terms?
• What is the percentage contribution of imported oil to primary energy supply?
• What is the contribution of imported coal to primary energy supply in real terms?
• What is the percentage contribution of imported coal to primary energy supply?

5.5 Main features of the market for small scale heating systems
• What is the proportion of heat consumption devoted to small-heat?
• What is the total energy consumption of domestic heating sector in absolute terms?
• What proportion of domestic heat consumption is delivered through DH?
• What proportion of domestic heat consumption is fulfilled with biomass?
• What proportion of domestic heat consumption is fulfilled with coal?
• What proportion of domestic heat consumption is fulfilled with LPG?
• What proportion of domestic heat consumption is fulfilled with natural gas?
• What proportion of domestic heat consumption is fulfilled with oil?
• Which is the share of homes heated by electricity?
• What is the share of small-scale heating systems older than 15 years?
• What is the number of small-scale heating systems older than 15 years?
• What is the share of houses connected to natural gas grid?

5.6 Bioenergy is already implemented with a strong growth
• What is the growth rate of domestic heat output from biomass in the last 4 years (CAGR)

5.7 An intense competition is not recognisable
• Number of competitors providing (manufacture or sale) small-scale heating appliances
• Total amount of small-scale heating capacity sold (by existing competitors) over the last 4 years
6. Regulations (laws/mandatory targets for bioenergy, permitting, emission thresholds, etc.)

6.1 Regulatory instruments to support bioenergy markets have successfully been introduced
   • How large is the quota for RES heat in absolute terms?

6.2 Are criteria for efficiency required?
   • What is the minimum fuel efficiency value in small-scale heating systems?

6.3 Existing emission thresholds can be fulfilled with the applied technology
   • What are the dust emission limits for small heating based on solid biomass?
   • What are the CO emission limits for small heating (< 50 kW) based on solid biomass?
   • What are the CO emission limits for small heating (50 - 150 kW) based on solid biomass?
   • What are the CO emission limits for small heating (150 - 500 kW) based on solid biomass?
   • What are the OGC emission limits for solid biomass heating systems (< 50 kW)? (in mg/Nm³ at 10% of O2)
   • What are the OGC emission limits for solid biomass heating systems (50 - 150 kW)? (in mg/Nm³ at 10% of O2)
   • What are the OGC emission limits for solid biomass heating systems (150 - 500 kW)? (in mg/Nm³ at 10% of O2)

7. Project financing context (economic situation, loan, banks, etc.)

7.1 The country has a solid financial position
   • Standard and poors rating

7.2 Export friendliness
   • Euler Hermes rating
   • Corruption perception index
   • Country risk as reflected by the @rating country of COFACE
   • Ranking of feasibility of “starting a business” in the IFC-World Bank Doing Business Index
7.3 Ease of doing business
- Ranking of Feasibility of “getting credit” in the IFC-World Bank Doing Business Index

7.4 The banks are familiar with bioenergy technology and support its development
- Are there credit facilities for households to install biomass boilers?

7.5 Foreign investments are supported in the target country
- Are there any programmes implemented in the region to attract foreign investments?
- Biomass fuel prices (wood chips, pellets, etc.) are published on market places

7.6 The value of the investment is stable due to a low currency exchange risk
- Is the market part of the Euro Zone?
- Was the inflation rate of the country more or less stable within the last 4 years (CAGR)?

8. Readiness for uptake (public acceptance, stakeholder networks, etc.)

8.1 Efficient networks and information are accessible
- National and regional agencies are providing effective help to foreign companies wishing to invest
- Is there a domestic heating association, or similar corresponding body, assisting the market?
- Public web sites/information/market reports on bioenergy

8.2 Public acceptance/knowledge of technology
- Is modern wood heating for households known to and well-regarded by general public?
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