A spring-board for your exports

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

EU Handbook
District Heating 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

The Cross Border Bioenergy project is supported by the Intelligent Energy Europe programme (IEE/09/933/S12.558306)

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**Glossary**

**BBE** - Bundesverband Erneuerbare Energie e.V.
**BMU** - German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
**CHP** - Combined Heat and Power
**DERA** - Danish Regulatory Authority
**DKK** - Danish currency: Krone
**EEC** - Energy Efficiency Credit
**EEG** - Erneuerbare-Energien-Gesetz
**EMS** - European Monetary System
**EU ETS** - EU Emissions Trading System
**FNR** - Federal Agency for Renewable Resources
**HUF** - Hungarian currency: Forint
**IFC** - International Finance Corporation
**ITABIA** - Italian Biomass Association
**KÁT system** - current Hungarian support program for energy from RS
**LIAA** - Investment and Development Agency of Latvia
**LSFRI** - Latvian Forest Research Institute
**LSUA** - Latvian Association of Heating Companies
**METÁR system** - Hungarian support program for energy from RS, which is supposed to replace the current KÁT system in January 2013
**ÖNACE** - Austrian classification of economic activities of companies
**RENERGIE** - Raiffeisen Managementgesellschaft für erneuerbare Energie

**RES** - Renewable Energy Sources
**RES-H** - Renewable Energy Sources - Heating
**RS** - Renewable Sources
**SRC** - Short Rotation Croppice
**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 possibly to implement flexibility projects as mentioned in the RES directive.

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 the different bioenergy markets in Europe. The B2B-plattform can support direct action by facilitating contact and networking between bioenergy stakeholders and companies. In this section of the website, furthermore 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 the 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 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 district heating sector is available in the biogas 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 DH

Almost 50% of the total energy consumed in Europe is used for the generation of heat. Renewable energy for heating covered 11.9% of total final energy consumption in 2008 and 5.5% of the total gross final energy consumption of the EU27. 68 Mtoe out of the 565 Mtoe of total final energy consumption for heating were covered by renewable energy.¹ Biomass used for heat covers 55% of all RES. On average, over 80% of heat supplied by district heating (DH) originates from renewable energy sources or heat recovery (i.e. from electricity production or industrial processes).²

DH currently covers 10% of the total heat demand in Europe. There are more than 5,000 medium and large scale DH systems, with an annual turnover of €20 billion and 2 EJ (556 TWh) heat sales. However, market penetration of DH is unevenly distributed. While DH has an average market share of 10% in Europe, it is particularly widespread in North, Central and Eastern Europe where market shares often reach 50% and more (see Table DH Volumes).³

District Heating and Cooling (DHC) is cost-effective and ecofriendly. Increasing the use of renewables and the share of CHP, DH is one target of the EU RES-Directive for 2020. An increasing number of national governments have identified DHC as an efficient technology to achieve the main objectives of the European legislation regarding sustainable energy. According to the European Technology Platform on Renewable Heating and Cooling⁴ over 25% of heat consumed in the EU could be generated

¹ Eurostat, http://ec.europa.eu/eurostat
² AEBIOM, www.aebiom.org
³ Euroheat & Power, www.euroheat.org
⁴ RHC-Platform, www.rhc-platform.org
through renewable energy technologies in 2020; by 2030, renewable heating and cooling could supply even more than half of the heat used in Europe. Strongly required new investments and modernizations of energy plants, pipelines and fuel procurement machinery fleets are underway in the cross border bioenergy markets.

Table ‘DH Volumes’: District Heating Volumes in 2009

Source: Euroheat 2009
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)

"Overall attractiveness of European Countries for District Heating"

The map displays the overall attractiveness of the EU27-member states’ DH 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.

Scoring ‘Basic Data’

In 2010, total contribution of bioenergy was 85.3 Mtoe in the EU27. The share of bioheat was 72%, 61.4 Mtoe. The overall target according to the NREAPs is to increase the annual use of bioenergy up to 138.3 Mtoe in 2020, with bioheat accounting for 65% (90 Mtoe).

Thermal heat-only plants are used alongside CHP plants. However, one of the EU’s targets is to increase the share of CHP. At present, cogeneration supplies around 13% of the heating market and the installed CHP capacity (about 95 GWe) accounts for about 11% of electricity demand. The Commission estimates that CHP could produce 18% of the total electricity demand by 2020. The critical factor regarding the construction of CHP plants is how easily the heat created in the process can be sold. When there is demand for the heat, the efficiency of a CHP plant is always better than in separate heat and power production. On average, over 30% more energy is derived from the fuel when the plant produces both electricity and heat.

As a fuel, natural gas dominates the CHP market (about 40%), followed by coal (27%). Renewables, mainly biomass, but also combustible waste, are becoming increasingly important having reached 10%. CHP systems have reached a significant stage of penetration in the EU industry sector, producing approximately 16% of final industrial heat demand. CHP plants, which produce heat and electricity concurrently, account for almost 63% of EU-27’s bioenergy production from solid biomass. Important growth is assumed in biomass-based CHP, mainly in DH but also in industry.

The assumption is that biomass CHP installations represent approximately 2/3 of the total installed capacities of biomass based power plants. CHP reduces both, GHG emissions and fuel costs since it uses fuels more effectively. An international study, co-financed by the Commission, confirms the possibility of saving an extra 400 million tons of CO₂ annually by increasing the share of
The share of renewable energy sources used in the generation of DH is constantly increasing (see Figure Composition of DH'). At the same time the share of coal, oil and petroleum products used have decreased whilst their prices have increased. Creating conditions for the expansion of DHC schemes will, thus, secure a more sustainable energy system.¹

¹ EuroHeat & Power, www.euroheat.org
increased. This development, together with the large scale utilisation of CHP technologies, makes DH one of the most interesting sources for heating. The obligation to reduce CO$_2$ emissions and to increase the share of renewable energy in order to meet European requirements is regarded as one of the main drivers for the development of DH. An increasing number of national governments have identified CHP/DHC as an efficient technology to achieve the main objectives of the European legislation regarding sustainable energy. Also the demand for cooling, especially in new buildings with high standards, is growing and, therefore, the market for district cooling is enlarging. It can be estimated that approx. 260 TWh of electricity are currently consumed for cooling in Europe. Given the rapid increase of cooling demands, the potential for savings is enormous.

The majority of energy use takes place in urban areas where DHC networks represent a critical infrastructure to ensure large scale integration of RES. The large majority of renewable heating and cooling will still be produced from biomass sources. RHC-Platform expects biomass use to more than double by 2020 - mostly to meet heat demand. Markets are open for modern heat-only and CHP plant technology investments, all size multifuel boilers, heat networks, fuel supply technologies, logistic systems, and RES-fuel trade possibilities are available on the European and global level.

Figure 'Sales': District Heating Sales
Figure ‘Composition of DH’: Energy supply composition of generated DH
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 below.

The dependency on foreign fossil fuels, geopolitical instability as well as climate and environmental issues are the driving energy security aspects which have heightened the importance of renewable and domestic fuels as an element of the energy, environmental and agricultural policy. The EU energy policy has three principal aims: sustainable development, competitiveness, and secured energy supply. The measures to achieve these goals are the improvement of energy efficiency, the deployment of new technology, and a better utilisation of RES.

The EU has set the following objectives for its member states until the year 2020:

- To reduce GHGs by 20% compared to the year 2005, to increase the share of renewable energy by 20%, and to increase the energy efficiency by 20%. Besides the common RES (20%) and renewable energy target for transport (10%), the directive sets the national renewable energy targets for all 27 members of the EU. EU targets are binding but divided individually among the member states. The member states had to adopt NREAPs with binding targets for heating and cooling, electricity and transport biofuels from renewables. It is up to member states, however, to decide on the mix of contributions from these sectors to reach their national targets,
choosing the means that best suit their national circumstances. Nevertheless, each member state will have to achieve at least a 10% share of renewable energy (primarily biofuels) in the transport sector by 2020. RED/NREAPs and ETS (emission trading system, zero emissions rating of bioenergy) represent strong demand drivers.

The Directive on the promotion of renewable energies is expected to have a strong impact on the heating and cooling sector as it addresses not only electricity but also the heating and cooling markets for the first time in Community law. After 2014, the Directive indicates that Member States shall allow (for new and renovated buildings) minimum levels of renewable energy sources to be supplied by District Heating and Cooling networks using a “significant proportion” of renewable energy sources (AEBIOM 2011 Annual Statistical Report).

DH can greatly contribute to achieving policy objectives. According to Euroheat\(^1\), doubling sales of DH by 2020 will reduce Europe’s primary energy supply by 2.6% or 50 Mtoe/year, diminish its import dependency by 105 Mtoe/year, and lower its CO\(_2\) emissions by 9.3% or 400 Mtoe/year. Thus, the obligation to reduce CO\(_2\) emissions and to increase the share of renewable energy in order to meet European requirements is considered as one of the main drivers for the development of CHP DH. An increasing number of national governments have identified CHP/DHC as an efficient technology to

\(^1\) www.euroheat.org
achieve the main objectives of the European legislation regarding sustainable energy.

The EU's official scenarios for renewable energy supply assume heat and power production from biomass to more than double from today's level of 800 TWh to 1700 TWh by 2020, and to 2700 TWh by 2050. To increase the use of RES and to decrease still existing barriers, there are already many directives concerning RES in place. The EUR-Lex database of the EU portal contains all relevant legislation. The subject areas of energy and the environment alone contain more than 500 paragraphs of law. More information about national RES-policies, invest and trade funding possibilities, grants, incentives etc. is available in the following chapters of this handbook.
2.4. Feedstock Potential

This category analyzes the biomass potential for the development of DH 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, but this potential still has to be developed at the local, regional, national and international level. Biomass is by far the most important source of RES energy in Europe. CHP/DH plants can use different types of fuels. Biomass represented 68.6% (104.7 Mtoe) of the consumption of RES in the EU in 2009.\(^1\) The EUBIONET III Project\(^2\) has estimated that the total practical biomass potential for energy is 6.577 PJ (157 Mtoe, EU24 and Norway in 2006), of which 67% is woody biomass and about 48% of the estimated biomass potential is exploited. EEA has calculated that the environmentally com-

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2. www.eubionet.net
patible bioenergy potential in the EU25 amounts to 187 Mtoe in 2010, 228 Mtoe in 2020 and 284 Mtoe in 2050. For the EU27, the results are 10% higher (see Figure ‘Bioenergy Sources’). The biomass will stem from wastes and residues (100 Mtoe), energy crops from agriculture (85 Mtoe) and wood fuel directly from the forest (43 Mtoe) in 2020.³

Amongst the whole usable practical biomass potential forest (41%) and waste (38%) sectors can contribute the lion’s share. The remaining 21% may come from the agricultural sector and is scattered over many different small categories. Within the agricultural group, the largest contribution may come from straw, dedicated cropping and prunings.⁴

The largest potential for cheap input materials, especially in Central and South Europe, comes from waste and residuals from agriculture and perennial crops on released agricultural lands. Residuals from agriculture are underutilized, especially in regions where suitable energy plants and boilers are not yet available. Biomass produced from agrofields consists of residues (straw, etc.) and specifically cultivated crops (for example, miscanthus, poplar, willow, reed canary grass, rapeseed and maize). In agriculture the main sources of residues come from arable crops in the form of straw and from maintenance of permanent crop plantations like fruit and berry trees, nuts, olives, vineyards, and citrus: the total potential of energy from by-products could amount to 6734 ktoe per year and the total straw potential was 16.475 ktoe in 2004 and is expected to

³ AEBIOMs 2011 Annual Statistical Report
⁴ AEBIOM, www.aebiom.org
Around 40% (178 million hectares) of the EU27 land area is forest and other wooded land. 75% of the total forest area is available for wood supply, with a growing stock of 21,750 million m³, increment 768 million m³ and fellings 484 million m³ in 2010. The annual potential for energy of forest biomass (primary residues, whole trees for energy, logging residues and stumps) is 35-40 Mtoe, while the current use of forest residues was estimated to be 8.5-9 Mtoe (25% of the potential). The Forest Energy Potential in Europe (EU27) is for instance reported by the Finnish Forest Research Institute.\(^7\)

Six EU Member States have more than half of their land area covered by forest and other wooded land: Finland (77%), Sweden (76%), Slovenia (63%), Latvia (56%), Spain (55%) and Estonia (54%). The lowest shares are found in Malta.

\(^5\) www.eubionet.net and www.aebiom.org
\(^7\) http://www.metla.fi/julkaisut/workingpapers/2008/mwp069.htm
(less than 0.5%), the Netherlands (11%), Ireland and the United Kingdom (both 12%), and Denmark (14%). The largest present round wood production is in Sweden, France, Germany and Finland, but also smaller countries like Austria, Czech Republic and Latvia have a large present production. Most of the wood production is going to the wood-industry for non-energetic use. Primary forestry residues (e.g., logging residues, early thinning wood and extracted stumps) will be available proportional to the amount of round wood harvested. The regions with a relatively large contribution to the primary forest residues are concentrated in France, Italy, Finland, Germany and Sweden. Also European pellet trade and export from outside Europe has grown rapidly and will continue.

The potential sources of forest fuels are felling residues, stumps from current fellings, and the complementary fellings from the annual change rate surplus, including roundwood, crown mass and stump wood. It was estimated that felling residues total 211 million m³ annually. Annually harvestable residues were estimated to be 76.5 million m³. Annually harvestable stump wood was estimated to be 7.4 million m³. The total amount of annually harvestable residues and stumps is altogether 83.9 million m³ which could be used for energy production. If complementary fellings were to be 25% of the annual change rate surplus and directed entirely to energy use, 101.6 million m³ (solid) of above ground biomass and about 1.2 million m³ (solid) of stump wood could be used for energy annually. Thus the available forest fuel totals is about 187 million m³ per year, i.e. about 150 million tonnes of fresh wood, which corresponds to about 411 TWh of energy or 36 Mtoe.\(^8\)

Competition for wood resources is increasing, and, obviously, fulfilment of the demands for industrial use, energy production and protection would require compromises. The forest sector offers large energy use potential almost in every country. Wood and wood waste accounted for more than three quarters of gross inland energy consumption from renewable sources in 2009 in Estonia (97%), Lithuania (87%), Poland (83%), Finland (82%), Latvia (80%), and Hungary (78%). The lowest shares were recorded in Cyprus (16%), Italy (23%), the United Kingdom (27%), and Luxembourg (28%). The utilisation of forest residues is often connected with industrial round wood harvesting especially in the Nordic countries. Hence, the use of round wood by the forest industry impacts also the exploitation of the forest residue potential and prices. Industrial by-products and processing residues (bark, sawdust, cutter chips, grinding dust, black liqueur etc.) are already exploited in energy production quite well. European pellet trade between the countries and import from outside Europe has grown rapidly and will continue.\(^9\)

Long-period practical experience and knowledge is existing about forest fuels, pellet and peat procurement, logistics

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\(^8\) EU and Finnish Forest Research Institute www.metla.fi
\(^9\) European Commission, AEBIOM
and combustion (Scandinavian fuels). But biomass is also exported and imported more and more. The biomass trade is global and the trend is to use different kinds of mixed biomass sources: 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 is one challenging issue already today.¹⁰


<table>
<thead>
<tr>
<th>Year</th>
<th>2007</th>
<th>2020</th>
<th>2030</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Primary Energy Consumption</td>
<td>98</td>
<td>220</td>
<td>300</td>
<td>370</td>
</tr>
<tr>
<td>Total Final Energy Consumption</td>
<td>78</td>
<td>175</td>
<td>261</td>
<td>357</td>
</tr>
<tr>
<td>Made up of:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heat (biomass for heat and derived heat)</td>
<td>61</td>
<td>124</td>
<td>182</td>
<td>231</td>
</tr>
<tr>
<td>Electricity</td>
<td>9</td>
<td>20</td>
<td>35</td>
<td>56</td>
</tr>
<tr>
<td>Biofuels</td>
<td>8</td>
<td>32</td>
<td>45</td>
<td>70</td>
</tr>
</tbody>
</table>

Table ‘Potentials’: Potential objectives for bioenergy, including aq breakdown according to the final form of the energy, Mtoe

Source: AEBIOM
2.5. Business Cases

The business case analyzes the price levels, subsidy guarantees and support schemes that can affect the viability of specific bioenergy technology applications. In the Figure ‘Business Case’, the scores of all EU countries in this category are shown.

It has been calculated nowadays 400 billion USD public money are still used to support fossil fuels compared to 60 billion which are spent in renewable energy sources. Fortunately, most of European countries have the target to increase the use of domestic fuels and renewables. RES Directive 2020 is one important supporter for this issue in the Member States.

The consumption of RES has significantly increased in the recent years in Europe. The main focus has been and will be on biomass while hydro power stagnates and solar and wind energy show impressive growth rates, but start from a relatively small market share. The increasing use of biomass will offer a large variety of business and technology transfer markets and export possibilities to the stakeholders. Markets are open also for DHC plants of different type and size and networks/grids for bioheat, bio-cooling and CHP.

Europe is one of the world’s strongest economy and a main player in world business with its population of 700 million (EU27: 503 million in 2011). In the EU27 internal trade between the member states is fostered by the removal of barriers
to trade such as tariffs and border controls. In addition, worldwide export/import business in Europe is a huge and growing market area itself. Typical facts are high-quality education, historical but modern infrastructure with up-to-date telecommunication systems, highest standards of living, powerful industry and capacity, dense logistical systems, high-tech knowledge etc. Moreover, 17 states are members of the Eurozone decreasing the currency exchange risks for investors from other Eurozone member states. Currently, however, the financial crisis is affecting some member states, influencing the economic stability which might cause temporary barriers for some investments. However, the energy sector is a reliable investment sector. More electricity, heat and cooling is needed. Sustainable development, environmental issues, energy efficiency, the “phase-out of fossil fuels” are also the trends in European community. All countries in the EU have committed to the Kyoto Protocol, and the EU is one of its biggest proponents. Renewable energies in general are warmly welcomed by society, and as bioenergy is the largest energy source in Europe, the market is well aware of the importance of bioenergy. The accelerated development of RES in Europe is accepted by a huge majority.

The future of the development of biomass also depends to a large extent on the incentives created by the EU member states. The potential of bioenergy technologies to further penetrate the electricity and heat market depends on:

<table>
<thead>
<tr>
<th>Score</th>
<th>District Heating subsidies (in % of investment costs [cumulative, including tax advantages])</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>Agricultural appliances max. 40 %, commercial appliances max. 30 %</td>
</tr>
<tr>
<td>Germany</td>
<td>30% Umweltinnovationsprogramm 40 EUR/kW with efficiency of &gt;70%, for systems &gt; 100 kW - 2 MW</td>
</tr>
<tr>
<td>Estonia</td>
<td>50%</td>
</tr>
<tr>
<td>Finland</td>
<td>30-40%</td>
</tr>
<tr>
<td>Hungary</td>
<td>&gt; 30%</td>
</tr>
<tr>
<td>Lithuania</td>
<td>50%</td>
</tr>
<tr>
<td>Latvia</td>
<td>40%</td>
</tr>
<tr>
<td>Slovenia</td>
<td>40-50%</td>
</tr>
<tr>
<td>Slovakia</td>
<td>&lt; 10%</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>European Union</td>
<td>17,577.7</td>
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<tr>
<td>Germany</td>
<td>3,577.0</td>
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<tr>
<td>France</td>
<td>2,776.3</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>2,417.6</td>
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<tr>
<td>Italy</td>
<td>2,198.7</td>
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<tr>
<td>Spain</td>
<td>1,493.5</td>
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<td>Netherlands</td>
<td>840.4</td>
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<td>Poland</td>
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<td>Belgium</td>
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<td>419.2</td>
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<td>Denmark</td>
<td>333.2</td>
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<td>Greece</td>
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<td>Portugal</td>
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<td>Ireland</td>
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<td>Estonia</td>
<td>22.2</td>
</tr>
<tr>
<td>Malta</td>
<td>8.9</td>
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</tbody>
</table>

Source: The data for GDP and GDP per capita (PPP) are based on the World Economic Outlook, April 2012 (International Monetary Fund, www.imf.org)
• The sustainability of biomass sources
• The competitiveness of energy or other products based on biomass
• The rate of progress of biomass technology

The CHP sector generally shows that feed-in tariffs and other incentive schemes for renewables can be very effective to contribute to huge market growth in the energy sector.
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.

DH is adopted in large quantities in European cities and municipalities. Heat-only technologies and plants are the most common, while district cooling is developing and doing so increasingly during the last decades. CHP has already reached a large share of energy supply in some countries, especially in the northern part of Europe. Traditionally, DH-plants have been fossil fuelled. Often they have obsolete technology, marked by energy losses and negative environmental outputs. The EU’s new energy and environment policies have influenced changes of the old energy production model. Modern multifuel boilers and feeding conveyers have been adapted, new technology solutions have come
into the market, bioCHP systems have increased etc. Also different kinds of fuel mixes have been adapted to energy plants. Change is overall relatively slow but firm, and in the single regions the switch to local renewables is constantly ongoing. This is mainly initiated by the targets to increase energy and fuel self-sufficiency, to improve work possibilities, to support the local economy, to improve environmental conditions etc. With continuing urbanisation modern biobased DHC with or without power production will also constantly increase. The main reason for the popularity of DH is its cost-effectiveness and eco-friendliness.

By scale and size, the sector’s business and technology area and markets are very large. DH-bioplants investments with boiler systems also require heat networks with pipelines, pumps, heat exchangers, radiators, control and safety equipment, valves, and temperature meters. Also biomass production and fuel supply to the plants will offer a variety of technologies and logistical possibilities for stakeholders in the market. Boiler capacities for DH-purposes vary from 1 MW (thermal) boilers up to many hundred MW boilers (heat-only or CHP). Especially multifuel boilers are popular with plant owners. Small size DH systems are based on boilers under or slightly above 1 MWth, generally grate firing technologies. This DH capacity can only deliver heating for a small amount of buildings. In larger municipalities the heating network is usually connected to
a 3-6 MWth boiler, which also produces electricity if it is a CHP boiler (1-3 MWe). In large cities with office buildings and industry, areas boiler capacities reach up many hundred MWth and more. Often these boilers are CHP plants with remarkable power capacity.

Multifuel boilers can use many kinds of biomass fuels. However, the availability and cost of different types of biomass varies considerably between countries and regions. In general, the availability of biomass resources, its quality, and the demand for fuels, as well as machine and labour costs are the defining factors. They must be studied on a local level in order to attain reliable results.

The key technologies of the sector are combustion or gasification of solid biomass and generation of heat-only or CHP. For combustion there are several technologies (grate firing systems, fluidized bed combustion systems, jet blower firing, gasification systems etc.). Same kind of basic boilers are suitable for both Heat-only and CHP plants in medium and large scale plants. Fuel quality and logistic development in transport together with the utilisation of cogeneration technologies make DH one of the most popular sources for heating. However, heat demand varies highly on the season in most countries. Whilst in winter all waste heat can be used, the demand during summer is not that high. Because of this the district heat demand and consumption varies monthly. Moreover, weather conditions also differ within the geographical scale of countries and regions. Therefore, good insulation of CHPs and heat-only plant’s district heating pipes
According to AEBIOM’s calculation, biomass input in 2008 to DH amounted to 4.1 Mtoe and to 34 Mtoe for electricity and CHP respectively. When CHP also produces heat, the sector’s output sums up to 7.8 Mtoe. The target for bioheat derived from DH and CHP by 2020 is 14 Mtoe.

improves energy efficiency in Nordic and Eastern Europe. In Nordic countries this is even obligatory. The pipelines used in Scandinavia consist of two service pipes made of steel, surrounded by polyurethane thermal insulation. The insulation layer is protected by an outer casing made of polyethylene plastic. A similar structure is currently used also elsewhere in Europe, but the two-pipe design is a Finnish and Swedish speciality. The structure of district heating pipes is standardized by means of European EN standards. However, at present all one-pipe and two-pipe structures use the maximum insulation thickness, the so-called series 3 specification. So, the thermal insulation on Scandinavian district heating pipes is thicker than in other European countries.

Also biomass production and handling technologies and logistic system markets will offer huge possibilities to cross-border business activities. Rapid development of technologies will enable the production of high quality fuels, improve energy security and sustainable supply, offer clean and effective combustion processes and optimally-integrated solutions for the inhabitants of the communities (households, offices, shops, service buildings and industry).

The 2020 and 2050 targets for biomass district heating promises expansive markets to all stakeholders: The RHC-Platform expects biomass use to more than double by 2020 and to reach around 370 Mtoe of primary energy in 2050, mostly to meet heat demand (231 Mtoe total contribution to heat demand in 2050).
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.

For stakeholders and investors there are different laws, regulations, financial support systems, limiting values for noise emissions and emissions in every country. Due to the fact that technology standards often differ amongst countries, a higher degree of harmonization is urgently needed. The main targets and tools used to increase the use of renewables are seen in the national renewable action plans.

For biomass trading there are European CEN standardization rules which are used in many countries. For instance CEN/TC 335 standards for solid biomass fuels including EN 14961 standards for wood fuels. For biofuels the availability and prices of biomass raw materials, logistics
and other production costs play an important role when competing with fossil fuels prices. Market information will be easier to access through their increased availability on internet portals, enabling stakeholders to access price information on energy raw material almost in real time.
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 a 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 have increased their involvement in supporting RES projects significantly. As an example, the EIB’s loans to the RES sector reached over €4 billion in 2009. International and numerous local banks offer financing in the EU27 countries. Some are specialized in investments into renewables. Capital availability in the renewable sector from the banks is influenced by a number of factors:

1. Capacity of banks to offer long-term credits 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.

The European Commission provides special funds and programs for the energy and environmental sector. Huge amounts of different kinds of R&D and demonstration and invest programs exist at state and country level. Also incentives, feed-in tariffs and green certificate systems exist, but they differ strongly between countries. The best way to go for interested investors is to contact the related energy and bioenergy associations first. Countries which are the member of the Eurozone, currency exchange risk for investors coming from other Eurozone member states is low.
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.

The readiness for uptake for the CHP and DH sectors with renewables in Europe is considered to be good, though new projects need to be planned and implemented in a considerate way under participation of local inhabitants and stakeholders.

Currently under preparation, the European Technology Platform on Renewable Heating and Cooling with other Biomass Associations like AEBIOM, 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 indus-
try, but in the meantime, ways to commercial success must be found by using existing technologies.

New capital investments in the production of district heat will increase in European countries. The use of fuels is flexible in modern energy plants. Also building-specific oil heating is continuously being replaced by DH in cities and municipalities.
3. COUNTRY ATTRACTIVENESS - IN DEPTH ANALYSES

3.1. AUSTRIA

Austrian Biomass Association (ABA)
Christoph Rosenberger
Franz Josefs-Kai 13
A-1010 Wien
Tel.: +43-1-533 07 97 25
Email: rosenberger@biomasseverband.at

3.1.1. Overview Chart

In the general scoring for sector, Austria - Upper Austria is rated place 53 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 Graph ‘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 294 km) 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.

8.4 million Austrian inhabitants were...
counted at the beginning of 2011. By 2050, the figure should reach ca. 9.4 million, according to projections. The municipality with the largest population is Vienna, which had 1.7 million residents at the beginning of 2011. A fifth of Austria’s population thus lives in the federal capital. Next come the provincial capitals Graz (262,000 residents), Linz (189,000 residents), Salzburg (148,000 residents), and Innsbruck (120,000 residents). Austria’s weather is characterized by a transitional climate. This means, an oceanic climate with moist westerly winds predominates in western Austria, and as one moves eastward, the climate becomes increasingly continental with decreasing precipitation, hot summers, and cold winters. In addition, the local climate is strongly influenced by the altitude, local topography, and exposure to the prevailing westerly weather conditions.

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

3.1.3. Energy Policy

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 renewable sources in 2010. The measures are diverse, there are on the one hand Initiatives sensitizing the public to energy issues (e. g. ‘klima:aktiv’), and on the other hand several subsidies as well as suitable framework conditions to promote renewable energies were created.²

² Source: Erneuerbare Energie in Zahlen – Die Entwicklung erneuerbarer Energie in Österreich im Jahr 2010; Bundesministerium für Land- und Forst-
According to the EU internal burden-sharing, Austria has to reduce its emissions by 13%. In the year 2009, greenhouse gas emissions in Austria reached 80.1 million tons. Thus, the emissions of the year 2009 were 11.3 million tons above the Kyoto target that was established for the period from 2008 to 2012. When also taking into consideration the emissions trading, the project of Joint Implementation and Clean Development Mechanism and the balance from afforestation and deforestation the deviation from the target is about 5 million tons of CO₂-equivalents. So the over-all gap from the years 2008 and 2009 results 11.9 million tons CO₂-equivalents. To keep the over-all gap as small as possible the implementation of effective domestic measures is necessary.

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

Due to these requirements, Austria is bound to:

- increase the share of RES of the total energy consumption to 34% – the share in the transport sector should be at least 10% and
- reduce the energy consumption by 20% compared to the prognosticated level of the year 2020 by improving the energy efficiency.

The Table ‘Expectations Bioenergy’ shows the development and the expectations of bioenergy consumption in Austria from 2005 to 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. 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. In Austria national incentives support a further development of the infrastructure and the security of supply of DH. From 2009 to 2018, an annual expansion of the DH-grid up to 144 km length is assumed. The investment incentives for DH from RS focus especially on the development of small-scale heating supply in rural areas. Other measures are the further education of professionals in the
Table ‘Expectations Bioenergy’: Consumption of Bioenergy in Austria – Development & Potential from 2005 to 2020

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**SUM OF BIOENERGY**: 140.2, 181.5, 210.9, 237.2

construction sector. According to ‘Energiestrategie Österreich’ an amount of 38.2 PJ will be produced by DH from RS by 2020.

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

- For private households the replacement of fossil heating systems by modern biomass heating systems - pellets, wood chip and log wood combustion, biomass district heating – needs to be focused. Thus investment programs for the installation of modern biomass heating systems must be well considered in the budgets of the federal states. 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 the Climate and Energy Fund 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 included.
- 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 refurbishments 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.
- To increase the efficiency and to optimise biomass district heating plants, micro-grids and commercial biomass plants, a benefitting framework of 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 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 km$^2$.

National 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 had an impact on agriculture and forestry: As in

3 Federal Research and Training Centre for Forests, Natural Hazards and Landscape; http://bfw.ac.at
most other EU member states, a steady downward trend in the number of operations is 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 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 economically healthy, productive, farmer-oriented agriculture and forestry in a functional rural community.\textsuperscript{4}

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 in Austria about 46,500 ha of arable land and grassland were used for the production of biomass, while energy crops cultivated 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


<table>
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<th>Federal state</th>
<th>Area. in km\textsuperscript{2}</th>
<th>Agricult. use</th>
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</table>

Table ‘Land Use’: Percentage of land use\textsuperscript{1}) in Austria 2010

Source: Federal institution of Statistics Austria: Facts & Figures – Annual edition 2011; 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
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 in Austria about 1,000 ha of short rotation wood and 800 ha of miscanthus were used energetically. It is estimated that the area used for short rotation crops can be extended to 15,000 ha until 2020. The 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, using the straw from 15 % of the Austrian corn cropland (about 92,000 ha) could produce 3.8 PJ of 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.5

3.1.5. Business Case

The total turnover of investments in renewable energy technologies reached €5.229 billion in 2010, which was a 5.1 % increase compared 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 is, however far bigger than just the turnover and employment effects. The ability to generate energy from domestic sources reduces the need of fossil fuel imports. Hence the national economy will be less prone to crisis. In a longer term the economy will gain sustainability.6

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 then recovered again in 2008. In 2010 the sales figures dropped once more, most noticeably for domestic logwood boilers. The underlying causes are a reduction in public support schemes and the delayed effects of the economic and financial crisis. 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 8 shows the number and capacity of annually newly


Biomass district heating has a long tradition in Austria, dating back to the early 1980s. In 2010, about 1,880 plants with a total capacity of 1,600 MW were in operation, supplying 3,200 GWh of heat to their customers. District heating plants used about 1.2 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 ‘Number and Capacity’ shows the number and capacity of annually installed biomass boilers < 100kW heat output, whilst Figure ‘Newly Installed’ 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 consumption of bioenergy increased by 30 % from 140 PJ in 2005 to 182 PJ in 2009 (Figure ‘Final Energy Consumption’). The heating market is the main sales market for biomass with a share of 79 %, followed by the biofuel market with...
Figure 'Newly Installed': Number of annually newly installed Biomass Boilers > 100 kW Heat Output from 1996 to 2010 in Austria

![Graph showing number of newly installed biomass boilers](image)

Source: Chamber of Agriculture, Lower Austria, Biomass Heating Survey; publication: "Basic Data Bioenergy 2012"; published by Austrian Energy Agency and Austrian Biomass Association

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

![Graph showing biomass stove sales](image)

Source: Bioenergy 2020+; publication: "Basic Data Bioenergy 2012"; published by Austrian Energy Agency and Austrian Biomass Association
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 by 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 ‘Production Development’). During this period, the heat from biomass 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 small scale heating. 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 efficiency. With the fuel amount saved through the replacement of old appliances, further 45,000 households can be heated.

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). A significant decline of 170,000
households from previously 738,666 households could also be observed in the use of heating oil and liquid gas systems. There are 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 ‘Space Heating’ shows the energy consumption from space heating in Austrian households 2003/04 to 2009/10. Figure ‘Heating Technologies’ shows the heating technologies used in Austrian households 2003/04 to 2009/10.

3.1.7. Regulation

There are numerous regulations in Austria that affect the operation of heating systems based on biomass. The most important ones are listed below.

Both norms „Emissionsschutzgesetz für Kesselanlagen – EG-K“ and „Luftreinhaltungs-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 to approval and already approved appliances with a capacity of more than 50 kW.

The „Abfallverbrennungsverordnung (AVV)“ regulates combustion techni-
3.1.8. Project financing

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

Austria positions itself sees on the fifth place of whole Europe after Luxembourg, Norway, Sweden and Switzerland in the COFACE country risk rating. According to the Corruption Perception Index for the level of transparency Austria took the 16th po-

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

Austria achieved the 32nd place of 183 reviewed countries in the ‘Ease of Doing Business’-ranking of the IFC. So the ease of doing business is seen to be quite well in Austria although the rank of ‘Starting a Business’ is relatively low in consequence of the very high administrative and regulative requirements.

**Useful links:**

Facts and figures:
- **DEPV - German Wood Fuel and Pellet Association**
- **DEPI - German Pellet Institute**
- **FNR - Federal Agency for Renewable Resources, [www.fnr.de](http://www.fnr.de) / [www.bienergie.de](http://www.bienergie.de)**
- **Federal Ministry of Economics and Technology**
- **BMELV - Federal Ministry for Environment, Nature Conservation and Consumer Protection**
- **KfW - KfW-Bankengruppe**
- **Ministry of Environment, Climate Protection and Energy Sector**
- **Bank for Baden-Wuerttemberg**
- **LfA - Förderbank Bayern**
- **ILB - Investment Bank of the German State Brandenburg**
- **Umwelt Unternehmen Bremen**
- **City of Hamburg**

10 Corruption perceptions index 2011, [http://cpi.transparency.org/cpi2011/results/#CountryResults](http://cpi.transparency.org/cpi2011/results/#CountryResults)
3.2. Germany

German Bioenergy Association (BBE)
Thomas Siegmund
Godesberger Allee 142-148
D-53175 Bonn
Tel.: +49-228 81 002-22
Email: siegmund@bioenergie.de

3.2.1. Overview Chart

Country Score Bavaria - DH (November 2011)

In the general scoring for sector, Germany - Bavaria is rated place 2 out of total 81. The underlying categories that influence this result are displayed in the bar chart above.

3.2.2. Basic Data

Germany, officially the Federal Republic of Germany, is a federal parliamentary republic in Europe. The country consists of sixteen federal states while the capital and largest city is Berlin. Germany is with 357,104 km² land area one of the largest countries in Europe, located in a temperate climate zone with -0,5 degree Celsius in January and 17 degree Celsius in July on average. The forest area in Germany amounts to 107.000 km² (nearly 30% of the whole land area). 188.000 km² (52% of the land area) is agricultural land (grassland, parkland, heather, marshland, gardens).¹

The total population is 81 million.

¹ Federal Office of Statistics: www.destatis.de
The population density is with 229 inhabitants/km² on average considered to be attractive, providing sufficient sales potential even on regional scale, although there are differences in real terms with lower densities in eastern and northern parts of Germany in relation to western and southern regions.

**Useful links:**

Facts and Figures:
- Johann-Heinrich-von-Thünen-Institut
- Federal Ministry for Food, Agriculture and Consumer Protection
- Federal Statistical Office
- EUROSTAT
- German Renewable Energies Agency Information Platform, [www.unendlich-viel-energie.de](http://www.unendlich-viel-energie.de) and [www.foederal-erneuerbar.de](http://www.foederal-erneuerbar.de)

### 3.2.3. Energy Policy

The German government aims at reaching a share of RES of the final energy consumption of approximately 20% in 2020, thereof 14% in the heat sector - rising to 80% in 2050. 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, a development of biomass-fired district heat systems will be necessary. Due to its characteristics as a storable feedstock and a flexible energy supplier, bioenergy will play a key role in this strategy. The most important support scheme is the Renewable-Energy-Heat-Act and the integrated ‘market incentive program for renewable energies’ (MAP).

The Federal Ministry for Environment, Nature Conservation and Nuclear Safety (BMU) established the law and authorized the KfW-Bank to support biomass heating systems (see Figure ‘Permitted Grants’).

The KfW-Bank hereby supports in addition to pellet and wood chip plants (nominal heat output bigger than 100 kilowatt) also district heating networks fired with renewable energies.

A major focus of the KfW-Bank is to implement the program of the BMU to promote renewable energies. It is the bank’s task to give grants and, thereby, to promote the increasing use of renewable energies in order to conserve the limited resources of fossil fuels and to contribute to environmental and climate protection goals. Assistance is provided for solar units and biomass units with heat grid. Under the program ‘Marktanreizprogramm – Erneuerbare Energien Premium’ KfW gives grants for communes and companies who want to install a biomass boilers or a biomass-fired heat grid.

The purpose of the Renewable-Energy-Heat-Act is to facilitate the sustainable development of energy supply, particularly for the sake of protecting our climate and the environment, to reduce the costs of energy supply to the national economy, also by incorporating exter-

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2 Erneuerbare-Energien-Wärmegesetz (EEWärmeG): [www.bmu.de](http://www.bmu.de)

3 Market incentive program (MAP): [www.bmu.de](http://www.bmu.de)
nal long-term effects, to conserve fossil fuels and to promote the further development of technologies for the generation of electricity from renewable energy sources.

The political will to develop the biomass-fired district heating systems can be seen as quite favourable, as the benefits of biomass are recognized and biomass is seen as a key technology to increase the market share of RES in general. The proposed measures to reach the targets of the nREAP are considered to range from very good to sufficient; however, there is still room for improvements.

Another support scheme is the ‘Act on combined heat and power generation’ (KWK-Gesetz) which supports district heating networks which are connected to CHP-plants. But in the heat market CHP plants fired with solid biomass and supplemented with a district heating network only play a small role.

With the amended Renewable Energy Law (EEG) there is an obligation to apply a minimum of 60% of CHP in bioenergy plants which generate electricity to increase the efficiency factor. The waste heat produced by this electricity generation is then, for instance, utilized in local and district heating networks or made available to industry as process heat. It can also be used to produce cooling.

4 www.bmu.de - Act on granting priority to renewable energy sources (Renewable Energy Sources Act): With the feed-in law in Germany, called “Renewable Energies Act” (Erneuerbare Energien Gesetz, EEG),

5 www.bmu.de
for industrial purposes, for refrigerated warehouses or for cooling buildings. But this kind of heat production is not supported directly. There is only a feed-in-tariff for each kilowatt hour of electricity produced.

The support of district heat fired with biomass is also welcome on the stage of the German states. So there are a few incentive programs for biomass heating systems combined with district heat grids in the different states (see chapter 3.2.5. Business Case)

Useful links:

Laws and Ordinances:

National Renewable Energy Action Plan:
- Nationaler Aktionsplan
- Biomasseaktionsplan
- EU Transparency Platform - Action Plant

Renewable-Energy-Heat-Law:
- BMU - Erneuerbare Energien
- Gesetze im Internet

Market Incentive program for Renewable Energies:
- KfW
- Bafa (for small-scale boilers and stoves without heat grid)

Institutions:
- BMU - Renewable-Energy-Heat-Tax
- BAFA - Federal Office of Economics and Export Control
- Pellets F&E and Marketing (Federal Agency for Renewable Resources)
- DBFZ - German Biomass Research Center

Associations:
- BEE - German Renewable Energy Federation
- BBE - German Bioenergy Association
- C.A.R.M.E.N. e.V.

3.2.4. Feedstock

2,300 m² of farm land (including grassland), and 1,460 m² arable farm land (without grassland) are available per capita. 107,000 km² of forest area contain a wood reservoir of more than 3.5 billion m³ and a yearly growth of 120 million m³ of new biomass in the forests. There is a big potential for wooden biomass in Germany. The usage of wood per year in Germany was about 120 m³ (including material use of wood in saw mills). In addition with approximately 40 million private households and a strong biomass processing industry, wood chips in Germany offer a considerable potential for various district heating systems based on biomass.

In Germany 56% of the forest area is owned by public bodies. 44% of the forest area is in private property. More than 50 million m³ wood is used energetically for electricity and heating purposes annually. Out of all RES used for heating production wood adds up to 70 % (wood

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6 Inventurstudie 2008: www.vti.bund.de
7 www.bmelv.de
8 German Wood Fuel and Pellet Association: www.depv.de
chips, wood pellets, firewood etc.). Germany has a large stock of wood in hand. From its 3.6 billion m³ of forest 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. Regions with the largest areas of farm land (grassland and arable land) and forests are in total terms Bavaria (3.5 million ha), Lower Saxony (2.9 million ha), North Rhine-Westphalia (1.7 million ha), Brandenburg (1.5 million ha) and Mecklenburg-Western Pomerania (1.5 million ha).

Although the demand for wood chips has increased in the last years, German forests are not even close to over-exploitation. Moreover, the supply with wood chips suffices for a stable supply of decentralized heating plants in district heating networks for a couple of years, even if the number of plants increases. For 2020 the German Biomass Research Center (DBFZ) prognosticates a supply gap for wood (See Figure 'Supply Gap') in the German economy. The biggest consumer groups of wood in 2020 will be the material use (nearly 50%), split log heating systems (10%) and CHP plants with more than 12%. Other consumer

Figure 'Supply Gap': Supply gap for wood for material and energetic use in 2020 in Germany

Source: German Biomass Research Centre
groups are pellet heating systems, district heating systems and fuels for transport (Please see the left bar in Figure 'Supply Gap'). To cover this demand there are different wood types which will be available in 2020: the biggest source in 2020 will be forest wood (50%), saw mill residues (10%), used wood (less than 10%), landscaping residues, short rotation coppices and other minor important sources. The prognosticated supply gap will be around 250 PJ/year.

Because of that, raw material suppliers are already exploring alternatives for raw material, especially from Short Rotation Coppice (SRC) with cottonwood or willow or landscaping residues. In 2011 the whole cultivated area for energy wood adds up to 6,000 hectar (See figure 'Increased Production'). The total potential for SRC is calculated to 500,000 ha.¹¹

**Useful links:**

Facts and figures:
- **FNR - Federal Agency for Renewable Resources**
- **DBFZ - German Biomass Research Center**
- **AMI - Agricultural Market Information Company**
- **BMELV - Federal Ministry for Food, Agriculture and Consumer Protection**

### 3.2.5. Business Case

Although prices for fossil energy carriers in the heat, transportation and electric-

¹¹ www.bmelv.de

city market have risen steadily within the last decade, the break-even point for bioenergy has not yet been reached because production costs of bioenergy increased has also been increasing due to rising feedstock prices. Also the prices for wood chips have increased slowly (See Figure 'Price Development').

Also prices for fossil fuels, which need to be imported to a significant scale, took a jump in prices, especially since 2003. Compared to the reference year 1991
The price index for crude oil imports rose to 376 points in 2008, which means a growth by 276% in this period. Between 01/2009 and 04/2010, prices advanced strongly by 90%. The price development for coal is comparable with an increase from 100 points in 1991 to 248 points in 2008, although with fewer fluctuations. Main driver is an increased coal demand in the BRIC countries and the US. The higher fuel procurement costs are reflected in increased electricity prices for households as well, which rose from €40.67 per month for a reference household (3,500 kWh/a) in 2000 to €67.7 per month in 2009.

The average price for wood chips in Germany in 2012 is between €130 – 140/ton. The prices diverge between southern and northern Germany (See Figure ‘Average Prices’).

Investments into biomass heating systems and grids in Germany are supported with public budgets. The KfW and the BMU promote facilities for use with renewable energies. With the MAP-Premium-Program the BMU wants to promote the acquirement and the operation of pellet and wood chip heating systems and heat grids 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 come under the group exemption regulation.

12 www.kfw.de
Eligible are:

- Automatically loaded facilities with a capacity of more than 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

Additional Promotion of district heat grids:

- Promotion if the heat grid predominantly provides heat for the heat demand in newly built houses
- No promotion for heat grids which only provide process heat
- Heat grid has to be ran at least with 50% renewable energies
- Heat dwelling density of the whole heat grid of at least 0.5 MWh per year and per meter length of pipeline
- Amortization subsidy of €60 per constructed meter pipeline
- Maximum promotion sum for the heat grid of €1,000,000
- €1,800 amortization subsidy per residential transmission station (but no promotion for newly built houses), if there is a valid connection contract for the initial operating of the heat grid

BMU and KfW promote up to 100 % of
the investment cost, but not more than a total sum of €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. An additional bonus can be paid for biomass heating plants if they guarantee very low dust emissions and/or for the installation of a buffer storage:

- Low dust emissions: €20/kW if dust emission are less than 15mg/m³
- Installation of a buffer storage: €10/kW (if there is buffer storage for the boiler with a minimum storage volume of 30l/kW)

In addition to the MAP of the BMU there are special promotional programs for communes and companies in the German states:

![Figure 'German States': Promotional offers in the German States for biomass heating systems and heat grids](image_url)

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<td>Biomass heating systems combined with local heat grids</td>
<td>Communes and townships</td>
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<tr>
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<td>Automatically fired Biomass heating systems and heating grids</td>
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<td>Erneuerbare Energien Premium</td>
<td>Big Biomass heating systems; local heat grids; Upgrade of heat storage tank</td>
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<td>Boilers between 80 kW and 1 MW</td>
<td>Firms and Companies</td>
<td>Grant: At least €600 plus 1 €/kW</td>
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</tbody>
</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 + €45 for every kW nominal heat output above 30 kW  
New building: €1000 + €30 for every kW nominal heat output above 30 kW  
Building stock: €45 for every kW nominal heat output up to 500 kW  
New building: €45 for every kW nominal heat output up to 500 kW  
For bigger plants the grant is defined individually  
For local heat grids: €30 per meter grid length; [Link](#) |
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<td>Program/Initiative</td>
<td>Technology/Equipment Provided</td>
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<td>Mecklenburg-West Pomerania</td>
<td>Aktionsplan Klimaschutz</td>
<td>Heating systems and co-generation of heat and power; heat grids</td>
<td>Small and medium sized companies; Housing industry; Non-profit organizations; Associations</td>
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<td>Progress.nrw</td>
<td>Combined pellet and solar heating system up to 250 kW</td>
<td>Private households; Small and medium sized companies; Communes</td>
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<td>Modernisation 2009 – Promotion of social living quarters (furthermore valid)</td>
<td>Wood pellet boilers and wood chip plants</td>
<td>Private and public institutions</td>
<td>Investment grant or cheap credit</td>
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<td>Förderprogramm im Rahmen des Konjunkturprogramms II und des Ministeriums für Umwelt, Forsten und Verbraucherschutz</td>
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<td>Biomass heating systems</td>
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</table>
### Market environment

In Germany district heating has a market share of around 14% in the residential buildings sector. The connected heat load is around 52,729 MW. The heat comes mainly from cogeneration plants (83%). Heat-only boilers supply 16% and 1% is surplus heat from industry. The cogeneration plants use natural gas (42%), coal (39%), lignite (12%) and wood/waste (7%) as fuel. Solid biomass-fired CHP-plants also contributed 13.9 TWh to the general heat supply in Germany in 2011.

Germany offers excellent geographical and infrastructural framework conditions for investments into heat production facilities and technology development. In Germany more than 1,000 biomass heating plants currently supply residential estates and public buildings with heating via district heating networks, but there are more than 10,000 installed boilers and plants bigger than 100 kW. The po-

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**12 Source in this section:** www.ag-energiebilanzen.de / www.dbfz.de

**13 Source:** www.dbfz.de
tential for the increase of district heating networks is very big. Larger wood boiler systems for supplying industrial facilities are used primarily by the timber processing industry. The efficiency of a biomass heating system can be improved significantly, by connecting several heated houses to form a local heating network. A local heating network with small units is a long term benefit for providers and costumers.

Heating with biomass is a clean and sustainable alternative to oil and natural gas. The most efficient size is between 50 and 1,000 kW in power. These sizes are used in housing estates, apartment buildings, row houses or public buildings. Besides the comfort, energy effectiveness is considerably higher than for individual heating systems. The heating material is supplied in small intervals. Thus the space needed for storing the biomass is reduced to a fraction of the usual volume. The disposal and the system maintenance are managed simultaneously with the fuel supply. The system is often installed and financed by a contractor. In this way the client does not have the responsibility for the whole planning and building management. A conventional heat meter is used to measure and calculate the actual amount of the total heat consumed by a housing unit.

Internal contracting is an economy measure. The contractor’s tasks are assumed by the local authorities. The main advantage of internal contracting is that the local authorities do not need to enter long-term contracts with external contractors. Nevertheless the aimed savings can be met. Cost saving internal contracting is a well suited instrument to minimize the heating expenses. It includes measures in the building’s heating systems which are financed by fuel expenses. These savings can be achieved by free solar energy or very low price biomass energy. Additional requirements are a cost saving installation and an efficient fuel distribution logistics.

In Germany there is a broad consensus in society for nuclear phase-out until 2022. There will be an accelerated development of RES and also a significant improvement of energy efficiency in the German market. The major part of the RES heat supply in Germany will be pellet and wood chip plants, as their planning as a small or medium-sized heating plant fits to requirements of a decentralized district heating and a decentralized energy supply in general.

In 2010 more than 9,000 biomass heating plants with a nominal heat output between 100-1,000 kW were installed (see Figure ‘Amount Biomass Heating’). These heating plants are fired with wood chips, pellets, saw mill residues or wood logs. Basically a plant with more than 100 kW is already able to supply more than one building with a small heat grid. Often they supply a whole apartment building with a few flats, a few buildings which are located close to each other or 2 or 3 buildings with a higher heat demand. There are 140 biomass heating systems with a nominal heat output of more than 1 MW installed in Germany. Most of them are fired with wood chips
3.2.7. Regulation

There is no direct supporting regulation or obligation for biomass DH in force. District heat based on biomass is eligible to be accounted to the renewable heat obligation for new buildings within EEWärmeG (if RES-H quota is fulfilled with biomass, at least 30% of the heat demand has to be covered).

The First Ordinance for the Implementation of the Federal Immission Control Act (‘Small combustion plants ordinance’)

entered into force on the 22nd of March 2010. This ordinance applies to wood-fired heating systems, stoves and other small combustion plants fired with so-

(see Figure ‘Amount Biomass Heating <1MW’).

Useful links:

Facts and figures:
- FNR - Federal Agency for Renewable Resources
- Bioenergie
- BMELV - Federal Ministry for Environment, Nature Conservation and Consumer Protection
- DBFZ - German Biomass Research Center
- Energy supply statistics in Germany
- CARMEN e.V.

14 1. Bundesimmissionsschutzverordnung (1. BImSchV): www.bmu.de
lidle fuels smaller than 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 of 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. Boiler 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\(^{15}\) or in the Technische Anleitung zur Reinhaltung der Luft (TA-Luft).\(^{16}\) The Federal Immission Control Act also regulates the kind of raw material, which can be fired in combustion plants < 1 MW:

1. Natural finished wood/not fragmented in the form of saw dust, chip, bark
2. Natural finished and fragmented wood with bark, especially in form of split log or wood chips, including brush wood or cone
3. Pellets from natural finished timber in form of wood briquettes after wood

\(^{15}\) Bundesimissionsschutzverordnung (4. BImSchV). www.bmu.de
\(^{16}\) Data Source: www.bmu.de
standard DIN 51731\(^\text{17}\) or DINplus pellet certification

4. Ply wood, chip boards, fibre-boards without timber preservative, heavy metals or halogen compounds

5. Painted, varnished or laminated wood without timber preservative, heavy metals or halogen compounds

Wood chip plants below 1 MW are allowed to use wood from point 1 to 5. Wood types 4 and 5 are only allowed in boilers with a nominal heat output bigger than 30 kW in the timber processing industry. Apart from this, wood types 4 and 5 cannot be used in any plant.

To install the heating plant and the appropriate district heat network, different building licenses have to be obtained. These building licenses are given by local authorities in the communes where the district heating should be installed.

DEPV and NABU, which is 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 becomes more and more important in public discussion 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)\(^\text{18}\) states sustainability as a major principle for all forests in Germany. All foresters have to oblige to the law and therefore only can log the amount of trees which will grow back. The German Bundeswaldgesetz is often referred to as best-practice worldwide, as it combines ecologic 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
- NABU - Nature and Biodiversity conservation Union

**3.2.8. Project Financing**

Germany is considered to be a ‘save’ 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, the ‘easiness of starting business’ in Germany is assessed by the IFC World only 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 district heating systems. The KfW-Bank supports heating systems with a nominal heat output of more than 100 kW (please see Chapter 2.1.4. business environment). Different regional banks (please figure 5: Promotional programs in the German states) 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 the reliability and sustainability of feedstock supply as well as on a sound concept for the sales of the product.

The ‘easiness’ of getting financing is very much dependent on individual project designs as banks assess reliability of chosen technologies as well as the security of feedstock supply and price risks. In addition, economic benchmarks e.g. on connection density of district heat customers, are taken into account to guarantee an economic sustainable operation of biomass heating plants. Still, biomass heating systems get investment subsidies which are delivered to investors via house banks. To get this support a list of regulations and criteria have to be fulfilled.

**Useful Links:**

Facts and figures:

- **BMU - Federal Ministry for the Environment, Nature Conservation and Nuclear Safety**
- **DEPV - German Energy Wood and Pellet Association**
- **DEPI - German Pellet Institute KfW-Bank www.kfw.de**
- **FNR - Federal Agency for Renewable Resources**
- **C.A.R.M.E.N. e.V.**

**3.2.9. Readiness for Uptake**

Especially in the case of heating, the use of solid biomass to generate energy represents the largest share of renewable energies (in Germany up to 70%). The further increase in the use of biomass is an important component to achieve the goals set out in the German government’s climate change policy and the so called energy transition, which has been decided after the nuclear disaster of Fukushima in March 2011. One part of this strategy is the development of a decentralized heat supply with district heat grids.

The key to this is a reliable political framework, including provisions such as long-term funding systems. The global and regional potentials of solid biomass are distributed unequally. However, by improving transport logistics and tapping additional biomass resources such as woodcuttings from landscaping and short rotation coppices, solid biomass can also play an important role in the future energy supply.
The German bioenergy market is excellently organized, as there exists for each market sector at least one specialized association, organized under the roof of an umbrella organization which is the German Bioenergy Association (Bundesverband BioEnergie: BBE). Amongst these associations there is one main organization in charge of wood pellets (DEPV), but no organization in charge only for district heating systems, so the BBE is primarily responsible for this part. This allows to clearly deal with technology related issues and to represent to diverse interests of the different stakeholders (raw material 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 chips and biomass district heating are held in a very positive way, as the distribution of wood chips is done in local or regional areas and supply routes for biomass-fired heating plants are still very short. Technical concerns, like dust emissions of boilers, have been mitigated. The biggest concern stays the raw material supply for the use in district heating systems. Basically there is more than enough raw material available on a regional level. A big challenge for the acceptance of district heating would arise, if there would be more co-firing (CHP) with industrial pellets for power generation, like it is already done in England or Denmark. In this case the concern, whether sufficient raw material is available for district heating, would also impair the good name of bioenergy heat in Germany, because of sustainability issues of the raw material supply.

In addition to concerns of 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
- C.A.R.M.E.N. e.V.

**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
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Tel.: +49-88 30 772
Email: paniz.aiel@cia.it

3.3.1. Country Score

![Country Score bar chart](image)

In the general scoring for sector, Italy - Central is rated place 4 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/sq.
In 2009, Italy was the world’s 7th 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 stagnation, political instability and problems in pur-
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 trucks 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 renewable energy sources: according to the National Energy Action Plan (NEAP), approved in June 2010 following EU Directive 28/2009, biomass is supposed to become 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. The most recent data shows 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%.

![Figure 'NEAP': Contribution of energy generated from solid biomass to total energy consumption.](source: RES (2020). Elab. AIEL on NEAP)
 amongst 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. The target set by NEAP for 2020 is 5.2 - 5.4 Mtoe (Table ‘Gross RES Heat Consumption’, Figures ‘Trend of Consumption’ and ‘Consumption Thermal’).

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, the Italian forest area amounts to 8.8 million

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

<table>
<thead>
<tr>
<th></th>
<th>2008</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gross production RES-H</td>
<td>RES production share</td>
</tr>
<tr>
<td>Geothermic</td>
<td>213</td>
<td>7%</td>
</tr>
<tr>
<td>Solar</td>
<td>67</td>
<td>2%</td>
</tr>
<tr>
<td>Biomass:</td>
<td></td>
<td></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>Total</td>
<td>3.238</td>
<td>100%</td>
</tr>
</tbody>
</table>

Figure 'Trend of Consumption': Expected trend of gross heat consumption from biomass
Market Handbook District Heating

industries. The internal wood chips production is not recorded by the national statistical office yet; nevertheless, based on the plants’ consumption and the amount of chips imported, the production can be estimated to account for 1.2 million fresh tons per year.

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 energy costs including investment and operation costs. Initial investment costs start from €250,000 for the boiler. The costs for the heating networks vary from €150/m up to €600/m, or from €59/kW up to €185/kW.

- The cost of energy output can vary depending on several factors:
  - Investment costs,
  - Nominal power output,
  - Length of heat distribution network,
  - Costs of input material (wood fuel), etc.

\(^3\) ISTAT 2007

\(^4\) Pettenella, 2009
Figure: Price Development: Price development for energy production in €/MWh

Table: Cost Wood Chips: Costs of wood chips (VAT excluded), January 2012
According to a rough estimation, energy output costs vary from €500/MWh up to €90/MWh.

District heating in Italy is mainly fuelled with wood chips. Table ‘Cost Wood Chips’ shows a comparison between wood chip costs with different origin and source. Through the usage of heat from RS, Italy will generate a net income of over €89.6 billion in the period from 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 is will save over 17 million tonnes of CO$_2$ emission annually, thereby playing an active and important role in climate change mitigation.

3.3.6. Market Environment

Comparing 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 generated from solid-biomass in 2010 amounts to approximately 6.7 Mtoe, out of which merely 0.15 Mtoe were consumed in district heating (Table ‘Consumption Estimates’ Figure ‘Consumption Wood Fuel’).

Unfortunately, there are no statistics on electricity and heat produced in CHP that use wood fuels, in Italy yet. In any case, according to a survey carried out by ITABIA, around 61 plants, both power plants and CHP, are in operation producing a total energy output of 436 MWl. 32 plants are CHP plants. The total power installed is over 400 MW with a network length of more than 1,000 km. District heating systems based on wood biomass are largely fuelled with wood chips (around 450,000 t/year). District heating systems are mainly located in the north, in particular in Alto Adige, and the centre of Italy. The biomass is
### Table ‘Consumption Estimates’: Consumption estimates of energy generated from wood biomass

<table>
<thead>
<tr>
<th></th>
<th>Mt</th>
<th>M (%)</th>
<th>N C V (MWh/t)</th>
<th>TWh</th>
<th>Mtoe*</th>
</tr>
</thead>
<tbody>
<tr>
<td>District Heating</td>
<td>0.41</td>
<td>40</td>
<td>2.81</td>
<td>1.2</td>
<td>0.1</td>
</tr>
<tr>
<td>Small DH &amp; boilers &lt;500kW</td>
<td>0.38</td>
<td>30</td>
<td>3.4</td>
<td>71.6</td>
<td>6.2</td>
</tr>
<tr>
<td>Domestic Consumption (pellets included)</td>
<td>18</td>
<td>20</td>
<td>3.98</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>4</td>
<td>0.3</td>
</tr>
<tr>
<td>Total</td>
<td>20.59</td>
<td></td>
<td></td>
<td>78.1</td>
<td>6.7</td>
</tr>
</tbody>
</table>

1toe = 11.63 MWh

Source: Pettenella D., 2011

The use of biomass for heat production has been supported since 1998 with 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-fuel benefits from a VAT reduction of 10% (DPR n. 633/72

3.3.7. Regulation

In Figure ‘Wood fuelled DH’ the geographical distribution of district heating systems is illustrated. The class colour represents the sum of the nominal power output of all plants installed in the specific region.
In 2005, Energy Efficiency Certificates (EEC) also known as the White Certificate Scheme were introduced containing special qualifications for biomass district heating and CHP. The EECs are a market mechanism aiming to promote energy-savings within the industrial and residential sector. EECs certify the reduction of primary energy consumption achieved either by improvement of energy efficiency and/or the substitution of fossil fuels with RES. In this context, 1 EEC corresponds to 1 toe of energy saved.

New requirements regarding the application of EEC were introduced in October 2011 in the Deliberation of Authority for Electricity Energy and Gas (EEN 9/11).

Despite several incentive schemes targeted at biomass heat in Italy, market growth of the sector has been slow due to the lack of concrete and long-term support measures.

Also on the local level investment based support measures exist. For district heating the existing support measures are summarized in the Figure 'Support Measure'.

2011, the medium value of EEC was around €105-106 per toe saved (Figure 'Price Trend EEC').

Around 23% of EECs released in the last years are related to thermal purposes in the civil/private sector, in which the biomass district heating is included (Figure 'Sector EEC').
Since August 2005, district heating has been contributing to the EECs with around 167,200 toe. The distribution of district heating at the regional level is shown in Figure ‘Distribution EEC’. Its global contribution to the total reduction of primary energy consumption is 2.23%.

Figure 'Price Trend EEC': Trend of prices of Energy Efficiency Certificates (EEC)

![Price Trend EEC Graph]

Source: GME, data processed by Tholos

Figure 'Sector EEC': Distribution of energy sectors for which TEE were emitted

![Sector EEC Graph]

Source: AEEG processed by Tholos
The general principles of the new support measures, which will be valid from 2013 onward, are defined in Art. 28 of D.Lgs 28/2011; however, the decree law has not yet been proclaimed.

The emissions thresholds for Districts heating are defined in D. Lgs n. 152/06 Allegato 1 parte III, as reported in Table ‘Emission Threshold’.

Specific emission thresholds can additionally be imposed at the regional level if they are thought to be necessary, i.e. in Piemonte and the Lombardia Regions.

The approval process can be subdivided into two cases:

- Conferenza dei servizi (Unified procedures): all the competent authorities are involved in the same meetings (region or province, municipality, health authority, fire brigades, etc.)

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**Figure 'Distribution EEC': Distribution of Energy Efficiency Certificates emitted for district heating at the regional level**

**Table ‘Emission Thresholds’: Districts heating emission thresholds**

<table>
<thead>
<tr>
<th>Thermal Power Output</th>
<th>35-150 kW</th>
<th>150 MW</th>
<th>kW-3</th>
<th>3-6 MW</th>
<th>6-20 MW</th>
<th>&gt;20 MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dust</td>
<td>mg/Nm3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Organic Carbon (COT)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>30</td>
<td>20/10*</td>
<td></td>
</tr>
<tr>
<td>CO</td>
<td>-</td>
<td>350</td>
<td>300</td>
<td>250/150(^5)</td>
<td>200/100(^5)</td>
<td></td>
</tr>
<tr>
<td>NO2</td>
<td>-</td>
<td>500</td>
<td>500</td>
<td>400/300(^5)</td>
<td>400/200(^5)</td>
<td></td>
</tr>
<tr>
<td>SO2</td>
<td>-</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td></td>
</tr>
</tbody>
</table>

*Average daily values
• Declaration of activity start (DIA) to be presented to the municipality in addition to all the single authorizations required. In the first case, specific emission thresholds could be imposed on a single plant by the competent authorities depending on the geographic location where the plant will be located.

3.3.8. Project Financing

Investments in the Italian market are considered to be ‘quite safe’ from a country risk perspective. According to COFACE country risk rating, Italy positions itself in the centre span. However, the Corruption Perception Index for the level of transparency is not encouraging.

Banks are familiar with financing bioenergy projects with regards to 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.

The biomass heating system and the heat grid are often financed and installed by a contractor, so that the client does not have the responsibility for the whole planning and building management. A conventional heat meter is used to measure and calculate the actual amount of the total heat consumed by a housing unit. Internal contracting is an economy measure.

3.3.9. Readiness for Uptake

Generally, district heating can be said to be accepted by the public. The most common problems are related to the origin, supply, and sustainability of biomass and its production. Another issue is that of particle emissions. Since combustion particles are a health concern and PM10 emission threshold values are regularly exceeded, especially in winter, public concern with regards to district heating cannot be eliminated.

71% of all plants that are opposed by the public or residents nearby are renewable energy plants. Figure ‘Opposed Plants’ indicates the location of these plants (marked with the colour red) in Italy (all renewable energy sources for heat and electricity production are included).

Useful Links:

Facts and Figures:

• nREAP
• EEG – Autorità per l’energia elettrica a il gas
• GSE – Gestore servizi energetici
• Inventario forestale delle foreste e del carbonio - National Forest and Carbon Inventory
• ISTAT – Istituto nazionale di statistica
• APAT Lombardia
• REF Ricerche SRL

Figure 'Opposed Plants': Plants indicated in red are renewable energy plants that are opposed by the public (2010)

Source: Nimby forum.

- CECED Italia
- Agriforenergy/Technical Review
- Nimby Forum
- Titoli di efficienza energetica/Gestore mercato elettrico
- Titoli di efficienza energetica/Pubblicazione a cura di enea

Associations / Institutions:
- AIEL - Associazione Italiana Energie Agroforestali
- ENEA – Ente Nazionale per l’Energia e l’Ambiente
- FIRE Italia
- FIPER Italia
3.4. Hungary

Hungarian Bioenergy Competence Centre (HBCC)

Imre Németh
4 Tessedik Road
HU - 2100 Gödöllo
Tel.: +36 28 420 291
Email: obekk@invitel.hu

3.4.1. Country Score

Country Score Hungary Central Transdanubia- DH (November 2011)

In the general scoring for sector, Hungary - Central Transdanubia is rated place 38 out of total 81. The underlying categories that influence this result are displayed in the bar chart above.

3.4.2. Basic data

Hungary is located in Central Europe, in the Danube basin between the Alps and the Carpathian Mountains. Its territory is 93,033 km², and it shares borders with seven countries. Due to its central position in Europe, it is an important connecting region from geographical, economical, traffic, and cultural perspective.

Hungary is located in Europe’s continental zone with moderate climate. 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 ab-
solute maximum is +35.9 °C. 59.5 % of the country’s territory is used for agricultural purposes and 20.5 % is covered by forests. The total cultivation area (agricultural, forest, reed and fish ponds) adds up to 81.2 % of the country’s territory. The population is 9,986,000.

The GDP per person in Hungary lies at €15,300, which is approximately 65% of the EU average. The unemployment rate has risen from the 6-7 % before the economic crisis to current level of 10-11%.

Useful links:
- Hungarian Central Statistical Office
- Ministry of National Development
- Hungarian Energy Office
- Energy Centre Non-profit Ltd.

### 3.4.3. Energy policy

The primary energy usage in Hungary is expected to reach 1074 PJ by 2020, and 1125 PJ by 2030 as a result of the implemented structural changes. The total primary energy saving may reach 189 PJ. The largest share of energy savings can be achieved in buildings. Therefore, the government has started a comprehensive building energetics project as a part of the new ‘Széchenyi Plan’ in 2011. The objective is to modernise buildings energetically, to make them more energy efficient and to use RES.

The planned projects intend to put the energy efficient development of residential buildings, public buildings and other buildings into a uniform framework, which will include the application of RES in buildings, the renovation and energy efficient new construction. This complex energy use in buildings project consists of several elements. The financing (subsidy projects), the regulations (requirements, standards), and the projects on conscious shaping and information transfer are included in a complex way, complementing each other. The National Implementation Plans, amongst others, build on data on the energy consumption and energetic condition of buildings owned by the state and local governments. Annual measuring of the energy consumption and energetic condition of buildings will be undertaken to guarantee success of the programme.

The energy efficient renovation of residential buildings will be the outstanding priority in the future energy performance plans of Hungary. The concept of energy efficient new buildings is based on several measures: energetic modernization of building limiting structures, energetic systems and equipment, heat energy produced using RES, or establishing electricity producing capacities. The maintenance of this concept is related to more and more consumers (buildings constructed using industrial technologies / prefabricated block houses / owner-occupied blocks). A long-term objective is the establishment of green residential areas which offer a high quality of life. The spreading of the concept of green buildings and green towns (green roof, green walls, green surfaces) cons-
titute an integrative part of the energetic projects on public and private buildings.

Hungary’s heat energy consumption is depicted in Figure ‘Heat Energy Consumption’.

**Useful links:**
- Hungarian Energy Office; [www.eh.gov.hu](http://www.eh.gov.hu)
- Ministry of Rural Development; [www.vm.gov.hu](http://www.vm.gov.hu)

### 3.4.4. Feedstocks

Hungary has above average agricultural capabilities and continuously expanding forest that cover 20% of the total territory at the moment.

Considering Hungary’s technical potential, biomass plays an important role amongst the different RES. There are different types of input materials which can be classified in the following major categories:

- biomass from forestry;
- energy plants (crops and woody plants);
- agricultural by-products and waste;
- other by-products and waste.

The Table ‘Feedstock Potential’ shows the potential of each category that can
be produced on a mid-term (7-15 years), and the amount of energy that can be generated from this input.

Forestry dendromass is the major basis for biomass-based heat production in Hungary today. This waste material which is not suitable for industrial utilization; it can, however, be used for heating. The amount that is used by households for heating is significant. Today in a composition of broken pieces, and, furthermore, it is used in the form of chips in compound heating thermal power plants. One 20 MW electric biomass power plant is in operation in the country, based on wood chips. With the establishment of woody energy plantations the energetic biomass supply can be expanded considerably. Since the interest in energetic wood is continuously growing, also lands that were previously used for food production are being considered for such plantations. The larger flood areas can be used effectively for these plantations. The establishment of energetic wood plantations for power plant usage have also started in the surroundings of two biomass power plants. A further increase of the area used for energetic wood plantations is expected, which may reach approximately 100,000 ha, generating 25-30 PJ energy.

From the primary biomass produced in agriculture, the by-products, that occur in large quantities, could be used for energetic purposes. On average, the Hungarian agriculture produces 4.0-4.5 million tons of corn straw per year, of which livestock husbandry and industry use 1.6-1.7 million tons. A considerable part of the remaining 2.4-2.8 million tons of corn straw can be used for energy production producing about 2.4-2.8 PJ annually. In Hungary straw is primarily used for energetic purposes in the form of bale and briquettes.

The plough-land plant growing by-product (maize stalk) occurs in large volumes in Hungary, approximately 8-10 million tons each year, from which 4-5 million tons could be utilized for energe-

<table>
<thead>
<tr>
<th></th>
<th>Biomass Potential (million t/year)</th>
<th>Energy Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forestry Raw Materials</td>
<td>3.25</td>
<td>45.5</td>
</tr>
<tr>
<td>Energy Plants</td>
<td>5.6</td>
<td>74.16</td>
</tr>
<tr>
<td>Agricultural By-Products &amp; Waste</td>
<td>5.4</td>
<td>62.0</td>
</tr>
<tr>
<td>Other By-Products</td>
<td>0.55</td>
<td>6.6</td>
</tr>
<tr>
<td>Total</td>
<td>14.8</td>
<td>188.26</td>
</tr>
</tbody>
</table>

Table 'Feedstock Potential': Potential of each category that can be produced on a mid-term (7-15 years), and the amount of energy that can be generated from this input.
tic purposes, producing 48-60 PJ each year. However, currently due to the lack of suitable preparatory and combustion equipment, maize stalk is only applied to an insignificant volume for heat-production.

Among the by-products of agriculture, especially sunflower stalk and rape straw are produced in a considerable amount; these would be suitable for combustion purposes and 5-6 PJ energy could be produced from them each year. However, in order to realize this potential, suitable equipments for the preparation and combustion have to be available.

Furthermore, 350-400 thousand tons of waste material, especially in the form of woody by-products, is produced from grape and fruit production. This waste could generate between 5 and 6 PJ of energy.

Among the plants grown on large areas for energetic purposes, mainly the ‘Energy grass from Szarvas’ and the energetic wood plantations can be taken into account.

The technology that is needed for the production and harvesting of large quantities of perennial energy grass is available in Hungary. It requires special combustion technology due to its high mineral-content, especially silicone, as its ashes melt at a relatively low temperature (600-700 °C). The energy grass of Szarvas can provide 10 t/ha dry mass with an energy-content of 110-120 GJ over several years. This energy grass can be baled and used for pellet production. From one hectare grass, 6-7 tons of pellets can be produced, with combustion characteristics which are favourable in low performance boilers.

In the next years these types of biomass, which can be produced on plough-land and are usable for direct combustion, will be more and more in focus of the national energy policy. According to expert estimations on a medium-term at least 1 million hectares of agricultural land is available for non-food production. This stems from the fact, that a part of the plough-land has unfavourable growing capabilities for food and fodder plants, but can still be utilized in an economical way for energy production.

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

3.4.5. Business case

Regarding the direct costs the district heating service has been handicapped related to other heating methods.

Fees of district heating have been frozen by the government since the 31st of March 2011, and the fees could be increased by 4.2 % country-wide referring to the increase in reasonable costs at the beginning of this year. This tariff increase is not realized at heat-producing power plants but at the district heating providing companies. Therefore,
the producers of thermal energy are in a difficult financial situation. The introduction of the so-called METÁR system, which is supposed to start in January 2013, prospects the support of energy production based on RS. Due to the fact that the majority of the investors will wait for the new subsidy rules to be put in place, the construction works of the new ‘green’ power plants are expected to take up again in 2014. According to the strategy plan of the government, considerable amounts of subsidies will be available for the implementation of the reconstruction works and new investments in the new development period starting from 2014.

Prices have been influenced by the fact that natural gas fees increased by 2.6 % at the beginning of January, leading to an increase of 4.2 % for the end-users taking also the change of the VAT from 25 % to 27 % into account. During this year new price corrections can be expected as the gas purchase price increases and the Forint is continuously devaluing related to Dollar and Euro. A new increase of the gas price brings also triggers an increase in the DH price, since several heat-producing units use gas. Moreover, the increase in the price of natural gas also affects electricity prices, as almost one-third of electricity produced in the country comes from gas-fired power plants.

It can be stated that changes in the natural gas market are significant and determinant to the competitiveness of the Hungarian district heating sector. As usual, the district heating providers also expected the decrease in prices from the implementation of natural gas market liberalization.

However, due to the natural monoply in the gas transport sector via pipelines, the development of competition was doubtful from the beginning. The gas market is dominated by vertical integration of the dominant market actors typically extending over borders (and many times over sectors), embracing the whole value chain. Due to the falling back of the pricing connected to public utility price in the free market, and at the same time the wide spreading of the indexed pricing connected to import natural gas price, entering the free market does not evidently favour the entering companies. The price-scissor between the free market and the public utility price has gradually closed, decreasing the advantages achievable in the free market by the district heating providers. The advantage of purchasing from the free market primarily depends on the bargaining power of the companies, and it is only determined by the selected gas dealer on a secondary basis.

The subsidy system which is expected to be valid from 2013 intends to introduce a reception price differentiated according to technology type and size category in the field of renewable and alternative energy production. The motivation for useful heat-production becomes more emphasized as instead of the unilateral electricity reception support a combined heat and electric energy support will be implemented. The measures will introduce strict sustainability criteria related
to forestry biomass, and will define an upper size limit and an efficiency minimum level per energy source type, and even regional quotas will be introduced for biomass. The basic elements of the subsidy construction based on three pillars are as follows: a base price of green power production, a green heat bonus for motivating useful heat production, and the acknowledgement of social and national economic benefits in the reception price (development in the most disadvantaged region, due to suitability for regulations).

In Hungary there are no mandatory minimum levels of using renewable energy. Tender systems deal with public buildings in an outstanding way, they may even provide 100% subsidy to the energetic modernization and development. The newly built or renovated buildings achieving the parameters of a low energy-demanding or ‘passive house’ receive outstanding subsidies using the ‘bonus system’ within the tendering system.

Public buildings are among the greatest energy consumers within the building sector. It is therefore of outstanding priority to significantly decrease their energy consumption, and to develop an energy-saving strategy on a short and medium-term basis. The objective of complex modernization is to align the energetic renovation of buildings with climate protection objectives, and to increase the use of renewable energy technologies.

Almost each of the seven major breakthrough points of the New Széchenyi Plans focuses on the improvement of the energy performance of buildings and the acquisition of the necessary expertise for energy-saving facility management.

I. KEOP – Environment and Energy Operational Programme

The Environment and Energy Operational Programme (summing up to €4,916 million) implemented as part of the EU cohesion policy supports domestic projects with energetic purpose with two priorities: 5.15% of the total amount is available for the purposes of the priority axis ‘Increasing renewable energy source usage’, and 3.14% is available for the priority axis ‘Efficient energy usage’. After 2013 the tendering system is planned to be continued by starting a separate energy operational programme.

Subsidy for the priority axis ‘Increasing renewable energy source usage’ is provided by the European Regional Development Fund, therefore, the regions West Transdanubian, Central Trans-Danubian, South Trans-Danubian, North Hungary, North Great Plain, and South Great Plain are entitled for the KEOP subsidy. The Central Hungary region individually supports through its own operational programme the investments aiming at increasing RES usage. The ‘mirror programme’ is equivalent to KEOP renewable priority. In order to achieve a greater ratio of RES, thermal and/or electric energy production support can be applied for.

The system is controlled by several regulations, the two most important of which are the MeHVM-PM joint decree No.

KEOP constructions on the period 2009-2010:

- KEOP-2009-4.2.0 ‘Fulfilling local heating and cooling demands using RES’ construction supporting the increase in using RES
- KEOP-2009-4.4.0 Supporting ‘Renewable energy-based electricity, combined thermal and electric energy, and bio-methane production’.
- KEOP-2009-4.3 Supporting ‘Renewable energy-based regional development’.
- KEOP-2010-4.7.0 Supporting ‘Geothermal-based thermal and electric energy-producing projects’ preparatory and project development activities
- KEOP-2009-5.2.0/A ‘Third party financing’ building energetics development combined with renewable energy source utilization.
- KEOP-2009-5.3.0/A ‘Building energetics developments and public lighting modernization’
- KEOP-2009-5.4.0 ‘District heating sector energetic modernization’ (8 billion HUF planned subsidy target cost, standard, single-round process, with continuous submission)
- KEOP-2009-7.4.0 ‘Health-care Institutions Energetic Rationalization (Egi-nER)’

II. KMOP-2009-3.3.3. – Increasing the usage of RES

The Central Hungarian region individually supports through its own operational programme the investments aiming at increasing the use of RES, through the ‘mirror programme’ equivalent to the KEOP renewable priority.

III. Energy-Saving Credit Fund (EHA)

The Energy-Saving Credit Fund supports the implementation of investments aiming at increasing energy performance and the utilization of RES, by providing favourable interest credits. The credit fund was established in 1991, its target amount was HUF2.39 billion by the end of 2006. The fund is managed by Energy Centre Non-profit Ltd., crediting is performed by Kereskedelmi és Hitel Bank Rt. Enterprises and local governments can apply for the special credit. The programme still is in operation at the moment, and it is public.

IV. National Energy-Saving Programme (NEP)

The objective of the programme is to support projects aiming at energy-saving and using RES, until in 2000 a special credit and non-refundable subsidy was provided. From 2001 non-refundable subsidy was provided on a full-scale. The programme is suspended at the moment due to lack of sources.
Market Handbook District Heating

Useful links:
- Hungarian Development Bank
- Union of Biomass Product Line
- Hungarian Biomass Competence Center
- Green Investment System
- Association of Biomass Power Plants

3.4.6. Market Environment

Hungary is strongly dependent on imported energy. 62% of all fossil fuels are imported and when considering natural gas separately even 82 % are imported mainly from the former Soviet Union member states. The energy mix in Hungary is strongly dominated by fossil fuels. In 2010, 77.4% of the primary energy supply stemmed from fossil sources, 14.2% from nuclear power plants and 7.1 % from RS. The most widely used form of renewable energy was wood for combustion in power plants. The vast majority of domestic electricity (95 %) is produced from natural gas, coal, and nuclear energy sources. The ratio of natural gas and nuclear is significant (69 %); the power plant electricity capacity of Hungary is 9317 MW, the capacity available is 8417.7 MW, 3061.9 MW (36.4 %) is controllable, and 5350.8 MW (63.6 %) is uncontrollable. 84.4 % of the 9317 MW power plant capacity consists of 23 large power plants’ capacities.

40% of the total energy usage in Hungary is related to the building sector. The mandatory ratio of renewable energy within the primary energy consumption is increasing from the present 7.6 % to 20 % by 2030 according to expectations. A share of 14.65 % can be achieved by 2020. The vast majority of the 4.3 million households in the country do not meet the requirements. Ratios are similar among public buildings as well. 65 % of the heat energy demand is supplied by natural gas.

At the moment 220 district heating systems are in operation in 92 settlements in Hungary. The total number of district heated flats and houses is 650,000. This is 16 % of the national set of households. 95 % of the local government buildings have gas-heating.

The heat consumption of the population and the public bodies amounts to presently 150-160 PJ per year.

The share of district heated buildings is continuously decreasing, presently amounting to 14.9 %. This ratio in Budapest is 26.6 %, in rural towns it is 18.6 %, and in villages it is 0.22 %. 70 % of the district heated flats have a bad energy performance, therefore, it is inevitable to modernize them in the coming period.

A part of the district heating systems is completed, but often in need of reconstruction and modernization, and also the construction of new infrastructures is necessary. These, on the one hand, serve the utilization of RES (e.g. biomass boiler plant, thermal well, etc.), on the other hand, implement the transport. The heat energy originates from RES to the consumers (new long-distance line networks, thermal centres, etc.). Be-
Based on the existing KEOP constructions the district heating infrastructure can be developed. Within the new energetic operational programme planned to be started from 2014 the objective of the special portfolio is the development of the distribution network of the RES facilities. Moreover, the reconstruction of existing distribution networks and the survey of RES application facilities are planned.

The number of companies providing district heating is approximately 80. Most of them operate in a partnership and their owners are mostly local governments. The number of private companies providing district heating is approximately 10. District heating service fees are specified by the authorities at present. These authorities are the local government bodies.

**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

Effective EU and national rules on building energetics are as follows:

- 89/106/EC on the approximation of laws, regulations and administrative provisions of the Member States relating to construction products
- Law No. LXXVIII of the year 1997 on the layout and protection of built environment;
- Law No. LVIII of the year 1996 on the professional chambers of designer and expert engineers, and architects;
- Law No. LIII of the year 1995 on the general rules of environment protection;
- Government decree No. 192/2009 (IX 15) on the professional activities of certain construction professions;
- Government decree No. 191/2009 (IX 15) on the building industry implementation activities;
- Government decree No. 193/2009 (IX 15) on the building authority procedures and the building authority control
- Government decree No. 176/2008 (VI 30) on the certification of energy characteristics of buildings;
- Government decree No. 291/2007 (X 31) on the construction inspection activities;
- Government decree No. 343/2006 (XII 23) on the appointment and operational
conditions of construction and building inspection authorities;

- Government decree No. 244/2006 (XII 5) on the rules of exercising the activities of technical inspector in the building sector and of responsible technical director;

- Government decree No. 104/2006 (IV 28) on the planning of localities, architectural and technical planning and on the rules of entitlement for becoming technical expert in the building sector;

- Government decree No. 103/2006 (IV 28) on the rules of postgraduate system related to the exercise of some regulated professions in the construction sector;

- Government decree No. 253/1997 (XII 20) on National Requirements of Spatial Planning and Building;

- Government decree No. 105/1996 (VII 16) on the support of building reconstruction resulting in energy efficiencies;

- ÖTM decree No. 37/2007 (XII 13) on construction-related authority procedures and on the content of land development and construction technical documentation;

- TNM decree No. 7/2006 (V 24) on the energetical calculations of buildings;

- BM-GKM-KvVM joint decree No. 3/2003 (I 25) on the Detailed Rules of Technical Requirements of the Building Products, the Certificate of their Conformity, their Marketing and Use;ÉVM-Ipm-KM-MÉM-BkM joint decree No. 11/1985 (VI 22) on the mandatory applicability period of building structures and products used at their construction;

- NFGM decree No. 9/2010 (I 21) on the detailed rules governing the use of funds allocated to the priorities of the Environment and Energy Operational Programme and on certain titles of support;

- Government decision No. 2078/2008 (VI 30) on the measures by the Government to improve the energetic characteristics of buildings;

- NFGM decree No. 10/2009 (IV 14) on the target allowance in the construction sector;

- Law No. LIII of the year 2006 on the fastening and simplifying the implementation of investments outstanding from a national economical aspect;

- Government decree No. 161/2008 (VI 19) on the construction affairs examination and continued vocational training of construction and construction supervisory authority decision-preparers and decision-makers.

**Useful links:**

- Ministry of National Development
- Hungarian Energy Office
- Energy Centre Non-profit Ltd.

### 3.4.8. Project financing

Based on past experience of project financing the primary aspect is not the financial standing of the company creating the project but the establishment’s future return and income producing ca-
pability.
Basic criteria of project and real estate financing
- For the implementation and/or operation of a project of high value usually a partnership is founded.
- It is favourable if the project can physically, financially, and legally be separated from the parent company.
- Incomes and expenses should be easily separable.
- Generally, investments requiring high capital concentration must be implemented involving project management and technical experts of appropriate level.
- Experience gained in the implementation of similar projects is an advantage.
- Involving own funding and coverage promotes the implementation of the credit depending on the nature of the project and the security system.
Basic securities of project and real estate financing:
- Transfer of incomes and contractual rights
- Directing incomes to blocked account
- Mortgage on all instruments and bank accounts of the project
- Equity of redemption on the real estates
- Security interests/Mortgage on the shares/share in business of the project company
Moreover, banks have different strategies and solutions in the field of project financing, and for the project companies and company groups with appropriate background it is essential to find the finance company admitting and financing the project.

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

3.4.9. Readiness for uptake
District heating systems were installed to serve prefabricated, massive, industrial-like blocks of flats. Therefore, the heat-sources of these systems, the heat-insulation and heating equipment of the flats are energetically inefficient, and therefore the population finds the service expensive. The public acceptance of district heating had been increased by offering subsidies for a large part of the society over several years. During the past decade the modernization of district heating meant to primarily prioritize the combined electric energy production. The unclear ownership situations and the neglecting of the ‘market aspect’ result in deep, constant tensions between the service providers and users. This is in many cases manifested in validating the intention to step off from the service. It also hinders the investment by residential communities aiming at improving the energy efficiency. Today it is inevitably urgent to define national measures aiming at the real settlement of problems.
The energy policy has to support the formation of supply markets. An efficient aspect of this is to increase the motivation for energy-saving and stepping up against service providers’ propaganda to maintain the level of energy demand. An important field of energy-saving is reducing the losses in energy supply, and increasing the efficiency of energy supply. A part of the savings can be achieved in energy production and in energy conversion. Besides, it has become inevitable to provide controllable community networks and to introduce the system of usage-based payment on a wide-scale. Possible measures to achieve this are as follows: first, it is important to define and set out minimum specific energetic efficiency indexes (efficiencies) in the energy production. Another large field of saving is reducing the losses in energy usage, or in other words increasing usage efficiency. It includes the introduction of a certification system in the year 2012 on certifying the fulfilment of building performance requirements based on EU regulations. Energy-saving by the users may also be provided by the energy consumption indices specified by the authorities for household appliances, and their fulfilment. A financial fund is to be established for supporting efficiency improving investments. National support needs to be provided to increase the motivation for energy saving in the population.

Useful links:
• [Hungarian Association of Renewable Energy Sources](#)
• [Hungarian Biomass Competence Center](#)
3.5. Denmark

Danish Bioenergy Association
(DI Bioenergi)
Kristine van het Erve Grunnet
H.C. Andersens Boulevard
DK-1787 Copenhagen V
Tel.: +45 3377 3369
Email: keg@di.de

3.5.1. Country Score

Country Score Central Denmark - DH (November 2011)

In the general scoring for sector, Denmark - Central is rated place 44 out of total 81. The underlying categories that influence this result are displayed in the bar chart above.

3.5.2. Basic Data

The Kingdom of Denmark (excluding Greenland and the Faroe Islands) has a mainland area of 43 098 km² 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 inhabited, and the largest two islands are Zealand and Funen. Denmark also exercises sovereignty over the Fa-

1 Energy Policies of IEA countries, Denmark 2011 review
roe 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. Of the total surface area, 62% is used for agriculture, which offers a great theoretical potential for agricultural feedstock supply for the biogas sector.

The population of Denmark was 5.5 million in 2010, with 126 inhabitants per square kilometre, almost half of whom live on the islands of Zealand and Funen. Almost 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. A considerable contribution to the renewable energy sector comes and will come from district heating and co-generation heat based on biomass. A number of conditions promote the use of renewable energy in district heating, e.g. biomass is non-taxable. However, the regulations are intended to ensure that a large part of district heat generation comes from co-generation. Hence, it is not possible for separate heat plants to exchange taxable fuels for biomass (non-taxable). Therefore, expansion with biomass can only take place if biomass is used in co-generated heat.

Heat consumption must gradually be converted to using renewable energies. The energy agreement of the 22nd of March 2012 contains the following elements to reach the RES target in 2020.

- Converting the coal production at large-scale power plants to biomass will be made more attractive by amending the Act on Heat Supply.
- The CHP producers and heat consumers are allowed to enter into voluntary agreements where the tax benefit from switching from fossil fuels to biomass in the heat production can be split between the two parties.
- Furthermore 35 smaller open-field CHP plants that are struggling in the wake of high heating prices will be allowed to produce cheap heating based on a maximum of 1 MW biomass fired boiler.

The support scheme for the production of electricity and heat is regulated by the Promotion of Renewable Energy, Act on Electricity Supply and Act on Transmission Grid Operator Energinet.dk.

With an already extensive district heating system in Denmark, much of which is still based on fossil fuels, there is great potential for conversion to an increasing use of various forms of RES. This will form part of the Danish expansion with renewable energy up to the 2020 target.
The possibility of being able to change to renewable energy for heat generation without simultaneously producing electricity is limited to a certain extent by the provisions on choice of fuel as noted in the provisions of Executive Order No. 1295 of the 13th December 2005 on the authorisation of projects for combined heat supply installations (project order). According to the Order, District Councils can approve natural gas, biomass, biogas, and waste for the generation of co-generated heat.

With separate heat generation, it is impossible to exchange taxable fuels for non-taxable fuels, i.e. biomass. Expansion with biomass can, therefore, only take place if biomass is used in co-generated heat. The regulations are intended to ensure that a large part of DH generation is produced via co-generation.

The biomass technology is not yet efficient in small scale co-generation which means that small scale energy generation is not fuelled with biomass but in most cases with natural gas. This can be seen as a consequence of the regulation.

### 3.5.4. Feedstock

Danish biomass is derived either from waste and residues from forests, agriculture, or from energy crops. Straw and wood could provide energy of approximately 100 PJ per year in 2050. From that 70 PJ comes from the use of various forms of biological waste from agriculture, industry and cities. Beyond this there is a possibility of growing energy crops on a portion of the current agricultural area.

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 also 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.

In 1989, the government announced its intention to double the Danish afforestation within a century. Various steps have been taken towards achieving this goal. For example, a government grant scheme has been established that supports private afforestation on agricultural land and the state also works to plant new forests. Recent data suggests that the forest cover in Denmark is larger (14%) than previously estimated (11%) and that these forests are older than previously thought. This could change the status of Danish forests from being a net sink to be a net source in 2008-2012. An extensive survey of Danish forests was conducted in 2011, improving the present estimates with up to date figures. The survey will be finalised in 2012.

The harvesting levels in Denmark are below the annual increment. However, increasing wood supply from domestic forests is a subject to mobilization cons-
traints. Already today, Denmark is a net importer of woody biomass for energy end-use. 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. ²

In Denmark, the potential for producing bioenergy from biomass can grow further, also 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 bio-

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² ECOFYS, Renewable energy policy country profiles

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gas, animal fat for biodiesel and by using perennial energy crops as well as grass from low-lying areas. It will, however, be necessary to include part 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 (see Figure ‘Economic Performance Energy Crops’).³ The Danish agricultural sector’s contribution to bioenergy production is already relatively high as 12% of the 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

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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 increasing demand. Prices for straw and woodchips have been more stable, but even they show an increasing trend in the same period. It can also be noted that woodchip prices have consistently been above straw prices (Figure 'Biomass Prices').

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

The generation of RES-H is supported through tax exemptions. In CHP plants, the heat produced from biomass and biogas is exempted from energy taxes. Biomass in general is non-taxable as well as being CO₂ neutral, it is exempted from CO₂ duty.

Some projects can be supported by more than one support measure. For example, in CHP plants, the heat produced using biomass is exempted from energy taxes, and electricity receives feed-in tariff/premium. RES-E producers receive a variable premium on top of the wholesale electricity price. The sum of the premium and the market price shall not exceed a certain statutory maximum, which depends on the date of connection of the system and the source of energy used. In certain cases, system operators are granted a guaranteed premium and are thus not subject to a statutory maximum. The persons entitled to the payment of a premium are

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**Figure 'Biomass Prices': Historical Biomass Prices from 1997-2010**

Source: Dansk Fjernvarme
owners of systems for the generation of electricity from RS.\textsuperscript{6}

In the new energy agreement of the 22\textsuperscript{nd} of March 2012 several initiatives to promote the use of district heating have been decided on.

- An implementation for an expansion of the biogas sector has been agreed upon. The overall support for biogas used for co-generation is being increased to €15.46/GJ (DKK115/GJ) in 2012.
- From 2016 it will no longer be possible to install boilers in existing buildings in areas with district heating or natural gas as alternative.
- A fund will be established to promote efficient use of renewable energy in production processes in the industry. The aid is given as grants for projects that replace fossil fuels with renewable energy or district heating and energy efficiency improvements directly related to these conversion projects. Companies that currently use DH in their process may instead choose to continuously receive a grant for their additional costs of up to €5.68 €/GJ (DKK42 DKK/GJ) if cogeneration is converted to biomass and assuming that the scheme is approved by the EU under State aid rules.
- The Danish government will set aside €33.78 million (DKK250 million) in 2013 and €67.57 million (DKK500 million) annually from 2014 to 2020. The scheme will be evaluated during the first half of the 2015.
- A subsidy of €4.05 million (DKK30 million) is introduced annually from 2013 to 2020 to maintain and promote industrial cogeneration in industry and gardening which are financed through a security of supply fee.

**Useful links:**
- [Danish Energy Agency](#)

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\textsuperscript{6} ECOFYS, Renewable energy policy country profiles
• Danish ministry of Climate, Energy and buildings
• Danish District Heating Association

3.5.6. Market Environment

Denmark is a net exporter of oil and natural gas and can be expected to remain so at least until end-2018 for oil and 2020 for gas. Energy exports were 17.2 Mtoe in 2010 while imports were 13.8 Mtoe, making Denmark a net exporter of energy. The share of RES in TPES is relatively high at 20.7%, largely wind and biomass. In 2010, oil accounted for over half (54%) of Denmark’s indigenous 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.

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-Illund) 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 Illund 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 to Sweden and the western area was connected to 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 fa-
ilities are owned by nine regional grid companies.

In 2010, TPES amounted to 19.7 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.

The significant changes in the composition of energy consumption by energy type reflect changes in the composition of heating installations in homes over time. 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 at the cost of oil-fired boilers (see Figure ‘Heating Installations Homes’). As of 1st of January 2011, the total of 2.75 million heating installations are composed 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%.

In 2010 district heating amounted to 35.5% of household energy consumption. District heating production is generated at large-scale CHP units (46 %), small-scale CHP units (19 %), district heating units (19 %) and by autoproducers, such as industrial enterprises, horticultures and waste treatment enterprises (15 %). About 62 % of the Danish housing is supplied with district heating. This percentage cannot increase much

7 Statistics Denmark
further because the majority of remaining households are located in areas which have a low population density and therefore it would be too expensive to provide them with DH.

The 55 to 60 largest enterprises supply 60% of district heating. In 2010, 77.2% of the district heating was produced together with electricity. The corresponding figures in 1990 and 1980 were 58.8% and 39.1%, respectively. The remaining 22.8% is produced in smaller plants which primarily produce heat. There are about 600 suppliers of DH of which 200 district heating plants and 15 CHP plants are fuelled by solid biomass and 30 CHP plants are biogas-fired. Since the late 1980s and during the 1990s, the share produced at small-scale units increased as purely heat-generating district heating units were converted to small-scale CHP generation. The same period saw an increase in production by private CHP units. Total district heating production was 150 PJ in 2010. This was an increase of 14.9% compared to 2009, due to the considerably colder weather. Compared to 1990, production of district heating has grown by 62.3% and this is an increase of 90% compared to 1980 (see Figure “Type of Producer”).

District heating is a large end-user of biomass to energy in Denmark. In 2010, solid biomass and biogas contributed 52,085 TJ to renewable heat production, representing 39% of total renewable energy production. Biomass-fuelled DH and CHP plants have been a common part of the Danish electricity and district heating supply for decades. In 2010, 39% of the fuel mix was biomass, mainly straw (9%), woody biomass (18%), and waste (10%).

There was a significant change in the fuel used in the production of district heating in the period 1980 to 2010. In 2010 the distribution was: biomass 38.7%, natural gas 29.6%, coal 18.9% and oil 4.5%. Consumption of natural gas and renewable energy etc. has increased year by year. In 1990, the share of natural gas and biomass was 17.4% and 24.9%, respectively. The percentage of oil fell sharply from 1980 to 1990, and has subsequently remained more or less constant. Consumption of coal decreased significantly from 1990 to 2010. In
1990, this constituted 44.2% of the total consumption of fuel for district heating (see Figure ‘Fuel Consumption Change’).

In Denmark, the potential for producing bioenergy from biomass can grow further, also 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 by using perennial energy crops as well as grass from low-lying areas. It will, however, be necessary to include part 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.\textsuperscript{11} The Danish agricultural sector’s contribution to bioenergy production is already relatively high as 12% of the 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.\textsuperscript{12}

An analysis of the future role of district heating in the energy supply will be prepared and presented by the end of 2013. The government has set aside €0.4 million (DKK3 million) for this analysis. Moreover, an analysis of the development of bioenergy in Denmark will be prepared. This analysis will focus on whether the conditions for an efficient and environmentally sustainable use of biomass resources in the Danish energy supply are appropriate. The analysis must assess the CO\textsubscript{2} displacement as well. A total of €1 million (DKK7.5 million) in 2012-2015 will be set aside for this analysis by the

\textsuperscript{11} Ministry of food, Agriculture and Fisheries, Report on Biomass

\textsuperscript{12} Energy Policies of IEA countries, Denmark 2011 review
Danish government. The analysis will be presented by the end of 2013.

Useful links:
- Danish Energy Agency
- Ministry of food, Agriculture and Fisheries, Report on Biomass

Facts and figures:
- Annual statistic

3.5.7. Regulation

CHP plants are regulated by the Act on Electricity Supply and by the Act on Heat Supply, because the plants produce both electricity and heat. The plants vary in size and production methods and are as such regulated differently. The centralized CHP plants are exclusively subject to the Act on Electricity Supply, while the district heating transmission pipelines must be approved by the Act on Heat Supply. The large decentralized CHP plants (over 25MW) are also subject to the Act on Electricity Supply and the district heating transmission and distribution pipelines are regulated by the Act on Heat Supply. The small-scale CHP plants (below 25 MW) are regulated only by the Act on Heat Supply.13

The Danish Energy Agency has set the general conditions for the establishment and operation of district heating. These conditions are intended to ensure that both cost-effectiveness and consumers’ heating costs are taken into consideration. The Danish Energy Regulatory Authority (DERA) and the Energy Supplies Complaint Board monitor the district heating sector and handle complaints regarding prices and conditions. The district heating sector is owned and operated in various ways. There are cooperatives, jointstock companies and local authority companies (often interest group companies and local authority supply bodies). In the district heating market, both production and network companies are monopolies and regulated as nonprofit undertakings. DERA monitors their prices and delivery terms, and takes regulatory action if the prices and terms of the network companies are not in line with the non-profit regime.14

Danish local authorities are the central players in the public heat supply; they develop heating plans and are responsible for expanding district heating and for implementing any changes made necessary by amendments to the regulations in the Act on Heat Supply.

The obligations to use RES in new buildings are applied not on the building level, but 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

13 Danish Energy Agency
14 Energy Policies of IEA countries, Denmark 2011 review
areas there is an obligation for buildings to connect to a district heating system. Only new low energy buildings are dispensed from this obligation.\textsuperscript{15}

The emission limits are regulated by the Environmental Protection Agency. For combustion installations with a rated thermal input exceeding 50 MW emission limits are set by the ordinance on limitation of certain atmospheric pollutants from large combustion plants (\textit{Bekendtgørelse om begrænsning af visse luftforurendende emissioner fra store fyringsanlæg}). This ordinance sets limit values for SO\textsubscript{2}, NO\textsubscript{x} and dust. The Order distinguishes between existing and new facilities. The ordinance will be replaced by the Industrial Emissions Directive which will be implemented in Denmark in January 2013.

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

\textbf{Useful links:}
- [Ordinance](http://europa.eu/legislation_summaries/economic_and_monetary_affairs/institutional_and_economic_framework/l25061_en.htm)
- [Environmental Protection Agency](http://www.coface.com/CofacePortal/COM_en_EN/pages/home/risks_home/country_risks/rating_table?geoarea-country=COUN_AREA_04&rating=&brating)
- [Department of Environmental Science at the University of Aarhus](http://www.euo.dk/nyheder/euidag/2011/maj/foraarsprognose2011/)
- [ECOFYS, Renewable energy policy country profiles](http://www.ecofys.com/ratings/en/eu/)

### 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\textsuperscript{16} and Moody’s. In the COFACE country risk rating\textsuperscript{17} Denmark positions itself at the top of the score same as in the Corruption Perception Index\textsuperscript{18} for the level of transparency. The ease of doing business is seen to be quite favourable in Denmark by IFC World Bank.\textsuperscript{19}

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. 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.\textsuperscript{20} 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.\textsuperscript{21} For 2011 and 2012 inflation is expected to lie at 2.6 \% and 1.8 \%, respectively.\textsuperscript{22}

The easiness of getting a credit from banks is dependent on individual pro-
\textsuperscript{18} [Corruption perceptions index 2011](http://cpi.transparency.org/cpi2011/results/)
\textsuperscript{19} [IFC, Doing Business Index](http://www.doingbusiness.org/rankings)
ject designs as they assess reliability of chosen technology as well as feedstock supply security and price risks.

3.5.9. Readiness for uptake

Key institutions:23

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.

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 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 the 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.

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23 Energy Policies of IEA countries, Denmark 2011 review
3.6. Sweden

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3.6.1. Country Score

Country Score Sweden Middle Norrland -DH (November 2011)

In the general scoring for sector, Sweden - Middle Norrland is rated place 12 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 450,295 km², Sweden is the third largest country in the EU; however, with a total population of about 9.4 million it is only the 14th most populated one. On average,
21 inhabitants live per square kilometre but 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. Hence, 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.

Useful links:
Facts and Figures:
- Swedish Board of Agriculture
- Swedish Board of Forestry
- Official Swedish Statistics
- EUROSTAT

3.6.3. Energy policy

Swedish energy policies are somewhat unique in the EU, as there are no feed-in tariffs or mandates. The incentives and support systems are designed to be very general in accordance with PPP. Fossil energy is taxed higher than renewable energy in order to make the latter competitive on the market. The taxation combined with investment support for emerging technologies has been very successful, and created a strong market growth. Sweden has no binding or dedicated targets on specific energy forms. All policies are set to be technology neutral. There are therefore no specific targets for district heating in Sweden and no specific measurements included in the nREAP plans, apart from the general incentives for renewable energy in Sweden. As for all renewable energy forms of Sweden, the nREAP is hindering market development, as most EU 2020 targets for energy will be fulfilled already in 2012. So the measures in place are appropriate to reach the targets but are not designed to significantly boost market development.

The Swedish government aims at reaching a share of RES of the 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% which puts 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 EU Emission Trading System (ETS). Peat is also exempted from the energy and carbon tax, but is subject to a sulphur tax for its emissions. In the ETS, peat is considered as a fossil fuel. Plants that use waste as an energy fuel are all included in the ETS, and are not energy or carbon taxed. Nevertheless, waste constitutes a very interesting feedstock despite the tighter environmental restrictions that it is subjected to, as well as the increased cost of installations and ash handling, since generally companies pay plant operators to accept the waste which, by law, cannot be deposited in landfills in Sweden.

Over the last year, there has been a large discussion regarding the price levels of district heating and the lack of competitiveness in energy prices within district heating systems. Also, there have been complaints from industrial actors that have not been allowed to sell their excess heat on the closed and privately owned district heating systems. An official investigation ordered by the government on the possibilities of opening the market for third parties by law (Fjärrvärme i konkurrens = Competition in district heating systems) has been heavily debated but no changes in the current policy have been announced so far due to the opposition of the district heating markets.

Another policy that effects the expansion of district heating and thereby CHP in district heating systems is the increased demand for energy efficiency in the construction of new housing. Furthermore, targets for reduced energy usage in current building have been set. There are no direct support schemes or funding opportunities for district heating systems in place besides their exemption from the tax for renewable fuels used for energy production and the produced energy itself. Even though there has been a discussion about the introduction of an energy tax on heating in order to increase energy efficiency in these systems, no policy change has been announced yet. There have also been discussions about taxing the energy that is used for heating in order to increase energy efficiency; however, until now, no policy has been suggested by the government.

Useful links:

Laws and Ordinances:

- **Energy Tax Law**

  1. Fjärrvärme i konkurrens SOU 2011:44
  2. For more info on the regulation in Sweden see: [http://www.boverket.se/](http://www.boverket.se/)
The use of biomass for district heating is 40 TWh. The main fuels are residues from the forest industry (bark, sawdust, chips, shavings, etc), forest residues (tops, branches, wood of low industrial value), recovered waste wood, refined wood fuels (pellets and briquettes), municipal and industrial biogenic waste, bio-oils, and peat. Furthermore there is also substantial use of waste heat from forest industries in nearby communities. District heating accounts for more than half of the heating of buildings in Sweden. The use of perennial energy crops is minimal in Sweden, and for more grassy crops only in the pilot stage. Forest fuels will dominate the fuels for the foreseeable future, as an introduction of perennial energy crops in most cases most be combined with changes in fuel feed-in systems and boilers.

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. There is only a minor use of agricultural crops. Used wood materials also constitute a growing 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. Nevertheless, suppliers of raw materials have been exploring alternatives for several years, especially Short Rotation Coppice (SRC) with salix or willow. The potential to increase the availability of biomass remains to be large, in particular with regards to the agricultural sector.

Fuels are not believed to be the limiting factor for the development of district heating in Sweden. The main hindrance for further development, however, is the large investment costs relative to the uncertain policy situation as well as a shortage in heating and/or cooling demands.

The Figure ‘Biomass Potential’ provides an overview over the biomass potential of various sectors.

**Useful links:**

- **Swedish Energy Agency**
- **Swedish Board of Agriculture**
- **Swedish bioenergy association**
- **Swedish district heating association**
- **Swedish waste association**
ETS do not have the same incentives to change to renewable heat, the degree of biomass use varies. Whereas industrial applications still rely on fossil fuels, district heating plants targeting the consumer markets tend to have a much higher share of biomass usage. Almost all district heating systems are biomass or waste based; however, industrial application outside of the forest sector is lagging behind. This is due to the free hand-out of CO$_2$ emission certificates to these companies, and the low market price of the emission trading rights.

Most major cities are already equipped with district heating systems, and due to this saturation, the rate of new instalments of district heating systems have declined. It is important to note, however, that houses and industries are continually added to exciting district heating grids. Furthermore, smaller district heating systems are connected in order to install CHP capacities.

A commonly raised concern exists with

Swedish Board of Forestry
Official Swedish Statistics
EUROSTAT

3.6.5. Business Case

Due to the steady increase of the carbon tax, bioenergy has become cost competitive in all markets outside of the ETS. Unfortunately the value of carbon emission rights have been too low and emissions rights have been given out too freely in order to compensate the loss of the carbon tax for this sector. Another sector where bioenergy has not yet become the most commonly used fuel is the one of midsized industries that benefit from a reduction of the carbon tax. However, as the carbon tax for these instalments was raised in 2011 (up to 30%), and will be raised again in 2015 (up to 60%), it is expected that also these companies will show an increased market interest for bioenergy. As industries and district heating systems that are included in the
regards to feedstock prices; however, the nominal price index of biomass has shown no significant increases that would have been caused by the energy sector. During short periods there have been price peaks due to shortages, often caused by lowered activity in the forest sector as during the last recession, but overall the energy prices have been relatively steady. To assist the market with the indication of price levels of bioenergy, the Swedish energy Agency publishes the quarterly price indexes of bioenergy.\(^3\) To increase the level of transparency even further, discussions on how to create market sites for biomass trading are ongoing. An interesting market development with regards to increased transparency comes from ENBIO,\(^4\) a participating company of the Crossborder Bioenergy Project. ENBIO has recently introduced a biofuel trading site where bioenergy actors can trade and market their biomass volumes on an open and public site.

District heating is viewed as environmentally friendly, climate smart and an easy energy source that rarely fails. However, the price of district heating services has lately been questioned more frequently due to price increases, large price variations between different parts of the country, and the need of boiler and system renovations that most district heating systems are in need of. Renovations generally lead to price increases but they also open up the market for technical providers in Sweden.

Today, there is no direct public funding for the creation of new district heating systems or the instalments of boilers available. However, the exemption from the energy and the carbon tax and the availability of green electricity certificates for renewable electricity render these instalments profitable.

**Useful links:**

Facts and figures:
- [Swedish Energy Agency](http://energimyndigheten.se/sv/)
- [Swedish Board of Agriculture](http://)
- [Swedish Board of Forestry](http://)
- [Official Swedish Statistics](http://)
- [EUROSTAT](http://)
- [Swedish district heating association](http://)

### 3.6.6. Market Environment

In Sweden, biomass heating plants currently supply residential estates, public buildings as well as the industry with heating via district heating networks. As the district network system is so advanced in Sweden, only very few new stand alone networks will be created in the future. The largest market potential lies in the enlargement and combination of existing district heating systems and the addition of new energy sources as excess heat from industries. There is also a very large interest to install CHP capacity in district heating nets which currently lack the capacity to produce electricity. In order to do so, existing

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3 One example of a price sheet: SVERIGES OFFICIELLA STATISTIK STATISTSKA MEDDELANDEN EN 0307 SM 1202 se more on http://energimyndigheten.se/sv/Statistik/Energipriser/

4 www.enbio.se
networks have to be combined or technology has to be improved to lower the price of small scale electricity production from solid biomass.

The market structure in district heating has changed significantly over the last decades. Most district heating networks were built by municipalities that wanted to improve air quality in cities and to provide inhabitants with a clean and cheap energy source. Several of these district heating networks have been sold to private actors and smaller systems have later on been resold to new actors. In Sweden, the larger energy companies are focusing on big instalments and are selling of smaller district heating systems which provides a market opening for new market actors. However, as many of these district systems will need to upgrade their boilers and piping, market growth will mainly be based on the replacement and improvement of existing systems. Another opportunity is the switch of the fuel-handling system away from biomass to another energy source in order to make the system more cost competitive.

The biggest market potential therefore lies in the upgrading and/or connection of existing district heating networks, as well as in the enlargement of the share of excess heat sales and CHP installations.

There is a large market competition. Market actors in Sweden have a high expertise in the field the procurement of parts and an installation can come from several different suppliers. The market is therefore relatively easy to enter as the procurement actors are used to comparing quality and prices from several actors. The market is very similar with that of the district heating. Where all plant installations and sales that can produce bio-electricity to a competitive cost do so.

These plants are built on spec according to the client’s special needs, so customer relations and good knowledge is key to enter the market. Most constructions are built through consultant agencies that aid in constructing, planning, procurement and so forth.

There is a large focus at the moment to find small- and medium scale CHP solutions.

**Useful links:**

Facts and figures:

- Swedish Energy Agency
- Swedish Board of Agriculture
- Swedish Board of Forestry
- Official Swedish Statistics
- Swedish bioenergy association
- Swedish district heating association
- Swedish waste association

3.6.7. Regulation

The approval of solid biomass plants by authorities is not perceived as a barrier to market entry. 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 incineration plants and operations based on used wood face much stricter operation conditions.

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 in Sweden. 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 are both determined on annual basis for all plants according to emission data and emission averages.

Many biomass plants in Sweden are also encouraged to return the clean biomass ashes to the forest for nutrient cycling. This is supported by very high deposition cost for these ashes in landfills. The conditions for spreading of ashes are, however, relatively strict and the process is also costly. Hence, markets for the alternative usages of ashes, as filling material in landfills, in the field of road constructions, and as fertilizer in plant soils, have been developed. Further information and advice on this matter can be obtained from Svenska energiaskor (Swedish Energy Ashes), an organisation helping biomass plants with the handling of their bioash, as well as from Avfall Sverige, the Swedish Waste Management.

**Useful links:**

Facts and figures:

- Miljöbalken, Swedish environmental law
- Swedish Energy Agency
- Laws in the internet

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

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 ordinances 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 be financed. Many financial institutes openly claim to support investments in renewable energy but the projects must be financially viable in order to get loans. Small local banking offices can give generous loans but this often requires a local and well-known entrepreneur to be part of the project planned.

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 same than a sound concept for the sales of the product.

Useful Links:

Facts and figures:
- Swedish Energy Agency
- Swedish Board of Agriculture
- Swedish Board of Forestry
- Official Swedish Statistics
- Swedish bioenergy association
- Swedish district heating association
- Swedish waste association

Rating agencies
- Standard & Poor’s
- Moody’s
- COFACE
- 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. However, customers of district heating and green electricity are rarely aware of the
fact that they are actually buying district heating or green energy. 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. The information available and the size of the branch organisations do no directly correlate to the size of the industry. There is an acute information shortage in society and industry regarding the importance of bioenergy.

Companies can from these organisation get knowledge on legal changes, nation EU and global polices affecting bioenergy. There are also information exchange between companies and networking to acquire new business partners. Capacity building events are offered, as well as aid in legal affairs. There are also magazines and information material both B2B and for the public produced to increase the awareness of bioenergy. Sectorial projects are also being administered by these organisations.

In Sweden we also have regional energy hubs and municipal energy advisors to aid companies and private persons in their decisions upon energy solutions. District heating accounts for more than half of the heating of buildings in Sweden. In the beginning, the reason for the large investments in this infrastructure was the aim to build large heat plants with efficient flue gas cleaning in order to reduce air emissions caused by the large number of individual furnaces and boilers. Thousands of chimneys in a city were replaced by one single smokestack. The result has been very positive. Air quality has improved drastically in the cities, particularly in winter time. District heating and CHP are therefore being perceived as environmentally friendly. The largest barrier for new connections is the instalment fee that is sometimes perceived as high relative to other energy options.

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.

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.

Useful links:
Associations:

- **Swedish bioenergy association**
- **Swedish district heating association**
- **Swedish energy association**
- **Swedish waste association**

Institutions:

- **Swedish Energy Agency**
- **Swedish Board of Agriculture**
- **Swedish Forest Agency**
- **Swedish Environmental protection agency**
3.7. Latvia

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3.7.1. Country Score

Country Score Latvia - DH (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 east by the Russian Federation, 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 ca-
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°C 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 regions of Latvia are not administrative territorial divisions, since they are not mentioned in the law which lays down the administrative territorial divisions of Latvia. With 2,229,641 inhabitants and a territory of 64,559 km² it is one of the least populated countries of the European Union. There are five cities with more than 50,000 inhabitants.

3.7.3. Energy Policy

The Energy section of Latvia’s Sustainable Development Strategy 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 is to be increased to at least 40%. Thereafter it 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 and be increased gradually thereafter.²

The Law on Renewable Energy still has

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¹ Latvia in brief. Latvian Institute. http://www.latvia.eu/content/latvia-brief
Two types of fuel – natural gas and energy wood dominate in the Latvian district heating as primary energy resources. Since 2004 the total ratio of these energy resources in the structure of district heating fuels has had the tendency to increase replacing mainly the use of petroleum products and oil shale.

In district heating, local and individual heating wood and its derivatives are mostly used as renewable resources. Firewood, wood chips, chippings, pellets and other woodwaste are used for the needs of district heating.

Latvia has a high potential of solid biomass fuels (see Figure 'RES Latvia'). The main solid biomass source is wood. In 2006 has been estimated that approximately 55% of the total area of Latvia is covered by woods, making Latvia the fourth most forested country in Europe where only Finland (77%), Sweden (76%), and Slovenia (63%) are richer in forests.

According to the data of the Central Statistical Bureau, the area taken by forests in Latvia in 2008 was 3221 thousands of hectares, 1522 thousands 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

3 Ministry of Economics of Republic of Latvia. www.em.gov.lv
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 continues to increase year after year. It is promoted by the commissioning of new production facilities. 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.

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 millions m$^3$ were available for wood production in 2010.6

The Figure ‘Natural Increase’ shows the annual natural increase in wood and felling volumes by years (in million m$^3$).

3.7.5. Business Case

In 2011 the total number of boiler houses was 663 (see Table 'Thermal Power'). In 2011 130 of all 663 boiler houses used firewood, 85 – wood chips, 16 – pellets, 1 – briquettes, 1 – wood cut-offs, 1 – straw. A very large number of boiler houses – 309 – still use natural gas. A trend to supplement gas and liquid fuel boiler houses with modern firewood and pellet heating boilers has been observed in the last years.

However, if we compare heating tariffs in cities, where gas heating and wood heating is used, in 90% of cases gas heating is more expensive, including when electricity is generated along with thermal energy.

Table 'Thermal Power'

<table>
<thead>
<tr>
<th>Thermal power</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;= 0.2 MW</td>
<td>105</td>
</tr>
<tr>
<td>0.2 &lt;P&lt;=0.5 MW</td>
<td>100</td>
</tr>
<tr>
<td>0.5 &lt;P&lt;=1 MW</td>
<td>113</td>
</tr>
<tr>
<td>1 &lt;P&lt;=5 MW</td>
<td>242</td>
</tr>
<tr>
<td>5 &lt;P&lt;=20 MW</td>
<td>77</td>
</tr>
<tr>
<td>20 &lt;P&lt;=50 MW</td>
<td>14</td>
</tr>
<tr>
<td>&gt;50 MW</td>
<td>12</td>
</tr>
</tbody>
</table>

The rate of increase of the use of high-efficiency cogeneration units in district heating is held back by large volumes of investments required, limited opportunities of local governments to get loans, as well as slow capital turnover. Due to these reasons local governments are still operating low-efficiency units causing increased fuel consumption and failure to ensure heat supply in the required quality. However, the average level of efficiency of thermal energy generation units in Latvia has been evaluated as high.

Figure ‘Change in Price’ demonstrates graphically the differences in wood and natural gas prices from 2006 to 2010.

3.7.6. Market Environment

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.

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) (2009, Eurostat). 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 as shown in Table ‘Energy Structure’.

If we look at the structure of district heating supply, 28.66 PJ of thermal energy were generated in 2010. 16.82 PJ of this energy was generated by cogeneration plants, and 11.84 PJ by boiler houses; hence, cogeneration plants generated 58.7% of thermal energy, and boiler houses 41.3% of thermal energy from the whole district heating supply.

In Latvia almost all district heating networks are owned by municipal district heating companies. The Energy Law provides that local governments are responsible for the organization of heat supply in the area of the municipality. However, local governments frequently do not have sufficient funds to invest in the development of infrastructure, therefore one of solutions is to seek cooperation with private investors.

3.7.7. Regulation

The Law of Renewable Energy is not adopted by the Saeima. The draft Law on Renewable Energy provides for spe-
The following laws and Cabinet Regulations apply to district heating:

- Law On Administration of Residential Houses
- Law On Residential Properties
- Energy Law

- Energy End-Use Efficiency Law
- Law on The Energy Performance of Buildings
- Law ‘On Excise Duties’
- Law ‘On Regulators of Public Utilities’

### Table 'Energy Structure': Structure of generated energy between 2000 and 2010 (in %)

<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generated electricity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power plants</td>
<td>12.92</td>
<td>15.05</td>
<td>20.46</td>
<td>19.94</td>
<td>22.31</td>
<td>22.01</td>
<td>27.75</td>
</tr>
<tr>
<td>Cogeneration plants</td>
<td>12.92</td>
<td>15.04</td>
<td>-</td>
<td>0.01</td>
<td>0.02</td>
<td>0.03</td>
<td>0.07</td>
</tr>
<tr>
<td>Generated district heating energy</td>
<td>7.08</td>
<td>84.95</td>
<td>79.54</td>
<td>80.06</td>
<td>77.69</td>
<td>77.99</td>
<td>72.25</td>
</tr>
<tr>
<td>Cogeneration plants</td>
<td>32.89</td>
<td>40.03</td>
<td>44.08</td>
<td>44.87</td>
<td>40.85</td>
<td>42.86</td>
<td>42.40</td>
</tr>
<tr>
<td>Boiler houses</td>
<td>54.20</td>
<td>44.91</td>
<td>35.46</td>
<td>35.18</td>
<td>36.84</td>
<td>35.13</td>
<td>29.85</td>
</tr>
</tbody>
</table>

3.7.8. Project Financing

High investment costs and problems with raising funds constitute the most significant obstacles, especially for local governments. In Latvia almost all district heating networks are owned by municipal district heating companies. According to the Energy Law local governments are responsible for the organization of heat supply in the area of the municipality. However, local governments generally lack sufficient funds to invest in the development of infrastructure and, therefore, many of the municipalities seek to cooperate with private investors.

A project tender is organized by mediation of the Investment and Development Agency of Latvia to receive funding of the Cohesion Fund to increase the efficiency of district heating systems. It is aimed at significantly increasing the efficiency of thermal energy generation, reducing thermal energy losses in transmission and distribution systems, and promoting the replacement of fossil fuels with renewable or other fuels. In 2012 funds in the amount of 19,748,422.25 LVL are envisaged from the Cohesion Fund of the EU within the framework of the fourth wave.\(^7\)

The ease of getting a loan from banks is very much dependent on individual project designs as they assess reliability of the chosen technology as well as feedstock supply security and price risks etc. Each bank in Latvia has different credit conditions. In general the interest rate for bioenergy projects equals general average interest rate on the market. The interest rate of each project is influenced by several risk factors; however, the purpose of loan is not the decisive factor.

3.7.9. Readiness for Uptake

During the last four years not a single DH project was declined due to public opposition.

The Latvian Association of Heating Companies (LSUA), a professional organization uniting district heating companies, manufacturers of heating equipment, advisors and mounting companies, suppliers of heating units and equipment, as well as individual members, has been operating in Latvia since 1993.

Firstly, LSUA’s goal is to develop heat supply, and to introduce more progressive technologies, experiences as well as modern power-saving equipment. Furthermore, LSUA promotes the use of local fuel, and the development of local heating equipment manufacturing. Finally, LSUA aims at participating in the development of heat supply development plans and proposals of laws and regulations.

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and one of the leading establishments of scientific ideas in forestry and the related research and development in the country. LSFRI’s principal task is to research forest ecosystems and their components, and to work out recommendations for the sustainable and rational management and use of forests and its products.11

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. LSFRI’s principal task is to research forest ecosystems and their components, and to work out recommendations for the sustainable and rational management and use of forests and its products.11

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 the advertisement of local RES in order to achieve higher economic and energetical independence of Latvia. LATbio’ spreads information about the availability of local RES and usage aspects, and promotes the development of scientific work in the field of renewable energy and harvest technologies.10

Founded in 1946, Latvian State Forest Research Institute (LSFRI) ‘Silava’ is

11 Latvian State Forest Research Institute “Silava”. http://www.silava.lv
Leading questions of the DH 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?
      - What is the average summer 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?
      - What is the density of road-network?
      - What is the density of water ways-network?
      - 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?
      - There are high-volume targets for solid biomass for heat?
      - There are high-volume targets for heat from DH?
      - Proposed measures for DH 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 DH and CHP?
• 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?
• How large is the wood for energy potential based on waste wood 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?
• How much of the wood for energy potential based on waste wood 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
• Area of fallow/abandoned land available for agricultural expansion

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 DH can be claimed in subsidies (cumulative, including tax advantages)?
• When does the scheme end granting funding for DH?
4.2 Financial support schemes can be claimed for operation
- How high is the legally guaranteed price for DH heat based on biomass?
- How long is the guaranteed duration for the DH support scheme?
- Is the DH operation 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 for a kWh(th) for a tonne of wood chips?
- What was the price volatility of wood chips over 1 year period (2010, calculated as difference between highest and lowest, divided by lowest price)

4.4 Prices of fossil fuels are high and heavily taxed
- What was the average price of coal for large scale consumers over the last year (2010)?
- What is the commodity price development of coal over the last 4 years?
- What is the tax on coal?
- Is the use of coal supported e.g. by tax incentives, obligations, free delivery of CO2-allowances etc.?
- What is the price per kWh of gas for households (average over the last year)?
- What is the price per kWh of gas for large scale consumers (average over the last year)?
- What is the commodity price development of natural gas over the last 4 years?
- What is the tax on gas (CO2, energy, excluding VAT or `normal’ taxes)?
- Is the use of fossil gas supported e.g. by tax incentives, obligations, free delivery of CO2-allowances etc.?

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

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

5.2 Is access to the heating grid ensured?
   • Are there priority rules for renewable energy in the DH sector?

5.3 The heat market offers good opportunities
   • What is the share of natural gas in the district heating sector?
   • What is the total amount of energy consumed by the district heating network?
   • What is the proportion of customers connected to a district heating grid?
   • What is the amount of coal in the district heating sector?
   • What is the average age of the stock of domestic heating appliances?

5.4 Produced energy can freely be marketed
   • Is the heat market liberalised and private firms are free to participate in any part of the supply chain?

5.5 The heat market in the target country provides promising growth perspectives
   • What is the rate of the additional heat demand until 2020?
   • What is the growth rate of DH in the last 4 years? CAGR
   • What is the cumulative amount of renewable heat produced by DH in the last available year?

5.6 The Framework conditions for fossil fuels do not impair market development
   • 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?

5.7 The potential for DH is important
   • What is the proportion of the national heat consumption delivered through DH?
   • What is the total energy amount of the national heat consumption delivered through DH?
   • What proportion of DH is fuelled with biomass?
   • What proportion of DH is fuelled with coal?
   • What proportion of DH is fuelled with LPG?
   • What proportion of DH is fuelled with natural gas?
• What proportion of DH is fuelled with natural oil?
• Number of cities with more than 50,000 inhabitants
• What is the amount of process heat consumed by industry?
• Number of existing DH networks fuelled with coal
• What is the share of biomass based DH compared to all DH
• What is the growth rate of biomass DH output over the last 4 years (CAGR)

5.8 An intense competition is not recognisable
• Number of competitors providing (manufacture or sale) large-scale biomass-fired facilities
• Total amount of DH 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 The approval procedure by the authorities is adequate in terms of time
• How long does an average permitting procedure for CHP/DH projects (<500kW) take in the target country?
• How long does the approval process last in average for large scale (>2MW) CHP/DH plants

6.3 Existing emission thresholds can be fulfilled with the applied technology
• Extra information DH

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
• Ranking of Feasibility of “getting credit” in the IFC-World Bank Doing Business Index

7.3 The banks are familiar with bioenergy technology and support its development
• Is the support of bioenergy projects highlighted in official papers of the banks, like annual reports etc.?
• Are Governmental guarantees for loans for bioenergy investments in place?

7.4 Foreign investments are supported in the target country
• Are there any programmes implemented in the region to attract foreign investments?

7.5 The banks in the target country provide attractive conditions for bioenergy projects
• Can bioenergy plants benefit from interest rates for credits lower than usual in the market?
• Are the support conditions feasible in an adequate scope?

7.6 The market is liquid and transparent
• Biomass fuel prices (wood chips, pellets, etc.) are published on market places
• Financial market instruments (e.g. hedging, futures) are available to lower the biomass fuel price risk

7.7 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 DH association (with a minimum of 10 company members)
assisting the market?
- Public web sites/ information/market reports on bioenergy

8.2 Public acceptance/knowledge of technology
- Is DH known to and well-regarded by general public?
- Have any DH project permissions been declined due to public opposition in the last four years?
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Impressum

Publisher: AEBIOM
Author: AEBIOM
Editor: eclareon Consultants
First Edition September 2012

Acknowledgements:
Special thanks are expressed to all industry stakeholders of the district heating working group for their contributions and their part in the discussions during the elaboration of the list of criteria and indicators.

Photos: ABA, GDF Suez, Direct Industry, Vattenfal, Flickr.

www.CrossBorderBioenergy.eu