PromoBio Project IEE/10/470/SI2.593725

Promotion of regional bioenergy initiatives in Poland, Romania and Slovakia

FINAL REPORT

Pasi Poikonen (ed.)

Co-funded by the Intelligent Energy Europe Programme of the European Union

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Main responsible partners for final report preparation (authors):
Bartłomiej Asztemborski, KAPE, Poland, E-mail: basztemborski@kape.gov.pl, Phone: +48 22 626 09 10
Ovidia Caba, ADR Centru, Romania, E-mail: ovidia.caba@adrcentru.ro, Phone: +40 258 818 616
Marius Duca, ADR Centru, Romania, E-mail: marius.duca@adrcentru.ro, Phone: +40 258 818 616
Jukka Eronen, Metla, Finland, E-mail: jukka.eronen@metla.fi, Phone: +358 40 569 1180
Ján Ilavský, UNIAG, Slovakia, E-mail:jilavsky@pobox.sk, Phone: +421 917 47 88 33
Christa Kristöfel, BIOENERGY 2020+, Austria, Email: christa.kristoefel@bioenergy2020.eu, Phone: +43 7416 52238 55
Juha Laitila, Metla, Finland, E-mail: juha.laitila@metla.fi, Phone: +358 50 391 3255
Karolina Loth-Babut, KAPE, Poland, E-mail: kloth@kape.gov.pl, Phone: +48 22 626 0910
Adriana Milandru, ISPE, Romania, E-mail: adriana.milandru@ispe.ro, Phone: +40 724 222 669
Pavol Otepka, UNIAG, Slovakia, E-mail: pavol.otepka@uniag.sk, Phone: +421 905 940 293
Pasi Poikonen, Metla, Finland, E-mail: pasi.poikonen@metla.fi, Phone: +358 40 801 5188
Jyrki Raitila, VTT, Finland, E-mail: jyrki.raitila@vtt.fi, Phone: +358 40 719 5117
Christoph Strasser, BIOENERGY 2020+, Austria, Email: christoph.strasser@bioenergy2020.eu, Phone: +43 7416 52238 27
Ryszard Wnuk, KAPE, Poland, E-mail: rwnuk@kape.gov.pl, Phone: +48 22 626 09 10

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Foreword

Dear Reader,

Currently, humankind is facing two major problems related to fossil fuel energy sources: energy dependence from a few unstable countries and climate change. Both problems have great implications in the global economy either currently or for the decades to come. In order to fight these two problems, policy makers are taking into consideration all of the technological possibilities available: energy efficiency, renewable energy sources (RES), fossil fuels with carbon capture and storage, etc. Bioenergy is a renewable energy made available from materials derived from biological sources.

Bioenergy is the dominant renewable energy source, amounting to 10% (1,200 million tonnes of oil [toe]) of global primary energy supply. In the future, the Intergovernmental Panel on Climate Change (IPCC) estimates that the use of sustainable bioenergy will triple towards 2050. The International Energy Agency (IEA) has envisioned a scenario where bioenergy is considered as a necessary technology to significantly reduce CO_2 emissions by 2050. The European Union (EU) also sees bioenergy as a great opportunity. Bioenergy will play a crucial role in the achievement of the 2020 renewable energy targets: it currently provides more than two-thirds of the renewable energy in the EU and is expected to account for more than half of the EU's renewable energy in 2020, and about 11% of total EU energy consumption, according to each member states' National Renewable Energy Action Plan (NREAP).

However, while well established in some European countries, the production and consumption of bioenergy is facing non-technological barriers that are impeding its large scale spread into the markets of most EU member states.

The Intelligent Energy Europe programme (IEE) established by the European Commission, which ran from 2003 to 2013, aimed at supporting initiatives addressing non-technological barriers with activities focused on creating favourable market conditions: preparing the ground for investments: informing stakeholders and fostering commitment: shaping policy development and implementation as well as building capacities and skills. IEE projects are expected to achieve actual changes in the form of greenhouse gas (GHG) emission reductions, production of renewable energy and cumulative investments in sustainable energy within the duration of the project and beyond. From 2014 onwards, these kinds of projects will be financed by the new Horizon 2020 programme.

The IEE project PromoBio aimed at providing support to the implementation of local bioenergy supply chains and to trigger investments in new bioenergy business in Eastern European countries (Poland, Romania and Slovakia), where potentials in woody biomass are promising but are not fully exploited for the production of renewable energy. Best bioenergy practices and successful business models from the partner countries Finland and Austria were taken as a reference and transferred to the target regions.

This report aims at summarising the situation in the target countries and the impact achieved by PromoBio as well as providing recommendations to replicate the activities across the EU.

Emilio Font de Mora
Project Officer
European Commission
Executive Agency for Small and Medium-sized Enterprises (EASME)

Executive summary

The PromoBio project was a three-year development project with €923,000 total funding starting in June 2011 and ending in May 2014. PromoBio helped to meet EU 2020 targets for renewable energy in general and particularly in the target countries. Seven partners from Austria, Finland, Poland, Romania and Slovakia participated in the action. Finnish Forest Research Institute (Metla) and Technical Research Centre (VTT) from Finland and Bioenergy 2020+ GmbH from Austria were the leading expert organisations in supporting roles. The Polish National Energy Conservation Agency (KAPE) from Poland, Institute for Studies and Power Engineering (ISPE) and Regional Development Agency Centru (ADR Centru) from Romania and Slovak University of Agriculture in Nitra (SUA) from Slovakia were the target country expert beneficiary organisations. The target regions were Warmia-Mazury province (Olsztyn and Ostróda districts) in Poland, Centru region in Romania and Banská Bystrica in Slovakia. The project increased the use of woody biomass for energy in the targeted countries and developed regional policy development. The project focused specifically on forest resources such as solid biomass with the technology sector concentrating on combined heat and power (CHP) and heating technology.

The main activities of the project were analysis of the current bioenergy sector and policy at the starting phase of the project: support to regional bioenergy initiatives by preparing regional bioenergy Action Plans and their follow-ups: initiating bioenergy pilot projects by producing feasibility studies for the pilot cases: and strong training input by organising local-level and international training events for entrepreneurs as well as publishing the sector-specific guidebook in English, Polish, Romanian and Slovak languages. In terms of results, the project produced 17 feasibility studies, 12 letters of commitment and involved 27 companies in the project development processes. The project experience will be replicated in the other regions inside the target countries. About 400 people participated in the different project events and three contracts for biomass supply and two contracts in woody biomass investments were signed during the project lifetime. RES, based on heat and power production, generated a capacity of 31 megawatts (MW), with 72,000 tonnes of wood chips and sawdust mobilised and 20 new jobs created. New investments amounted to €6 million in the target countries. The new renewable energy production was equivalent to 16,000 tonnes of oil per year (toe/year) and 19,000 toe/year primary energy savings were generated. Annually, 45,000 tonnes of CO_2 GHG emissions were reduced. The major challenges in the target countries for the positive development of the use of woody biomass RES in energy production are forest ownership arrangements, entrepreneurship, country-specific support schemes for the sector and the other institutional framework developments.

1 PromoBio Project framework

1.1 Background

The aim of the project was to provide support for woody biomass bioenergy initiatives and find new woody biomass bioenergy businesses in the three target countries and regions in Eastern Europe. The target regions were Warmia-Mazury province (Olsztyn and Ostróda districts) in Poland, Centru region in Romania and Banská Bystrica in Slovakia. In these countries, forest biomass and other woody biomasses have been utilised insufficiently, but it is quite certain that their potential is great. The easiest and fastest way to accelerate the woody bioenergy sector's development is to learn from others who have a longer history in the field. North Karelia in Finland and Lower Austria have sophisticated woody bioenergy markets and technologies and they both can be considered to be among the spearheads of woody bioenergy business in Europe. Therefore, they worked as the points of reference in the project and their best practices and approaches were tested and transferred to the target countries. Partners in the target countries were SUA in Nitra, Slovakia, ISPE and ADR Centru in Romania, and KAPE in Poland.

The background of the project was the international climate agreements regarding GHG emissions and their reduction. The agreements started with the Kyoto Protocol 1997, which was ratified in 2005. On 23 April 2009 the European Parliament and Commission announced a directive (2009/28/EC) which states that the share of renewable energy consumption must be 20% in the EU. All member countries of the EU have their own binding RES shares determined to be reached at the latest in 2020. RES production shares of the project partner countries between the years 2005–2012 and the legally binding shares in 2020 are shown in Table 1.

In addition to fulfilling the requirements of the Kyoto Protocol the directive aims, for example, to contribute to regional and local development, exports, social cohesion and employment in small and medium-sized enterprises (SMEs). The directive states that it is essential to support decentralised renewable energy production and its demonstration and commercialisation. Decentralisation has many benefits: energy sources can be local, which promotes local employment: transportation distances are shorter: and the energy transmission losses are smaller, etc.

Table 1. The RES shares of the project partners (%) in primary energy consumption between 2005–2012 and binding shares for 2020 (Source: http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2013:0175:FIN:EN:PDF).

Year/Country	Austria	Finland	Poland	Romania	Slovakia
2005	23.0	28.5	7.2	17.8	6.7
2010	30.1	33.0	9.5	23.6	9.8
2011/2012*	25.4	30.4	8.8	19.0	8.2
2020	34.0	38.0	21.0	24.0	14.0

* Interim target, average of 2011/2012.

There have been some negative tendencies in RES share development in certain countries because the overall production volumes in the forest sector have decreased due to depression in the global market during 2008–2011.

As stated in the 2009/28/EC directive, all EU states have constructed their own NREAP, which provide detailed road maps of how the member state is expected to reach its legally binding 2020 target for the share of renewable energy in its total energy consumption. In the plan, the member state sets out sector targets, the technology mix and the trajectory it will follow and the measures and reforms it will undertake to overcome the barriers in developing renewable energies.

1.2 Approach to work and specific objectives of the project

The project work was divided into seven work packages (WP) defining the package level responsibilities belonging to the specific partners. Each of the packages produced certain written documents called deliverables which support the achievement of the results. The project structure and the packages and their interactions are presented in Fig. 1.

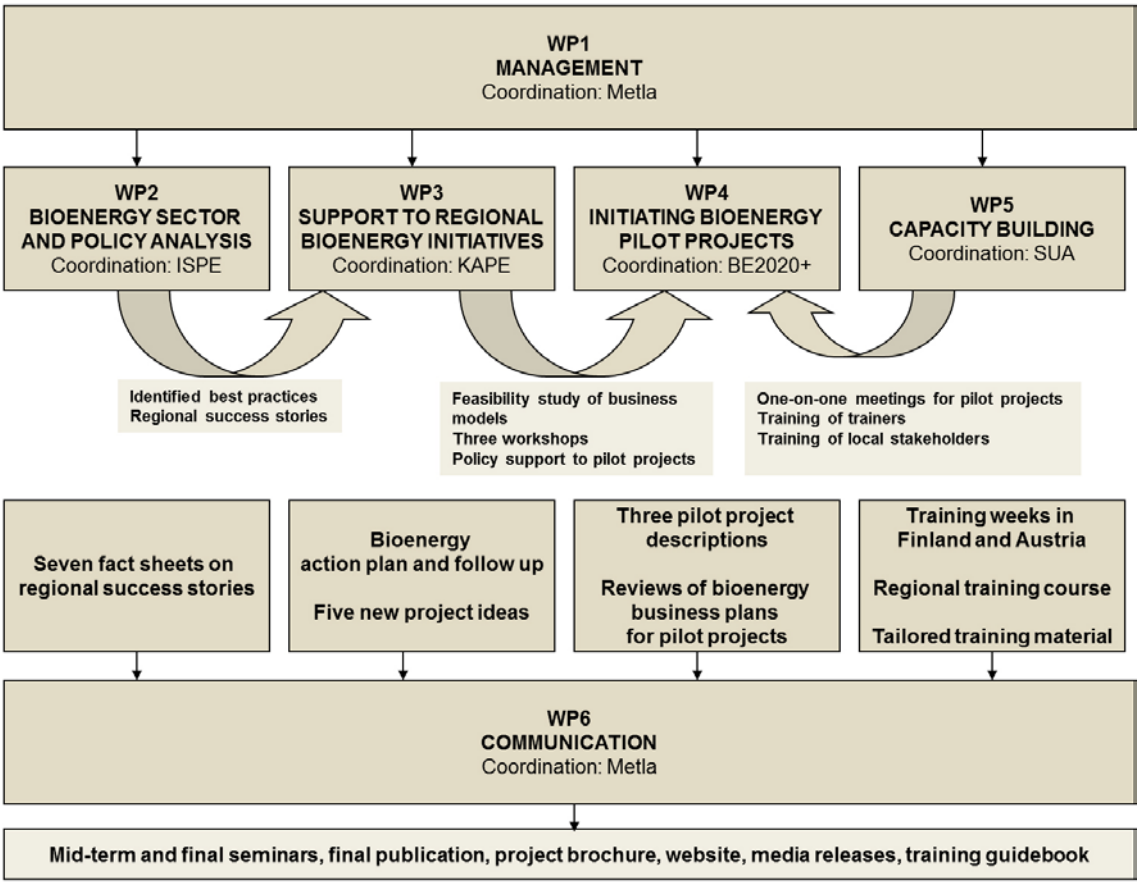


Figure 1. The seven project WP.

The first package included overall management and administration of the project aiming at successful implementation of other packages and achievement of useful end results.

The present states of the target countries' bioenergy sectors, existing bioenergy programs and bioenergy policies were handled in the second package. Also, each country's regional success stories on woody bioenergy were presented and discussed and their factsheets were outlined.

In the third package the ongoing regional bioenergy initiatives and activities were supported by activating regional strategies by arranging brainstorming workshops. In these, the most promising business models were found and the detailed bioenergy Action Plans for the target regions were created.

Local stakeholders who intended to invest in woody bioenergy businesses in the target regions were supported in the fourth package. In cooperation with regional authorities the most promising bioenergy project initiatives were found and selected. These initiatives received tailored consulting bringing energy wood suppliers and users together. As a result the partners created pre-contracts with help of the local authorities.

In package five the capacity of the local stakeholders was increased through training. The package was divided into two training sections; the first one for trainers and the second for the local stakeholders. As a result, a training guidebook was published in English, Polish, Romanian and Slovak languages.

The sixth work package provided communicational support for the participants throughout the project lifecycle. This included website, media releases, publications and other relevant information.

All project activities were strongly aligned with the directive 2009/28/EC and the work done will help the participating and other EU countries to operationalise their NREAP on a regional level.

The IEE programme financed the project but the partners' share was 25% of total costs, which increased their commitment to the project. The total eligible costs were estimated to be €923,000.

Table 2. The following performance indicators were set for the project at the beginning of its implementation and the assessment of their achievements.

THE ORIGINAL PERFORMANCE INDICATORS	THE ASSESSMENT OF THEIR ACHIEVEMENTS
A minimum of 30 companies at the project level re-evaluating their bioenergy value chains (40 thermal MW [MW_{th}]). Regular contact with companies (questionnaires and polls).	Twenty-seven companies were involved in the project development processes representing the capacity of 32 MW_{th}.
More than 45 local stakeholders at the project level taking part in the three regional workshops.	Two hundred and eighty-four experts participated in the all three workshops regenerating ideas, analysing problems and preparing the regional bioenergy Action Plans.
Ninety local stakeholders in three target regions at the project level involved in the strategic development.	The total number of different persons involved in the strategic process was 423.
At least two of three developed Action Plans should be introduced or already implemented at the project level. Letters from the public authorities responsible for the implementation of the Action Plans.	Four regional bioenergy Action Plans were produced – one per country and in Poland two for pilot districts.
Nine to 12 pilot project companies at the project level adopting the proposed models (30 MW_{th}). Business plans developed for the pilot projects.	Twenty-seven companies were involved in the pilot projects and 17 feasibility studies were produced for the pilot cases.
Between 18–24 pilot project business partners trained in Austria and Finland.	Nineteen business partners participated in the international training courses in Austria and Finland.
Identification of a minimum five new project ideas supported by the regional authorities to be developed in the following three years per target region.	Thirteen new project ideas were generated in the all target countries.

THE ORIGINAL PERFORMANCE INDICATORS	THE ASSESSMENT OF THEIR ACHIEVEMENTS
Nine to 12 pre-contracts signed at the project level which is three to four per target country.	Twelve letters of commitment were received and signed inside the pilot regions – two in Poland, seven in Romania and three in Slovakia.
Five contracts signed at the project level which is at least one per target country. Follow-up organised for current contracts.	Five contracts were signed of which three in Romania related to the biomass supply and two in Slovakia to investments.
Between 18-24 pilot project business partners at the PromoBio project level provided with tailored support services in establishing new bioenergy projects.	Twenty-seven pilot project business partners were involved in the development processes.
Twelve trainers trained in Austria or Finland.	Twelve trainers were trained in Austria and Finland.
Organising a local training course accepted as a part of the normal curriculum of four out of six training organisations from which trainers come. Training material distributed to 20 other training organisations in the country and used in training. Official training programmes and support letters presented by training organisations.	The target countries organised the training events with their own forces, supported by the Austrian and Finnish experts. Regional development and energy agencies (Warmia-Mazury; Centru) and local universities in agriculture (Nitra; Sibiu) and technology (Brasov) committed to providing training as part of their curricula.
At least one region per target country showing interest in replicating the project results. Letter of interest received from regions not involved in the project activities.	Poland shared its experiences with other districts in the Warmia-Mazury province. Romania replicated the results in a the south-western region (Oltenia). Slovakia relayed the gained experience to the northern (Zilina region) and the south-western parts (Nitra region) of the country. All the letters were received inside the pilot regions.

2 State-of-the-art bioenergy sectors in the target countries

2.1 Overall situation in Poland

2.1.1 RES in "Polish Energy Policy until 2030"

Development of the RES has a significant meaning for the realisation of the basic purposes of energy policy in the EU, including Poland. Increasing utilisation of these sources leads to a higher level of independence from energy imports. The RES often consists of small generating units located near the consumer which makes local energy safety higher and transmission losses lower. Generating energy using RES is characterised by contamination emissions (CO_2) being small or equal to zero which provides positive ecological effects. Evolution of this branch also contributes to the development of growth in less developed regions, if they have the potential to utilise renewable energy.

In the document *Energy Policy of Poland until 2030* the quantitative targets for renewable sources in energy production were defined. Also, the necessary mechanisms for the development of supportive actions for the achievement of the established goals were pointed out. The main targets of Polish energy policy in the field of RES are:

- increase usage of RES in total energy consumption at least to the levels of 15% (in 2020) and 20% (in 2030);
- achievement of a 10% share of biofuels in the transport fuel market in 2020 and increase of second generation biofuel usage (lignocellulosic fuels);
- protection of forests against excessive exploitation in obtaining biomass and balancing utilisation of agricultural areas for RES, including biofuels in a way which will not imply competition between sectors of renewable energies and agriculture;
- utilisation of already existing constructions owned by the Polish state which can stockpile water for electricity generation;
- energy diversification level enhancement and creation of the optimal conditions for progress of dispersed generation based on locally available raw materials.

Measures for development of RES utilisation defined by Polish energy policy include:

- determination ways of achieving 15% participation (RES) in final energy consumption divided among particular kinds of energy: electricity, heating, cooling, bio-components and in division of particular technologies;
- support mechanism maintenance for electricity producers using renewable sources through the certificate of origin system (green certificates);
- maintaining the obligation of gradually increasing bio-component shares in transport fuels in order to reach intended objectives;
- additional support instrument introduction encouraging wider generation of heating and cooling from RES;
- maintaining the principle of exemption from excising RES energy;

- direct support in building new RES units and grids using European funds and measures of environmental protection funds including measures coming from replacement fees and contractual penalties;
- stimulating the Polish industry potential to manufacture devices for the RES using European funds.

Utilisation of local energy resources and their rational management determine balanced regional development which influences on living conditions and the environment. The *Polish Energy Policy until 2030* as well as the national environmental policy for the years 2009–2012 (with perspectives until 2016) set out directions for sustainable development. National environmental policy for the years 2009–2012 integrates the economical, special and regional policies. This policy also indicates the necessity of energy efficiency improvement and decreases the negative impact on health and the environment.

2.1.2 The targets for Poland and ways of achieving them

The increase in RES in electricity and heat generation by 2020 (according to NREAP) are depicted in Fig. 2 below and Fig. 3 in the next page.

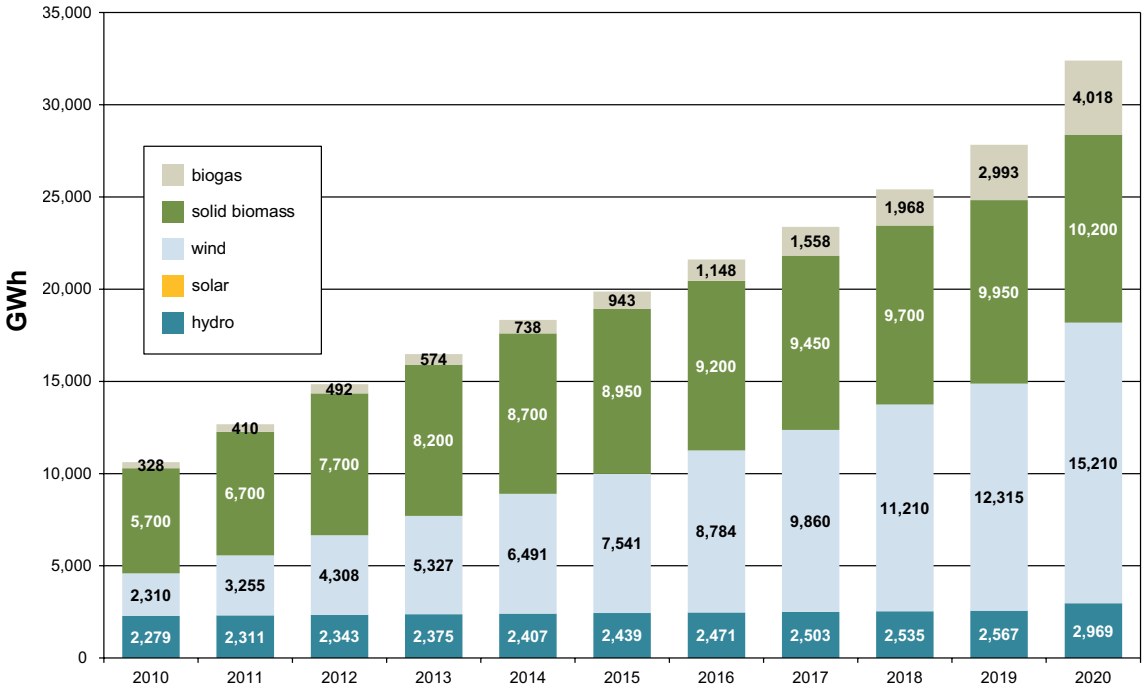


Figure 2. Evaluation of gross electricity generation predicted for each RES technology in Poland, in binding targets implementation in 2020 and indicative periodic course in RES participation in energy sector in years 2010–2020.

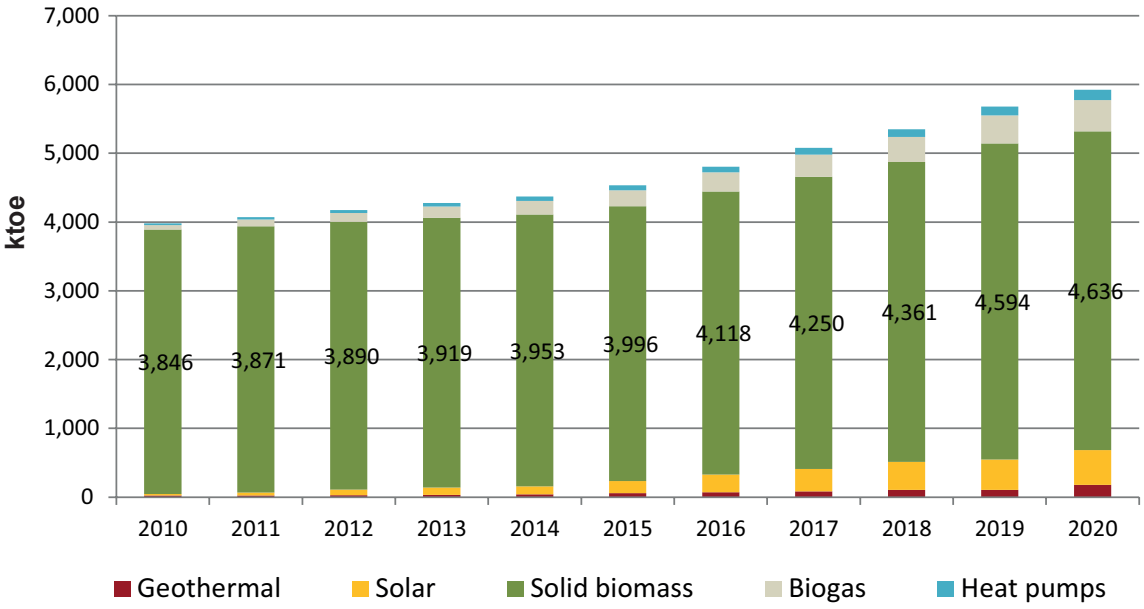


Figure 3. Estimation of total predicted input (final energy consumption) for each RES technology in Poland in terms of binding target implementation (year 2020) and indicative of periodic courses in RES participation in heating and cooling sectors in the years 2010–2020.

According to the NREAP, biomass plays a very important role in realising the Polish energy policy targets in electricity and heat generation with the support of national and European funds.

2.1.3 Current support

A crucial issue related to the economics of RES systems is the topic of green certificates, a quantitative mechanism introduced in 2005 which is based on the amended RES act dated 10 April 1997 as part of energy law (EL). The green certificates are property rights arising from the certificates of origin of electricity from RES conversions issued by the president of the Energy Regulatory Office (ERO). Currently these instruments are without time limits and they can be invalidated by the president of ERO. Electricity generated by RES has been exempted from the excise tax.

2.1.3.1 Scope of the law

The new law aims at adapting currently existing solutions to market conditions, which include first of all maintenance of present support systems for existing RES installations. The new law is intended to guarantee respect for the acquired rights for all who have become producers of electricity from RES before this act entered into force.

The draft regulations on the energy production from RES concerns defining of rules and conditions for performing activities in terms of generating electricity, as well as heating and cooling from agricultural biogas. The document also describes mechanisms and instruments supporting electricity and heat production as well as principles of issuance guarantee of origin for electricity generated from RES and electricity generated from agricultural biogas.

2.1.3.2 Objectives of the law

The act on RES provides implementation goals contained in the NREAP as well as in the document *Energy Policy of Poland until 2030*. Implementation of the law eliminates possibility of too much support in the certificates of origin system. A unit replacement fee will not be valorised and will stay on the level as in 2013 amounting to 297.35 złoty (Polish national currency unit; €1 = 4.21 złoty) for 1 MW hour (MWh).

Poland is supposed to achieve indirect goals of increasing energy production from RES, expected on a level of 9.54% by 2014, 10.71% by 2016 and 12.27% by 2018. Achievement of these goals will be based on two pillars of resources available and usable in Poland, i.e. by enhancement of electricity generation from wind and greater biomass utilisation for energy purposes.

The established values can be reached, providing sustainable RES development. The development should occur with regard to not only the obligation of Poland to Europe, but also environment protection. Enhancing RES exploitation cannot compete with food production. Thus RES development should grow in a harmony with interests among businessmen and agriculturally engaged entities.

The law on RES plans the implementation of a number of targets which address the following issues:

- increased energy safety and environmental protection through effective utilisation of RES;
- reasonable utilisation of RES with regard to the realisation of the long-term economic development policy of the Republic of Poland, satisfying obligations resulting from international agreements and increasing innovation and competitiveness of the Polish economy;
- creating mechanisms and instruments supporting generation of electricity, heating and cooling or agricultural biogas in RES installations;
- developing an optimal and sustainable final customer supply in electricity, heating or cooling or in agricultural biogas from the installation of RES;
- creating new workplaces with the growth of the number of current RES projects;
- ensuring the use of energy purposes by-products and residue from agriculture or industry using agricultural resources.

2.1.3.3 Auction system

Under the new law solutions based on the optimisation of the economic calculation for existing RES installations and implementation of a modern auction system for new and upgraded RES installations was also proposed which ensures the maximisation of benefits connected with the need to achieve a certain share of RES by 2020. This will enable the development of a small-scale prosumer (producer + consumer) party of the energy sector, used for meeting consumers' own energy needs.

2.1.3.4 Amendment of the energy law – Small Tri-Pack

In July 2013 the Polish Parliament adopted amendments to the EL – known as Small Tri-Pack. The new law contributes to the development of the energy market for prosumers. The document introduces several new concepts and solutions:

- RES was defined as a source using energy conversion processes from wind, solar radiation, air, soil and water temperature, waves, currents and tides of seas, falls of rivers, energy obtained from biomass, biogas from garbage landfills and biogas produced in processes of waste water discharge or treatment or decomposition of animal and plant remains;
- Small Tri-Pack introduces the definition of a micro-installation as a RES installation producing up to 40 kilowatts (kW) with owners exempted from the costs of connection to the grid an economic activity fulfilling national obligations;

- the new EL also defines the term prosumer as a producer and a consumer of energy which can be sold to the "supplier of last resort". This supplier has an obligation to purchase it at a price equal to 80% of the average selling price from the previous calendar year. The prosumer does not have to pay health insurance contributions;
- EL contains solutions promoting development of so-called prosumer energy sectors which rely on consuming electricity generated from RES for own needs and selling overproduction to the grid. In accordance with the EL, electricity generation in micro-installations by individuals who are not entrepreneurs within the meaning of the law, based on the freedom of economic activity and the sale of this energy, is not defined as an economic activity. Moreover, the EL determines that the supplier is obliged to purchase electricity generated from micro-installations, connected to the distribution grid which is located within the operation area of the "supplier of last resort" and offered for sale by the person mentioned in the EL. Purchase of this energy is conducted at a price equal to 80% of the average selling price of electricity from the previous calendar year, which is set by the president of the ERO in accordance with the EL.

2.1.4 Potential of the forest resources in energy production in Poland

2.1.4.1 Forest resources

The Polish forest sector plays an important role both internationally and domestically. Poland is the second largest producer of wood-based panels in the EU, the fifth in roundwood, the sixth in furniture and the seventh in sawn wood. The forest industry employs 187,000 people (143,000 in wood processing and 38,000 in pulp and paper). In Poland, forest land covers 9.3 million ha, stocked forest land covers 9.1 million ha, and the volume of the growing stock is 2.3 billion m^3 including 0.8 billion m^3 in mature and overmature forest (PGL LP 2012, GUS 2011). The average growing stock of forests is 257 m^3 per ha. The largest areas are located in the Mazowieckie and Zachodniopomorskie provinces (over 0.8 million ha) and the smallest is in the Opolskie province (249,500 ha).

More than half of the stocked forest land (71% of the stocked forest area and 74% of growing stock) is covered by coniferous tree species such as pine (60% and 62%), spruce (6% and 7%), and fir (3% and 4%). A significant area is covered by small-leaf tree species such as birch (7% and 5%), alder (5% and 5%), aspen and poplar. The share of broadleaf species such as oak, beech and hornbeam is about 13% of both the stocked forest land and the growing stock.

2.1.4.2 Utilisation of forest resources

Use of forest resources in 2011 was 37.2 million m^3 including 34.9 million m^3 of roundwood. The State Forests is a major supplier of wood on the Polish wood market, harvesting 35.1 million m^3 of wood, including 32.8 million m^3 of roundwood. In private forest, removals were 1.6 million m^3, and in addition 0.2 million m^3 of roundwood were harvested from national parks and 0.1 from municipal forest.

Wood from forest is the largest resource of solid biomass and covers a wide range of different biomass with diverse characteristics. The State Forests offers energy wood in different trading types. The most popular energy types of wood are small-size fuel wood, fuel wood, and general purpose industrial wood. Small-size fuel wood is one of the cheapest types of wood offered by the State Forests (about €12.3 /m^3 in 2011). Therefore, it is of high interest to the energy sector that all forest production of that type of wood is immediately purchased. A much more available type of energy wood is fuel wood. There are two types of fuel wood on the market, differing in price and energy properties: coniferous (1.3 million m^3 in 2011, €22.2 / m^3) and deciduous (1.5 million m^3 in 2011, €27.8 /m^3). The yield of fuel wood is twice the level of the production of small fuel wood. The most commonly available class of wood that can be used in the energy industry is a general purpose industrial wood. The special subgroups of the industrial wood dedicated to the energy industry are used by the paper industry and furniture factories. Pulpwood and other types of

general-purpose industrial wood are used sporadically by the energy sector. Based on estimates, about 10% of general-purpose industrial wood can be used as biomass input in the energy industry (about 1.6 million m^3 in 2011). Woodchip can almost be directly burned in boilers. However, due to a lack of adequate infrastructure, the State Forests is not able to deliver sufficient quantities of woodchip. It should be noted that, due to low availability and high prices, woodchips are not used in households as heating fuel.

2.1.4.3 Energy wood production

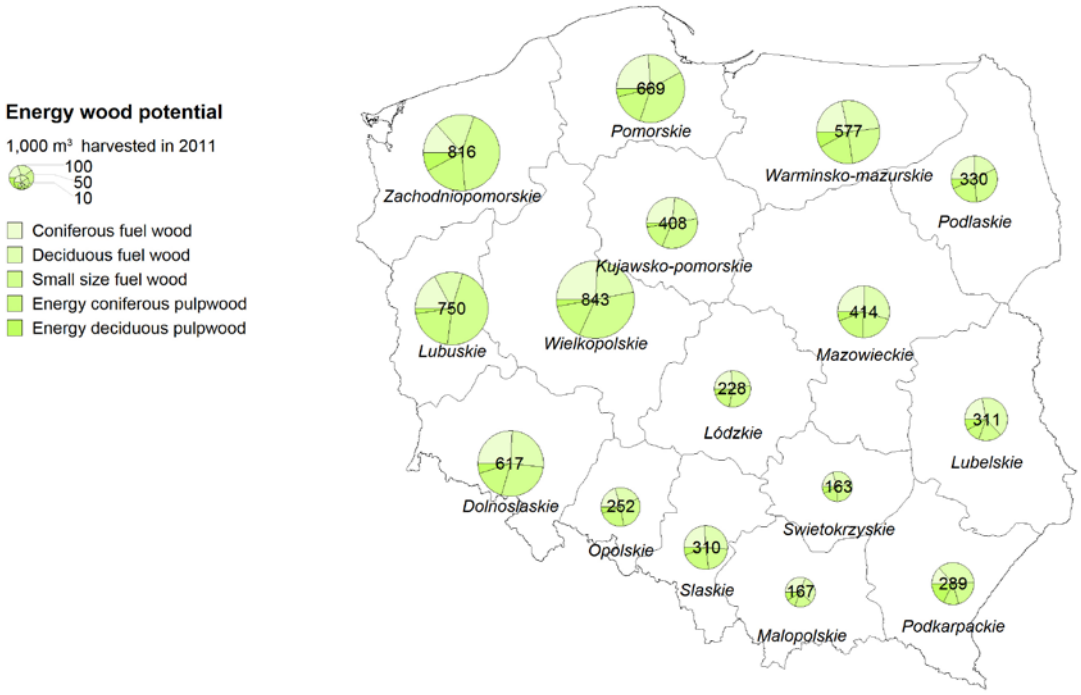


Figure 4. Energy wood production in Poland by regions.

The biomass energy market in Poland is less developed than the fossil fuel market and is restricted mainly to wood residues. However, it is continuously developing, mostly due to the recently dynamically developing use of biomass in co-firing with coal for electricity production and heating. Biomass is mostly traded to power plants via brokers. Brokers offer biomass with specific parameters concerning the transport, duty, and insurance of biomass. Brokers buy biomass from several producers, and offer it to several power plants. In practice, the biomass is supplied to the power plant that offers the highest price. This leads to problems with the reliability of brokers, because they cannot guarantee sufficient amounts of biomass to all power plants.

Largest pulp and paperboard producers in Poland:

- Stora Enso Poland S.A. Ostrolęka
- International Paper Kwidzyn Sp. z o.o.
- Mondi Świecie S.A.

Largest furniture and plywood entrepreneurs in Poland:

- Zakład Przemysłu Sklejek in Bydgoszcz MULTI S.A.
- Sklejka WRITE S.A.
- Orzechowski Zakład Przemysłu Sklejek

- Sklejka EKO
- Sklejki BIAFORM
- Pleiderer Prospan
- KRONOSPOL Sp. z o.o.
- Fibris S.A.
- HARDEX S.A.
- HOMANIT Polska
- STEICO S.A.

2.2 Overall situation in Romania

2.2.1 General information on the pilot region of the project

Centru region is located in the middle of Romania, on the riversides of Mures and Olt. The region is crossed by the 46th parallel of north latitude and the 25th meridian of east longitude. Due to its position, Centru region borders six of the other seven Romanian regions. Centru region has an area of 34,100 kilometres squared (km^2), representing 14.3% of Romania's territory and comprises six counties: Alba, Brasov, Covasna, Harghita, Mures and Sibiu.

The natural resources are various and include important deposits of methane gas, salt, nonferrous ores, construction materials, small deposits of inferior coal and numerous mineral water springs. Besides the resources of its subsoil, Centru region has a remarkable hydro-energetic potential and an extensive forest area (the forests cover more than one-third of the region's total area).

As of 2012, the population of Centru region was estimated at 2.36 million inhabitants, with an average density of 69 inhabitants /km^2. The urban population represents 60% of the region's population. The biggest regional cities are: Brasov, Sibiu and Targu Mures.

Figure 5. Brasov – the largest city of the Centru region (Source: Marius Duca, ADR Centru 2014)

Traditionally, Centru region has had an industry-based economy with a fast growing tertiary sector. Centru region still has a high but declining contribution of the industry to the GDP (gross domestic product per capita) and a significant share of the population is employed in this sector. As of 2011, the GDP per capita, expressed in terms of purchasing power standard (PPS), represented 45% of the EU average. The industrial nature of the region is demonstrated by its old and new economic branches: machinery manufacture (including the automotive sector), chemicals and pharmaceuticals, construction materials, wood processing, textiles, and food and beverage industries.

2.2.2 Energy resources including renewable sources

Romania has a wide range of primary energy resources, but in small amounts. According to the figures included in the national energy strategy for the period 2007–2020, the non-renewable resource potential, excluding uranium, is estimated at 929 million toe. The most abundant energy resource is coal deposits (mainly lignite) ensuring long-term energy stability. It is estimated that the hydrocarbon reserves (gas and oil) will be depleted by the end of 2020. Recently, significant reserves of oil and methane gas were discovered in the Romanian sector of the Black Sea.

The share of renewable energy in total gross energy consumption has increased from 17.2% in 2006 to 22.9% in 2012 (electricity and heating) according to Eurostat figures. The primary production of renewable energy in 2012 was estimated at 5,242 thousand toe according to Eurostat figures (of which three-quarters is bioenergy).

2.2.3 Regional biomass potential

The renewable resources potential of the region is closely connected with the characteristics of the topography, climate, hydrographic features, soil and vegetation. The area of the Carpathian mountains covering Centru region has a great potential for renewables, especially for biomass, wind energy and micro-hydroenergy. The hilly plateau of Transylvania, on the other hand has a great potential for biomass and solar energy.

The study drafted by ICEMENERG (The National Research and Development Institute for Energy) shows that Centru region has also a significant energy potential other renewable energy resources such as biomass and micro hydro powerplants. According to the figures included in the above mentioned study the biomass potential of Centru region is estimated at 20,277 TJ (tera joules) out of which 4,559 TJ is energy wood potential. Woody biomass potential is dominant in Harghita and significant in two other counties, i.e. Covasna and Brasov.

Covering 36.5% of the total surface of Centru region, the forests represent a valuable resource for the small rural communities located in the mountain area and contribute to a healthier environment. Most forested area is covered by deciduous forests (55% of the forested area) followed by coniferous forests.

Table 3. Forested area in Centru region by type of forest in 2012 (in 1000s of hectares).

Total	**1,259.9**
Forests, total	1,241.0
- Coniferous forests	565.9
- Deciduous forests	675.1
Other forested lands	18.9

Data source: Romanian National Institute of Statistics

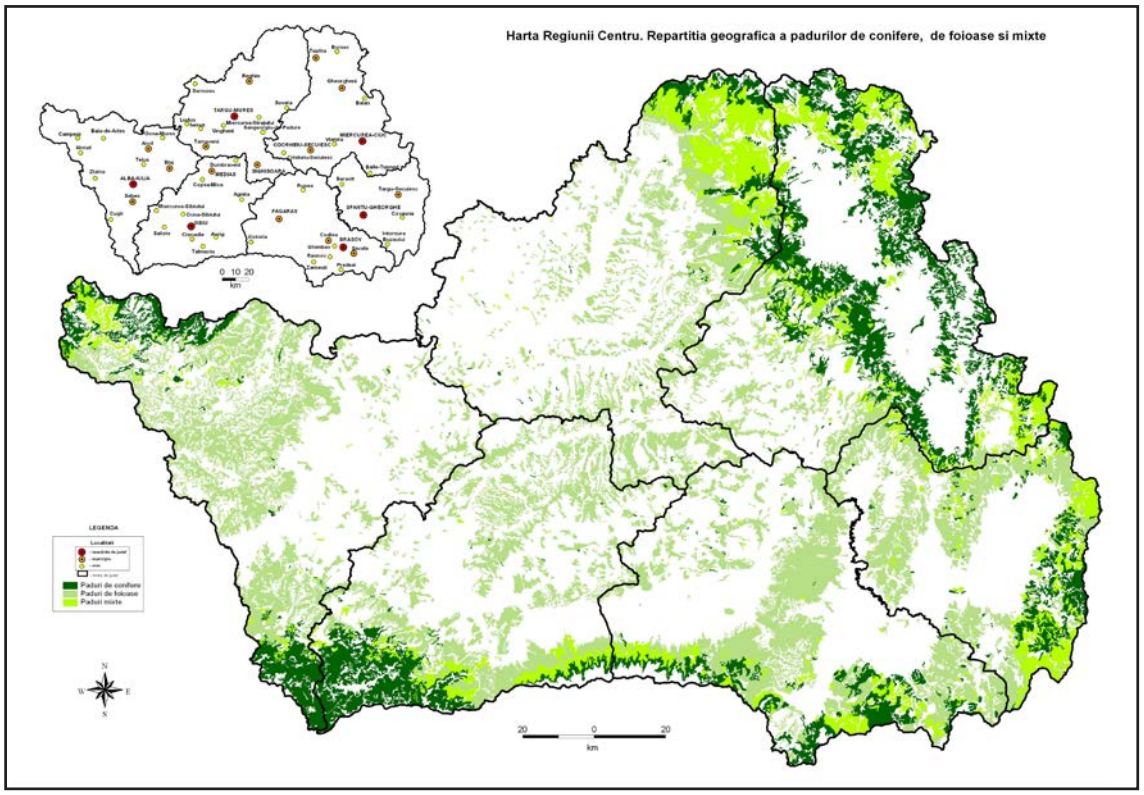


Figure 6. Forest area in Centru region.

With almost 4.3 million m^3 of wood harvested in 2012 Centru region is currently the second largest wood harvesting region in Romania and the number one timber producer. These economic activities generate large amounts of sawdust and various wood residues which could be used for energy purposes. Nowadays only a small fraction of these woody materials are used for local energy production in Centru region.

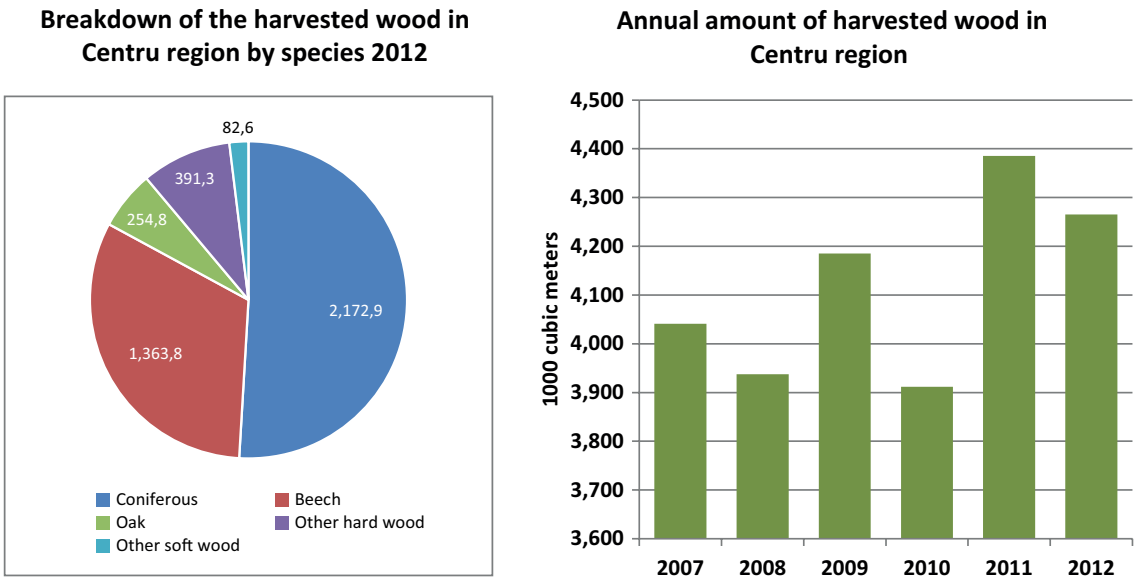


Figure 7. Breakdown of the harvested wood by species and annual amount of harvested wood in Centru region in 2012.

The largest biomass power plants in Centru region are located in the most wooded counties: Harghita (Vlahita and Gheorgheni), Covasna county (Intorsura Buzaului) and Alba county (Sebes). The fuel used ranges from wood chips and sawdust to bark, branches and other types of wood residues.

2.2.4 Forest management in Romania

2.2.4.1 Ownership of forests in Romania

There are more than 800,000 forest owners in Romania. Most are private forests, which are relatively small and fragmented. According to the Romanian Forest Code (law 46/2008) depending on their owners (state or private), the forested areas must fall into one of the following categories:

- state-owned public property;
- public property of territorial administrative units;
- private property of natural and legal persons;
- private property of territorial administrative units.

2.2.4.2 Forest management entities and regulatory bodies in forestry

There are several organisations and bodies in Romania in charge of the management of the forestry fund:

- the General Directorate for Forests which is part of the Ministry of Environment and Climate Change (MECC) is the central public authority responsible for forestry;
- the National Forest Administration (ROMSILVA) manages state-owned forests which currently represent around 3.3 million hectares (ha). ROMSILVA works as an economic entity performing forest administration operations;
- Regional Forest Inspectorates work under the authority of MECC representing the interests of the mentioned body in the territory. They have control and regulation enforcing responsibilities dealing with various aspects related to both private and public forest organisations;
- the Regional Forest Administration conducts its activities at a more local level with the aid of representatives of ROMSILVA in the relevant territories. They are in charge of implementing the national strategy in the field of forestry and acting for the protection, conservation and sustainable development of the public property forests;
- State Forest Districts are territorial (local) administrative units subordinated to the Regional Forest Administration directorates;
- Private Forest Districts are territorial (local) administrative units with administrative responsibilities in the private forests;
- the Institute of Forest Research and Management (ICAS) was established in 1933 as a public forest research institution;
- the Association of Romanian Timber Harvesting and Processing Companies (ASFOR) acts as an employer's organisation with the role of authorising the companies which perform activities in timber harvesting and processing.

2.2.5 Incentives for the development of renewable energies in Romania

The development of the bioenergy sector in Romania has been slower than expected due to the lower price of fossil fuels in Romania in comparison to other energy resources on one hand and the considerable costs of investments on the other hand. That's why financial support for the bioenergy sector is needed.

Several programs in different stage of implementation can be mentioned at the national level dealing with different types of incentives in the field of renewable energies. The potential beneficiaries vary from individuals to public authorities and companies. All these programmes have been successful and have served the interests of many companies and individuals. For example:

- The National Programme for Increasing the Energy Production from Renewable Sources (2010).
    - The overall objective of this programme was to fund environmental projects in order to increase the amount of energy production from renewable sources. The programme was financed by the Environment Fund. Subject to financing were the installations for production of renewable energy (wind energy, solar and biomass).
- Promotion Scheme for Renewable Energies (law no. 220/2008), supplemented and amended by the law 23/2014.
    - The present law creates the legal framework necessary to extend the use of RES. Level of national targets for the share of electricity produced from RES in gross final consumption of electricity in the years 2010, 2015 and 2020 is 33%, 35% and 38%. The biomass electricity generation, especially from energy crops, is encouraged by the above-mentioned law (23/2014) approving four green certificates paid for each one MWh of electricity produced and delivered to the national power grid.
- Sector Operational Programme "Increase of Economic Competitiveness" 2007–2013.
    - Priority axis 4 "Increasing energy efficiency and security of supply in the context of combating climate change"; key area of intervention 4.2. "Valorisation of renewable resources for green energy production". The overall objective of this area of intervention was to support investments in modernisation and development of new electricity generation capacity and thermal energy using all kinds of renewable sources: biomass, hydropower resources (in plants with installed capacity of maximum 10 MW), solar, wind, biofuels, geothermal and other RES.
- Casa Verde (Green Building) Programme.
    - The renewable energy solutions are promoted at the national level through a special programme called Casa Verde (Green Building) through which individual households are stimulated to replace their old thermal systems with new heating systems using solar, geothermal, wind and biomass energy. Currently this programme is suspended.

The Green Building Programme for public authorities used the Environment Fund to finance projects for installation of heating systems using renewable energy including replacing or supplementing traditional heating systems. The purpose of the programme was to improve the quality of air, water and soil by reducing pollution caused by burning wood and fossil fuels used to produce heat energy for heating and hot water and encourage the use of renewable, clean energy source systems.

Energy efficiency and production of energy from renewable resources will be on the agenda for the new structural funding in Romania during 2014–2020.

2.2.6 Conclusions

The current systems of promoting energy from renewable sources in Romania focus mainly on promoting/supporting electricity production, especially through large-scale projects. The support of heat production has been neglected, although it has a significant share in the total final energy consumption.

The green certificate promotion scheme (law 220/2008) has already shown its shortcomings – especially large and mega projects in the fields of wind turbines and solar panels were implemented that had a high degree of economic profitability in the current form of the law. These projects have caused a number of major drawbacks: difficulty in compensating variations of power generated in national electricity transport by large size wind and photovoltaic systems; increase in final price of electricity for consumers (including the value of green certificates corresponding to electricity from renewable sources); difficult to bear by the population and by industrial consumers; reduced economic effect of implementing these major projects given that they were developed by foreign investors, with imported technologies, which have created few jobs; and a low level of technology transfer with the net economic outcome – profit – usually externalised.

In these circumstances, there is a need to rethink the national priorities on RES: the effort to support RES by harnessing potential should be transferred at the local level through small/medium projects in a sustainable way.

This sustainability refers to low CO_2 emissions generated by the project implementation but also to these projects' economic profitability and positive social impact at the local level: generating jobs, gains in fighting pollution, the economic effects of these projects that would generate local benefits. Under all these aspects the efficient energy recovery of local biomass resources through sustainable projects is of utmost importance.

The traditional use of woody biomass in rural areas of Romania was in the form of firewood (especially in areas where there is no natural gas distribution network) used for heating and preparation of food. Unfortunately this use is conducted through inefficient and pollutant combustion installations with a very low yield (about 20%).

Support in the form of national/regional programmes is required to switch these inefficient installations to modern boilers with corresponding yields (> 75%). Another important issue in increasing the use of biomass in individual applications producing thermal energy is providing biomass resources (pellets, briquettes) at affordable prices.

With the support of the PromoBio project, the Centru region has succeeded in developing the *Biomass Action Plan for Centru Region*, a document providing an objective analysis of the current development of use of biomass and a set of principles and strategic action areas for the promotion/development of biomass uses.

2.3 Overall situation in Slovakia

2.3.1 Policy and legislative environment

The Strategy of Energy Safety of the Slovak Republic, approved by the government in 2008, and the NREAP, approved in 2010, have been the basic documents supporting the increase in energy efficiency and in higher utilisation of RES.

Share of energy produced from RES in overall energy consumption up to 2020 is demonstrated in Fig.8. The target of RES in 2020 is 14% of overall consumption (green line). The highest share has, and will have, electricity from RES, mainly due to hydro energy (blue line). Heat produced from RES is in the second place (red line) and liquid fuels in transport in third place (black line).

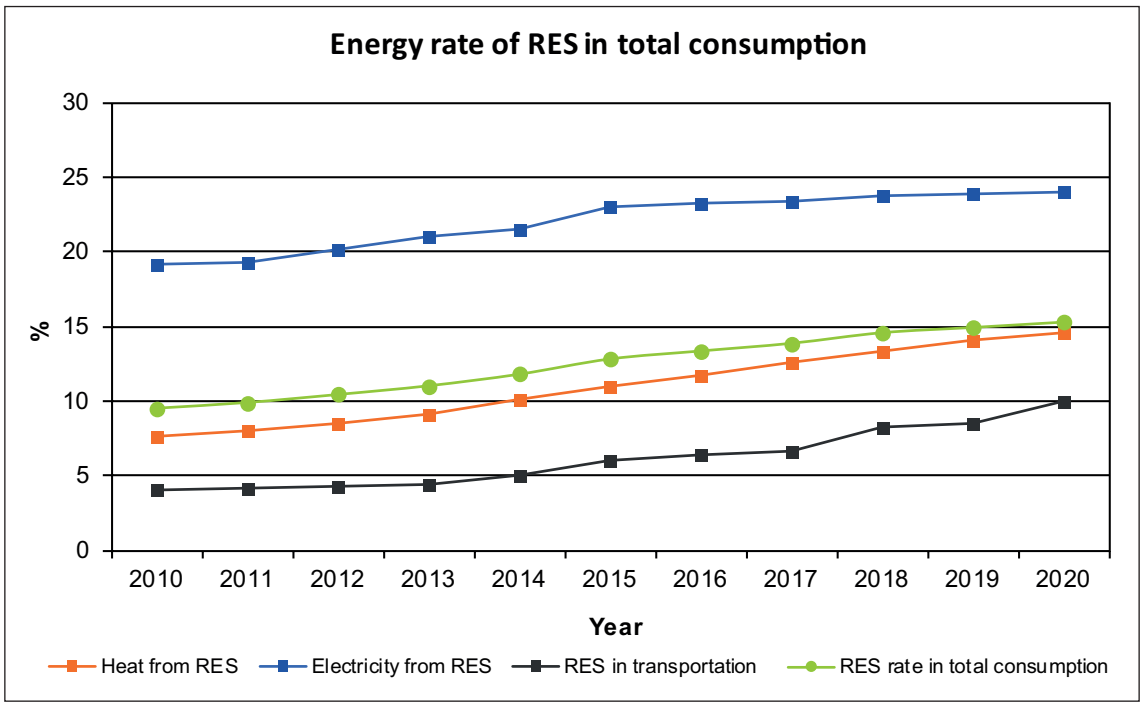


Figure 8. Share of RES in overall energy consumption.

Proportions of different types of RES in production of heat is shown in Fig. 9. The highest share has forest and agricultural biomass, covering more than two thirds of heat produced from RES (green). The second highest portion of heat will be produced from geothermal energy (brown) and the third from biogas (grey). Solar energy and heat pumps will contribute less than 1% of heat from RES.

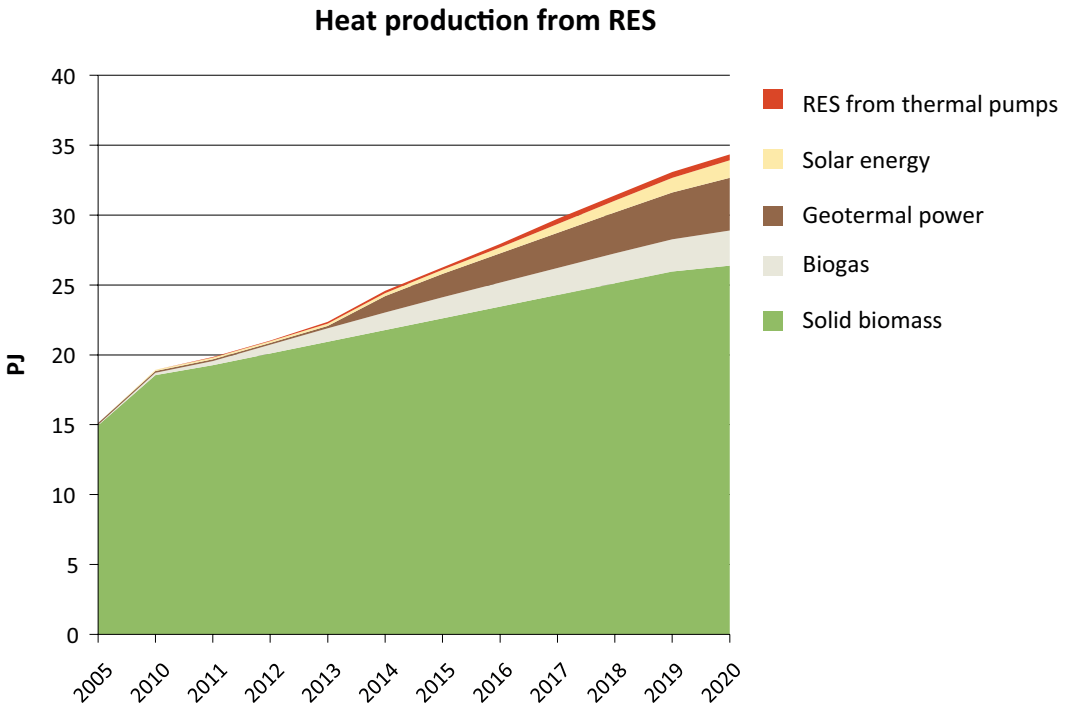


Figure 9. Production of heat from RES up to 2020.

Share of different RES in production of electricity up to 2020 is shown in Fig.10. More than one third of energy from RES will be produced from hydro energy (dark blue – power stations over 10 MW; light blue – power stations up to 10 MW). Electricity produced from RES will provide more than one-third of the total production (biomass – green; biogas – grey). Solar and wind energy will contribute by much less than one-third.

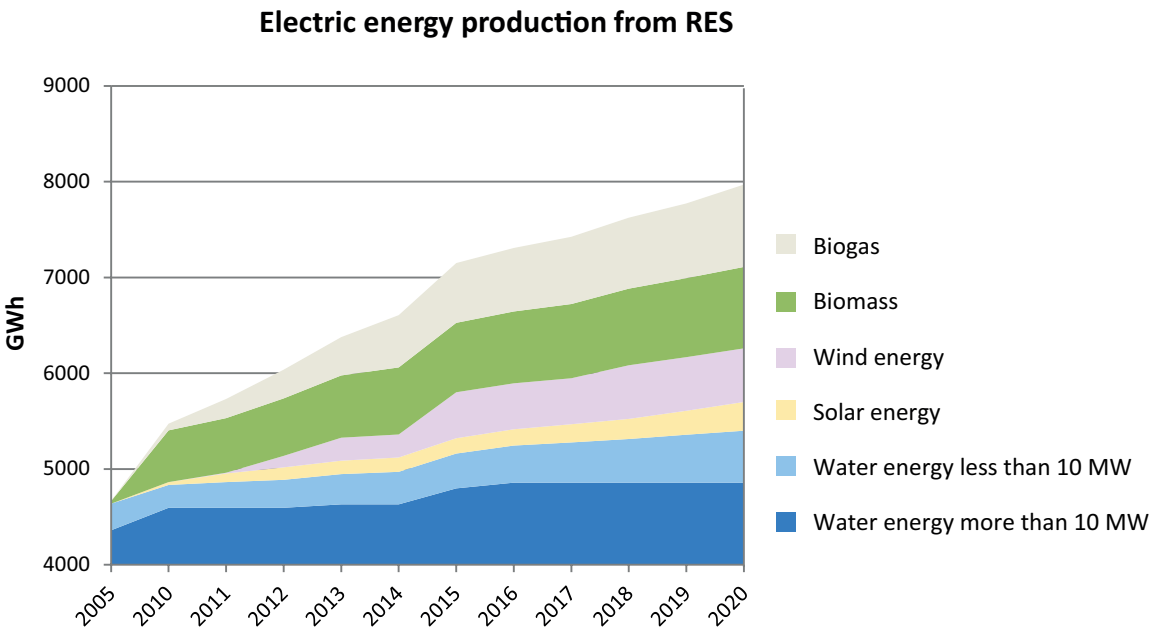


Figure 10. Share of different RES sources in production of electricity up to 2020.

Adopted legislation creates preconditions supporting utilisation of RES. Law No. 309/2009, on support of RES and highly efficient combined production of electricity and heat, secures for electricity producers:

- preferred connection of installation to the regional grid;
- preferred access into the system;
- preferred transmission, distribution and supply of electricity;
- power consumption by the operator of the regional distribution system;
- supplementary charge.

Bill of the Regulatory Office for Network Industries stipulates feed-in tariffs for electricity produced from different RES.

2.3.2 Forest resources in the region

Forests cover 48.9% of the territory of the Banská Bystrica region. The total forest area is 453,106 ha, i.e. 23.5% of the total forest area in Slovakia. The total growing stock is 102.9 million m^3 of wood under bark (41.3 million m^3 coniferous and 61.6 million m^3 broad leaved), i.e. 23.7% of the total growing stock in Slovakia. The mean annual felling in the region is approximately 1.7 million m^3. This volume represents 25.2% of the total volume harvested annually in Slovakia.

In addition to the current volume of harvested roundwood (with diameter> 7 cm over bark), there are sources of small wood for energy utilisation. The total volume of this additional resource of the above-ground forest biomass for energy in the Banská Bystrica region is more than 1.2 million m^3 per annum. When the

ecological, economic and technical criteria limiting utilisation of biomass are applied, the available volume of energy biomass from forests amounts to 302,400 m^3 of energy biomass.

There are also secondary energy biomass sources available from the wood processing industry. Annual wood processing capacities in the region are over 1 million m^3 of processed roundwood. Wood residues from wood industry in the region amount to over 280,000 m^3 annually.

2.3.3 Potential of biomass resources

The overall annual biomass potential for energy generation in Slovakia is 147 PJ (peta joules), which represents €1.89 billion (excl. VAT). However, the share of utilised woody biomass in the total energy potential of biomass is only about 18%. The wood-processing industries are substantial sources of wood-based fuels as these industries produce annually more than 1.8 million tonnes of wood residues. Their total energy value is 17.6 PJ.

The share of wood-based fuels consumption in the total energy consumption increased from 1.3% in 2002 to 2.1% in 2005, which was insufficient in comparison to its technical potential. The share of heat generation from biomass compared to the overall biomass potential was only 1.4% in 2005. The indicative target for 2010 was 20.8% of the biomass potential, which is an increase of more than 19% when compared to 2005. It is expected that the increase will be more than 29% by 2015. In terms of energy value, the target for 2015 represents a 15-fold increase of the target for 2010 and a 22-fold increase when compared to 2005.

2.3.4 Use of biomass for energy production

Woody biomass is currently used mainly in the form of traditional firewood and in the form of chips. Only very small amounts of woody pellets and briquettes are produced and used in the region.

The use of traditional firewood has been steadily increasing during the last decade due to the rise of prices of fossil fuels. Firewood has been used mainly in private family houses in afforested mountainous areas. According to the official statistics some 500,000 m^3 of firewood is used annually in Slovakia. Official statistics on the current use of firewood in the Banská Bystrica region does not exist. Assuming that the proportion of the production of firewood is identical to the proportion of annual removals in the region in comparison to the whole country, which is 25.2%, then some 125,000 m^3 of firewood is annually produced and used in the region from traditional felling of wood with diameter > 7 cm.

Production and use of energy chips in the region started in 2005–2006. It was mainly due to the reconstruction of brown coal boilers for co-firing of brown coal with chips in the Zvolenská teplárenská CHP plant.

Annual consumption of energy chips in the region in 2010 was around 250,000 tonnes. Several new investments in bioenergy were accomplished and new boilers commenced operations during 2010–2013 which caused increases in energy chip production and consumption to around 500,000 tonnes at the end of 2013.

3 Bioenergy initiatives in target countries

3.1 Supported initiatives in Poland

3.1.1 Background

In Poland, the pilot regions are *Warmia-and-Mazury* and *Mazowsze*. In the *Warmia-and-Mazury* province, two districts, Ostróda and Olsztyn, were selected for the analysis. The pilot region of Warmia-and-Mazury is located in the north-eastern part of Poland and there are several sources from which green energy could be obtained. The current status analysis indicates the existence of a very large bio-energy potential of uncultivated land. The possibilities related to other sources of biomass are also significant and remain unused, similarly to the potential of uncultivated land.

The Olsztyn district (poviat) with an area of 283 700 ha is situated in the centre of the Warmia–Mazury province (voivodeship). The region, inhabited by almost 120.85 thousand people, consists of 12 districts. The cities of this district are: Barczewo, Biskupiec, Dobre Miasto, Jeziorany and Olsztynek. The Warmia forests and lakes give the Olsztyn district the name 'Green Lungs of Poland'. The leading employment sectors of the region are: industry and building 47.5%, and services 15.1%. Currently in the district several installations using woodchip as a primary fuel are in operation. The total nominal power of these boilers is about 17 MW.

The district of Ostróda, with an area of 176 706 hectares, is located in north-eastern Poland. It covers the western part of the Warmia-Mazury province. The region has a medium population of 104.9 thousand people. The district consists of six rural and three semi-urban municipalities. The area is characterised by varied flora and fauna, and has a number of areas of uncontaminated nature, with glacial lakesand wild areas. Leading industries of the region are agriculture, wood industry (plywood, parquet floors), food processing (poultry slaughterhouses), production of ships and boats, office equipment, computers and paper products.

Table 4. Bioenergy potential of the analysed districts, according to the conducted analysis.

Bio-energy potential of biomass							
District name	**Energy crops (TJ/year)**	**Fallow lands (TJ/year)**	**State forest (TJ/year)**	**Private forest (TJ/year)**	**Refuse wood (TJ/year)**	**Straw (TJ/year)**	**Nominal capacity of heat plant (MW)**
Olsztyn	21.97	933.7	180.6	44.5	28.7	639.05	245.90
Ostróda	103.00	1,365.0	560.6	15.0	26.9	667.80	388.93
Total (TJ/year)	124.97	2,298.7	741.2	59.5	55.6	1,306.85	634.83
	4,586.82						

3.1.2 Best practices in the district of Olsztyn

Presently in the district of Olsztyn there are several installations using biomass for heat production. Most of them use wood chips because of the low price and its ease of processing. These include:

- a social welfare home in Jeziorany – 0.5 MW (boiler room for wood chips);
- a special purpose school and education Centre in Żardeniki – 0.16 MW (boiler room for gasified wood);

- a hotel in Barczewo – 0.53 MW;
- a heating plant for a housing estate in Olsztyn – 2.5 MW;
- a furniture manufacturing plant in Biskupiec – 6.35 MW;
- a wood dryer in Biskupiec – 0.5 MW;
- a wood dryer in Olsztyn – 0.1 MW;
- a wood dryer in Kolno – 1.5 MW;
- a wood dryer in Olsztynek – 1.6 MW;
- a wood dryer in Stawigud – 3 MW.

A heating plant for wood chips in a social welfare home in Jeziorany is the best example in the pilot region (Olsztyn) of an installation using biomass and solar energy for heat production. A boiler room with a nominal power of 0.5 MW is the source of heating and hot water for a social welfare building. The project also includes a solar installation with the area of over 200 metres squared (m^2) and power of about 200 kW. The system of solar collectors prepares hot water and fulfils 57.2% of the demand. Furthermore, a chipper for wood biomass was purchased and a chip fuel storage facility with an automatic fuel feeder was built. The project was 80% financed by the European Regional Development Fund under the Regional Operational Programme Warmia-Masuria for the years 2007–2013.

3.1.3 Best practices in the district of Ostróda

Presently in the district of Ostróda there are several heating plants for wood biomass:

- Łukta – nominal power of boilers is 2 MW (boiler room burns wood chips);
- Pałac Wojciechy – nominal power of the boilers is 150 kW (boiler room burns wood chips);
- Dwór Bieniasze – nominal power of the boilers is 150 kW (boiler room burns wood chips);
- Klonowy Dwór – nominal power of the boilers is 2 MW (boiler room burns wood chips);
- Kiełkuty – nominal power of the boilers is 2 MW (boiler room burns wet wood chips);
- Parafia Morąg – nominal power of the boilers is 100 kW (boiler room burns wood chips);
- Tartak Miłomłyn – nominal power of the boilers is 1.5 MW (boiler room burns wood chips);
- UNIWEX – nominal power of the boilers is 1.8 MW (boiler room burns wood chips and wood processing residue);
- PAGED SKLEJKA S.A. – nominal power of the boiler room is 8 MW (boiler room burns wood chips).

The heating plant for the housing estate in Łukta, with power of 2 MW using waste from wood processing plants and annual branch pruning, is the best example of an installation using biomass for heat production in the pilot region (Ostróda). The system consists of two boilers for biomass energy with power production rates of 1.5 MW and 0.5 MW (with 82% efficiency). It heats the school building, public healthcare institution, public administration buildings, private houses and local enterprises.

The heating plant in Łukta affects not only the local environment, but also the economy of the region. After conducting heating plant modernisation (exchange of low efficiency coal boilers for high efficiency boilers for biomass) the need for heat generation was reduced to 40% and the cost of 1 GJ (giga joules) of heat during the first five years after installation decreased from €1.05 to €0.75.

3.1.4 Business models

Heating plants for biomass in the pilot regions use the most typical business model in Poland which consists of two business partners:

- an entrepreneur generating energy who announces a tender offer to deliver a certain amount of biomass for a certain period of time;
- a contractor producing and delivering biomass.

The business model does not include brokers. After the contractor wins the tender fuel is usually delivered during the period of one year; the fuels delivered most often are wood chips or wood processing waste. A one-year contract period is quite short for a commitment to a long-term business development.

A low quality of biomass is the main problem in the Polish delivery chain. Usually the tender is won by the entrepreneur who gives the lowest price of biomass, however this is often contaminated. Through the above presented tendering mechanism the competition between contractors is restricted. Below, in the model for the supply chain of biomass deliveries for the local heating plants in Poland is presented (Table 5).

Table 5. The model of biomass deliveries to the heating plants in the pilot regions.

Biomass owner	Biomass harvesting	Chip producer	Chip transport	Chip seller	Chip consumer
State forest enterprise Forest owner Farmer	Contractor Forest owner	Contractor	Contractor	Contractor	Power plant

The most common business model for biomass supply in Poland is one involving only two companies: the heating plant operator announcing the tender and a company which wins the contract. The contractor is usually the owner or leaseholder of a wooded area or wooded fallow land. This entity acquires, processes and sells the biomass. The contract for biomass delivery is usually signed for a period of one year. There are no intermediary entities in this model.

The problem of the Polish supply chain is the fact that the tender is most often won by the company which proposes the lowest biomass price. This greatly limits competition between contractors. The biomass with the lowest price usually is of low quality and often damaged and spoiled.

3.1.5 Feasibility studies as technical and economic analyses for the pilot projects

Together with regional authorities and the Warmian–Mazurian Energy Agency (local partner) five projects were selected, two in the district of Ostróda:

- social welfare home in Szyldak and
- educational establishment in Dąbrówno.

And three for the district of Olsztyn:

- social welfare home in Barczewo;
- order of Malta aid hospital in Barczewo;
- social welfare home in Grazymy.

Together with the Ostróda district a third project was taken into consideration, a school in Morąg. However, due to the fact that its energy demand is covered by the district heating system, the idea was abandoned.

3.1.5.1 Szyldak welfare home

The Szyldak welfare home is owned by the Ostródzki district. The building is rented by the Foundation of the Order of Malta in Poland, who organise welfare housing. Currently the welfare house uses an oil-heating installation. The feasibility study proposed the installation of the biomass silo, a 300 kW biomass boiler of operate more than 5,000 hours at the maximum heat load. Such a boiler would use 145 tonnes of biomass (woodchip) for heat production. The total investment calculated in the feasibility study is on the level of 227,200 PLN and the operating costs are 39,221 PLN.

Figure 11. Social welfare home in Szyldak (Source: DPS Szyldak http://www.archaniolmichal.pl/galeria/).

3.1.5.2 Dąbrówno educational institution

The Dąbrówno educational institution is a middle school that currently uses coal-heating installation. KAPE's experts proposed the installation of the biomass silo and biomass boiler of 300 kW to operate more than 5,000 hours at the maximum heat load. This installation would use 90 tonnes of woodchip for heat production. The total investment cost is 227,200 PLN and the annual operating cost is 29,821 PLN.

Figure 12. Middle school in Dąbrówno (Source: http://pg-dabrowno.superszkolna.pl/galeria/zdjecia/22933/nasza_szkola).

3.1.5.3 Barczewo social welfare home

The Barczewo social welfare home is a social welfare entity dedicated to seniors and disabled persons in the district. The Olsztynski district authority is a direct partner in this project. Currently this building uses natural gas for its heat production. The project consists of installing the biomass silo and 400 kW biomass boiler. The investment cost is 262,200 PLN and annual operating cost is 77,009 PLN, resulting in a heating cost of 0.03 PLN/kWh.

Figure 13. Social welfare home in Barczewo (Source: DPS Barczewo http://dpsbarczewo.pl/index.php?option=com_phocagallery&view=category&id=3:dps&Itemid=50).

3.1.5.4 Grazymy social welfare home

Grazymy social welfare home is a social welfare organisation dedicated to mentally handicapped adults from the Gietrzwald district area. Currently oil installation is the system used for heating. The new feasibility study proposes a change of the heating system to biomass installation. KAPE's experts proposed the installation of the biomass silo and a 200 kW biomass boiler. Investment costs are

on the level of 98,000 PLN and the annual operating cost is 59,880 PLN. This installation would use 334 tonnes of woodchip for heat production.

3.1.5.5 Order of Malta aid hospital in Barczewo

The aid hospital in Barczewo is a medical institution. The building in which the hospital is located belongs to the Olsztynski district, which acts as the project initiator and main partner. Currently the heating technology used is based on oil and natural gas. The feasibility study proposes a switch to biomass and installing of the biomass silo and a 400 kW biomass boiler. The investment cost is 262,000 PLN and the total operation cost is 61,060 PLN. The installation would use 212 tonnes of wood.

Figure 14. Social welfare home in Grazymy (Source: DPS Grazymy http://www.dpsgrazymy.pl/).

3.1.6 Financing of projects

Due to the lack of the possibility of the pilot region authorities covering the investment costs it was not possible to achieve any pre-contracts during the project life cycle. Instead of assisting pilot regions in contracts, KAPE's experts prepared an analysis for the districts of the financial possibilities showing them how to finance those five projects from external sources.

From a positive point of view, the finance analysis indicated that for the years 2014–2020 there will be numerous opportunities of which regions can take advantage to finance installations equipped with biomass boilers after the end of the project.

Full documents are prepared in Polish and show the detailed possibilities. The funding programmes for the investments in the utilisation of biomass for energy purposes are briefly:

- the programme called 'Bocian' offers financial support for heat sources of biomass usage below power levels of 20 MW and for electricity generation in highly efficiency cogeneration with biomass combustion with power below 5 MW.
- the programme called 'Prosument' – is a financing instrument that provides the opportunity to pre-order and assembles micro-installations of renewable energy sources with a proposed budget of 600 million zł including 10–20% subsidies. Financing will be available from autumn 2014 at the earliest and will continue until 2020.
- the Environment Protection Bank (BOŚ) offers credit up to 100% of the investment and a long crediting period which provides the possibility to spread the investment costs for up to 15 years.
- EU Funds and their Operational Programmes for the programming period of 2014–2020 will offer a broad range of RES financing but details are not yet known.

The project team made every effort to allow the fastest possible realisation feasibility study in the pilot regions. Apart from the above-mentioned analysis, a document was prepared containing the terms of reference (ToR) for use by local authorities and details of the implementation of the feasibility study.

Due to the facts stated above, KAPE had to adapt the nature of assistance in preparation of contracts and take corrective actions that will accelerate the process of implementing bioenergy projects in the districts.

KAPE offered an exchange of knowledge during three types of meeting: with the manufacturers of boilers, with the users of biomass boilers and with entrepreneurs for whom pre-feasibility studies were made.

The purpose of the meetings with the manufacturers of boilers was also to investigate the market of biomass boilers and the scope of the current commercial offers. Interviews with entrepreneurs have brought a lot of information that may in the future help in the proper realisation of investment in the PromoBio pilot regions. The second type of meetings relied on visiting owners and users of biomass boilers. Meetings aimed at investigating the technology currently used in heating with biomass. The third type was meeting with people for which feasibility studies were made. The conversations showed that they are mainly interested in obtaining the greatest possible savings resulting from replacing the fossil fuel boilers with high-efficiency boilers using biomass as the main fuel.

The district authorities signed the Letters of Intent in which they state that they are ready to build new biomass installations that are mentioned in PromoBio results in the future, as soon as the financing is available.

3.1.7 Recommendations and conclusions

Currently, in the pilot regions the requirement for primary energy is very high and thus energy efficiency measures are recommended. The decrease of energy demand should be achieved by a number of activities connected with introducing thermo-modernization. Simultaneous replacement of the heating system is recommended.

Table 6. Thanks to PromoBio, a total of five projects will have the following impacts in Poland.

Concrete impacts	Poland
Increased RES-based heat and power production during the project cycle (2011–2014), MW	1,8 (a)
Increased RES-based heat and power production in the near future by 2020, MW	623 (b)
Biomass mobilised (tonnes/m^3) during the project cycle (2011–2014), tonnes	1,037 (c)
Biomass to be mobilised (tonnes/m^3) in the near future by 2020, tonnes	12,456 (d)
Type of biomass mobilised (tonnes/m^3) during the project cycle (2011–2014)	Woodchip, sawdust
Type of biomass to be mobilised (tonnes/m^3) in the near future by 2020	Woodchip, sawdust
Employment created during the project cycle (2011–2014), number of new jobs	No change employees*
Employment to be created in the near future by 2020, number of new jobs	Data not confirmed**

(a) Heat production in MWh of the biomass heating plants in operation with PromoBio support.

(b) Heat production in MWh of the total biomass heating plants which benefited from PromoBio support (2014–2020).

(c) Biomass quantity (wood chips and sawdust) in tonnes of the biomass heating plants in operation with PromoBio support.

(d) Biomass quantity (wood chips and sawdust) in tonnes of the total biomass heating plants which will benefit from PromoBio support (2014–2020).

* Investments are small and current employment is sufficient.
** Estimations are in the new RES act that is not yet force.

3.2 Romania

3.2.1 Background

On the basis of the PromoBio activities the Romanian partners identified several stakeholders interested in developing and supporting biomass initiatives. Some of them are involved directly in wood biomass business fields and others intend to use local and available resources to reduce energy costs and increase the efficiency of their current businesses. The main interested entities are located in two counties of Centru region: Covasna and Harghita. The main background characteristics of these two counties that led to better development of the woody biomass applications are the following:

- high level of forest covered area – Covasna 45.9% and Harghita 39.5% – in comparison with 36.9%, the average percentage for Centru region;
- keeping in operation the old district heating systems for urban residential and industrial consumers – the thermal sources use mostly conventional fuel which need implementation of modernisation and more efficient measures;
- the existence of small companies for primary wood processing and furniture manufacture that could be the source of sawdust;
- good forest management (both state-owned and private forests) that could create a sustainable supply of raw materials for bioenergy;
- supporting networks (professional associations) for bioenergy promotion, among which the most active are: PROWOOD (group of small wood processing companies, research institutes and public authorities) and GREEN ENERGY Biomass Cluster (companies, research institutes, public authorities and financial institutes).

The Romanian PromoBio partners enjoyed the continuous support of the Harghita and Covasna local authorities and GREEN ENERGY Biomass Cluster to find local initiatives of bioenergy development. They participated actively in different PromoBio actions (workshops, international training, national training, etc.) and they adhered to the PromoBio objectives and took advantage of the opportunity to participate in PromoBio activities.

3.2.2 Best practices

The existing bioenergy best practices were a real support of the Romanian partners in their activities to promote the woody biomass collected and used for energy generation. These initiatives and objectives constituted examples for potential biomass suppliers or heating plant operators.

The biomass heating plants in Intorsura Buzaului (Fig. 15) and Gheorghieni (Fig. 16) were chosen as best practice examples for the PromoBio project. These plants have been in operation since 2004. Both heating plants were included in the Sawdust 2000 programme. The amount of total investment was 90% granted by the EU, as well as the Danish and Romanian governments, and 10% was financed by each local authority.

The main purpose of these projects was to substitute fossil fuels (light oil and natural gas) with waste wood locally available, such as sawdust, chips and bark from the processing wood industry (sawmills, etc.) and forest residue.

For biomass management and supply best practices three examples were selected: SC TEGA SA Sfantu Gheorghe - Covasna County; and TREFOREX SRL Toplita and NEVAL SRL Zetea – both from Harghita County. The selected companies cover entire chains: raw material collection, processing, recovery, storage, transport and delivery of woody biomass.

Figure 15. Intorsura Buzaului heating plant.

Figure 16. Gheorghieni heating plant.

TEGA Company, (see Fig. 17) which operates in the urban public services area, initiated a large campaign for wood residue collection in cities and villages at the county level. The wood residues are chopped and crushed and could be delivered for energy production. As an example, TEGA uses wood chips as fuel in its heating plant; this project was co-financed by the Romanian Environmental Fund.

Figure 17. Wood residue collection campaign – TEGA Sfantu Gheorghe (Source: Green Energy cluster).

NEVAL SRL (Fig. 18) is located in Zetea, Harghita County and operates on the Romanian forest biomass market: timber harvesting, timber transport, wood chip production, pellets and briquette production.

Wood chips are produced from poorer quality wood resulting from harvesting operations, while wood pellets and briquettes are produced from sawdust and shavings resulting from wood processing industries (mostly from the furniture industry) as well as from its own wood processing activities. The biomass products result from processing the wood harvested mainly from thinning (diameter < 5cm) and cleaning actions of pasture areas.


Figure 18. NEVAL activities – biomass collection and processing and pellet production (Source: ISPE).

TREFOREX SRL (Fig. 19) is a private company for woody biomass collection, processing, transport and delivery in Toplita town and surrounding areas. TREFOREX is one biomass supplier for Gheorghieni DHS. Recently, TREFOREX obtained an EU grant for new investments achieving Bioenergy Toplita – "New manufacturing unit for woody briquettes using wood chips and sawdust".


Figure 19. TREFOREX activities including biomass collection and processing and pellet production (Source: TREFOREX SRL).

The GREEN ENERGY Biomass Cluster (Fig. 20) promotes and invests in acceleration of the entire biomass chain. Group members participate in numerous activities to promote the valorisation and use of woody biomass, including: training sessions on bioenergy issues, active involvement in local projects such as cultivation of energy crops (i.e. Salix viminalis) on poor soil (Poian village, Covasna County), support for building the biomass thermal plant at TEGA Sfantu Gheorghe.

Figure 20. Current activities of the Green Energy Biomass Cluster (Source: Green Energy Biomass Cluster).

ERPEK IND SRL (Fig. 21), a member of the Green Energy Biomass Cluster is a local company that has much experience in technical, design and execution activities based on its own conception (BioSistem type) of the biomass equipment in two main areas:

- biomass bakery ovens and other accessories in the field;
- biomass boilers and auxiliary equipment for heating plans (10–1,000 kW).

ERPEK IND SRL is also operator and biomass supplier (as processor, transporter, supplier) for the installed equipment.

Figure 21. Current activities of ERPEK IND SRL (Source: ERPEK IND).

3.2.3 Regional bioenergy action plan as basis for the further steps

The newly approved Action Plan for biomass and bioenergy of Centru region serves as a roadmap for increasing the use of biomass as a sustainable energy resource in Centru region over the coming years. The document was drafted within the PromoBio project by the Romanian partners in close collaboration with the relevant regional stakeholders. The plan was approved by the Regional Development Board on 19 February 2014 and entered into force later the same year.

The debates conducted during the three project workshops and during the meetings of the project support group have provided relevant information on the current situation of bioenergy in Centru region and emphasised the main difficulties encountered by the producers of energy from biomass. Moreover, a questionnaire was conducted, with local authorities and other public or private organisations as target groups. The purpose of the questionnaire was to assess if Centru region needs a regional bioenergy Action Plan and to determine the priorities and actions to be included in this document.

The supported pilot projects, the study visits and training courses held in the frame of the PromoBio project represented at the same time an important source of information for setting up the priority areas and actions to be included in the Action Plan. Seven pilot projects were successfully supported through the project PromoBio, in order to solve the main problems of the bioenergy sector: creating connections between biomass producers and biomass users, identifying financing resources, implementation of new technologies and other specific problems.

Based on the support of the PromoBio project together with different regional stakeholders seven local initiatives were selected to develop good business models at the local/regional level. These initiatives cover different types of beneficiaries (public/private), biomass sources (wood chips, sawdust, pellets) and consumers (industrial/agricultural/residential).

3.2.4 Feasibility studies as technical and economic analyses for the pilot projects

3.2.4.1 Office building Incubatorul de Afaceri (business incubator), Sfantu Gheorghe

Incubatorul de Afaceri Sfantu Gheorghe is an office building for 46 local SMEs and professional associations. The building refurbishment was financed by a national programme for SMEs' support and completed in 2010.

Initially, the heating system used natural gas as fuel; the heating costs rose annually due to increase of the natural gas price. After the first PromoBio workshop, COVIMM Company responsible for managing the building decided to replace existent heating system with a new biomass boiler. The PromoBio partners provided assistance from the beginning of the project and encouraged the business partners to reach an agreement. Consequently, a letter of commitment was signed between COVIMM and two local biomass and technology suppliers, MONDOIMPEX and ERPEK Companies.

This project consisted of installing a biomass boiler producing 135 kW for operation only in the winter period (1,800 hours at maximum heat load). This boiler uses 426 m^3 biomass (sawdust and wood chips) to produce 243 MWh/a. The investment calculated in the feasibility study is €37,400 and the operating costs are €6,669 resulting in a heating cost of €0.0363 /kW hours (kWh), in comparison with the existent heat cost of about €0.047 /kWh. The positive results of the cash flow analysis determined the beneficiary to start this project (see Fig. 22). According to the contract, the new biomass heating plant was in operation in November 2013. The first contract between COVIMM and ERPEK for biomass supply (wood chips)

was signed in the same month. The commissioning of the new biomass heating plant was organised by PromoBio project as recognition of the project support throughout the work period.

Figure 22. COVIMM Company decided to replace existent heating system with a new biomass boiler (Source: COVIMM).

3.2.4.2 Industrial consumer – Bertis Sfantu Gheorghe

SC BERTIS SRL is a local medium-sized enterprise. BERTIS SRL has as its main activities: food production (refrigeration and freezing of meat; processing of meat, milk-derived products and vegetables) and distribution. The network distribution covers seven counties from three different regions. After several meetings supported by the PromoBio partners, in July 2013, Bertis and ERPEK's representatives signed a letter of commitment for the development of the bioenergy investment: the installation of a biomass boiler to replace the existing natural gas boiler for covering the heat demand of BERTIS consumers.

This project consisted of installing a biomass boiler of 500 kW capacity to operate for 4,000 hours at the maximum heat load. This boiler uses 2,273 m^3 biomass (wood chips) to produce 2,000 MWh/a. The investment calculated in the feasibility study is €77,500 and the operating costs are €42,506 resulting in a heating cost of €0.0213 /kWh in comparison with the existent heat cost of about €0.039 /kWh. Taking into consideration the positive results of the cash flow analysis the beneficiary agreed to start this project. According to the contract the new biomass heating plant was in operation on November 2013 (Fig. 23). The first contract between BERTIS and ERPEK for biomass supply (wood chips) was signed in the same month.

Figure 23. New Bertis Sfantu biomass heating plant (Source: ISPE).

3.2.4.3 Agricultural consumer – Dalia Valea Crisului

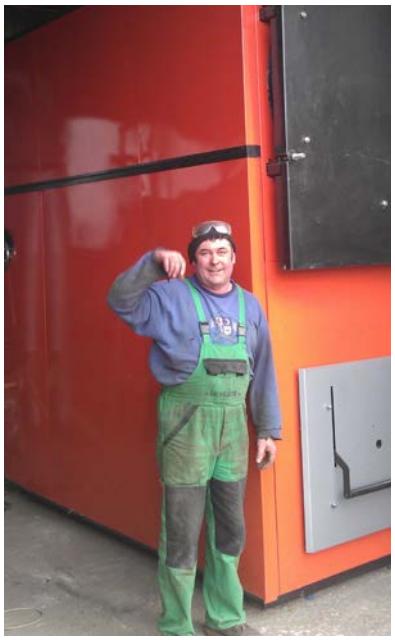
SC PRODUCTIE SI COMERT DALIA SRL (DALIA) is a floricultural producer located in Valea Crisului Village in Covasna County. Dalia Company was set up in 1993 and has continuously developed. Now, Dalia has more than 1 ha of greenhouses. The greenhouse heat demand is produced by inbuilt energy sources equipped with wood stoves using sawdust and firewood. The existent wood stoves are obsolete and not energy efficient. A part of raw material used as fuel (sawdust) for existent stoves is supplied by the beneficiary using the residues from floricultural activities. Before burning, this residue is transported from a wood processing company to obtain the fuel (sawdust). The rest of the biomass quantity needed for greenhouses heating is firewood bought from local suppliers.

Due to low efficiency equipment Dalia had great biomass consumption with high heat generation costs and increased final price of products. In this situation Dalia decided to develop a project to decrease the energy costs and contacted the PromoBio partner to ask for project support. The project goal is the installation of a new biomass boiler, replacing the existing low efficiency stoves to cover the heat demand of Dalia greenhouses. In July 2013 with the support of PromoBio partners, Erpek IND SRL as local wood boiler manufacturer and Dalia as beneficiary signed a letter of commitment to achieve the goals of the Dalia project.

This project consisted of installing a biomass boiler of 750 kW capacity for 2,500 hours of operation at the maximum heat load. This boiler uses 5,200 m^3 biomass (sawdust) to produce 1,875 MWh/a. The investment calculated in the feasibility study is €71,500 and the operating costs are €53,548 resulting in a heat cost of €0.0308 /kWh in comparison with the existent heat cost of about €0.0345 /kWh. Taking into consideration the positive results of the cash flow analysis the beneficiary agreed to start this project. According to the contract the new biomass heating plant was in operation in October 2013 (Fig. 24). The needed biomass quantity is supplied by the beneficiary. The forest and agricultural residues provided by the beneficiary

are processed by a local biomass processor to obtain the sawdust used as fuel in the new heating plant. The beneficiary transports raw material (sawdust) to and from the local biomass processor its own trucks.

Figure 24. New Dalia Valea Crisului biomass heating plant (Source: ERPEK IND SRL and ISPE).



3.2.4.4 Private dwelling consumer – Tg. Secuiesc

The owner of this house (190 m^2) has a small wood processing company – REDWOOD SRL. The company activity results in an important quantity of wood residue (at least 150 m^3 annually). Taking into consideration this potential energy resource the company contacted the PromoBio partners to install a small biomass heating plant for house heating. In July 2013 the beneficiary company and ERPEK IND SRL as technology supplier signed a letter of commitment and requested the technical support of the PromoBio project.

This project (Fig. 25) consisted of installing the biomass boiler of 25 kW capacity for 1,900 hours of operation at the maximum heat load. This boiler uses 125 m^3 biomass (sawdust) for heat producing 47.5 MWh/a. The investment calculated in the feasibility study is €7,390 and the operating costs are €349, resulting in a heating cost of €0.01 /kWh in comparison with the existent heat cost of about €0.0415 /kWh using an individual natural gas thermal plant. The positive results of the cash flow analysis led the beneficiary to agree to start this project. According to the contract the new biomass heating plant was in operation in September 2013. The needed biomass (sawdust) quantity is supplied by the beneficiary itself. Biomass costs include only the transport costs from REDWOOD to the house.

Figure 25. New Kajan Karoly Tg. Secuiesc biomass heating plant (Source: ERPEK IND SRL and ISPE).

3.2.4.5 District heating system (DHS) consumer - URBANA Odorheiu Secuiesc

URBANA is the operator company of the Odorheiu Secuiesc District Heating System. URBANA operates seven heating plants with more than 40 MW installed (heat capacity) and about 15 km of heat distribution network. This district heating system (DHS) was built in the period 1965–1985. Initially all hot water boilers used oil fuel and natural gas. Most boilers operate on natural gas; only one type of boiler uses biomass – wood chips. Now, Urbana has about 2,500 residential customers (apartments), supplying heat energy for heating and domestic hot water, but the installed capacity allows connection of 8,200 residential consumers. The reason for this disparity was the high tariffs on heat energy in relation to the average income of the clients. After 2008 URBANA started rehabilitation and modernisation motions to increase DHS energy efficiency. One was to replace a natural gas boiler with a 1.5 MW biomass boiler in 2010 (Fig. 26).

Based on "Local Energy Strategy" URBANA intends to continue the DHS modernisation works. One of the important investments will be the replacement of fuel with biomass (wood chips). This investment will be phased depending on the possibility of accessing structural funds (grants). Following the first PromoBio workshop, URBANA asked PromoBio for support in analysing the first development phase.

This project consisted of installing three biomass boilers of a total 9.5 MW (3 MW, 2.5 MW and 4 MW) capacity for 8,000 hours operation at the maximum heat load. These biomass boilers will operate according to an average annual heat consumption curve and they cover most part of the heat need throughout the year. However, the peak load will be delivered by existent natural gas boilers. Each boiler will be

placed in a different DHS heating plant. These boilers will use 89,412 m^3 biomass (wood chips) to produce 9,500 MWh/a. The investment calculated in the feasibility study is €1,750,000 and the operating costs are €1,309,660 resulting in a heating cost of €0.0188 /kWh in comparison with the existent heating cost of about €0.032 /kWh. Taking into consideration the positive results of the cash flow analysis, the beneficiary agreed to start this project and to prepare the requested documents to access the needed structural funds.

Figure 26. Heating plants old/new equipment – Beneficiary: URBANA Odorheiu Secuiesc (Source: URBANA and ISPE).

3.2.4.6 DHS consumer – GOSCOM Miercurea Ciuc (Kos Karoly)

Kos Karoly heating plant was built in 1970 to heat the local school. Initially it used light oil fuel, but since 1980 it has used natural gas. This heating plant consists of six natural gas boilers of about 4.5 MW capacity. This heating plant (Fig. 27) is a part of Miercurea Ciuc DHS, operated by GOSCOM Miercurea Ciuc. Due to the low energy efficiency of this energy source, GOSCOM intends to replace the obsolete boilers with biomass boilers (wood chips or pellets). GOSCOM's representatives attended at the first regional PromoBio workshop in 2012 and they were interested in participating in PromoBio activities. With the support of PromoBio partners they signed a letter of commitment together with the company NEVAL as local biomass supplier.

This project consisted of installing two biomass boilers of 3.65 MW (1.65 MW and 2 MW) capacity for 1,800 hours operation at the maximum heat load to supply the school. These boilers will use 7,731 m^3 biomass (wood chips) to produce 6,570 MWh/a. The investment calculated in the feasibility study is by €500,000 and the operating costs are €154,487 resulting in a heating cost of €0.0288 /kWh in comparison with the existent heat cost of about €0.043 /kWh. Taking into consideration the positive results of the cash flow analysis the beneficiary agreed to start this project. As in the previous situation, GOSCOM will prepare the requested documents to access the needed structural funds.

Figure 27. Kos Karoly heating plant; beneficiary: GOSCOM Miercurea Ciuc (Source: GOSCOM and ISPE).

3.2.4.7 DHS consumer – Biomass heating plant – Brates commune

Brates commune is made up of three villages (Brates, Pachia and Telechia). The municipality initiates, promotes and supports specific activities to increase energy efficiency for the main energy consumers from

the commune area. In this context, the municipality supports a project that consists of a biomass heating plant to replace the existent individual heating sources (stoves using firewood) which supplying 16 apartments situated in two multi-family buildings located in Brates village (Fig. 28). This existing heating system needs large fuel storage capacity and has very low energy efficiency. The project beneficiary and heating plant operator is the building owner association, as representative of the bioenergy end-users. The Brates mayor contacted the PromoBio partners to request technical support. They signed a letter of commitment together with TEGA SA as local biomass supplier.

This project consisted of installing one biomass boiler of 150 kW capacity (1,900 hours operation at the maximum heat load) to supply customers demand. This boiler will use 335 m^3 biomass (wood chips) to produce 285 MWh/a. The investment calculated in the feasibility study is €41,100 and the operating costs are €6,930 resulting in a heating cost of €0.0327 /kWh in comparison with the existent heat cost of about €0.0435 /kWh. The results of the cash flow analysis were positive and the beneficiary agreed to start this project, after obtaining the needed funding to finance this investment. Brates municipality began to prepare the financing request in order to access the structural funds dedicated to energy efficiency and RES.

In this project two partners are involved: ERPEK IND SRL as technology supplier and SC TEGA SA as biomass supplier. TEGA SA will collect and chop the wood residues and it will transport and distribute the biomass (wood chips) to the new heating plant.

Figure 28. Multi-family buildings in Brates village (Source: ERPEK IND SRL).

3.2.5 Conclusions

Summarizing, the Romanian PromoBio partners selected seven bioenergy initiatives from Centru region for technical support which have been developed as seven pilot projects at regional/national levels. Four pilot projects were put into operation in 2013, three of which began the procedure for preparing the application to obtain financial support from structural funds. Outcomes of these selected pilot projects are presented in the table 7.

Table 7. Concrete impacts in Romania by the project.

Concrete impacts	Romania
Increased RES-based heat and power production during the project cycle (2011–2014)	4,165.5 (a)
Increased RES-based heat and power production by 2020	356,413 (b)
Biomass mobilised (tonnes) during the project cycle (2011-2014)	1,277 (c)
Biomass to be mobilised (tonnes) by 2020	105,141 (d)
Type of biomass mobilised (m^3) during the project cycle (2011–2014)	2,411 m^3 wood chips and 5,613 m^3 sawdust
Type of biomass to be mobilised (m^3) by 2020	404,378 m^3 wood chips and 33,678 m^3 sawdust
Employment created during the project cycle (2011–2014), number of new jobs	4
Employment to be created by 2020, number of new jobs	11

(a) Heat production in MWh of the biomass heating plants in operation (four projects) in 2013 with PromoBio support.

(b) Heat production in MWh of the total biomass heating plants (seven projects) which benefited from PromoBio support (2014–2020).

(c) Biomass quantity (wood chips and sawdust) in tonnes of the biomass heating plants in operation in 2013 with PromoBio support.

(d) Biomass quantity (wood chips and sawdust) in tonnes of the total biomass heating plants which will benefit from PromoBio support (2014–2020).

3.3 Supported initiatives in Slovakia

3.3.1 Business models and actors

There are four common business models used in the Banská Bystrica region for production of biomass from forests and from trees grown in agricultural lands.The most important biomass owner is the state forest enterprise Forests of the Slovak Republic. On average it produces annually 170,000 tonnes of biomass for chipping, which is around one-third of the annual amount of chips produced in the region. The second-third of the volume of biomass comes from non-state forest owners and from farmers. The rest of woody biomass is produced by the forest industry, i.e. from sawmills. In the most prevalent business model the owners of biomass conclude contracts with private entrepreneurs for harvesting and transport of biomass to the roadside. Most of the cutting is done by chainsaws. Skidding is done by skidders or by agricultural tractors equipped for forest operations. During last few years the use of harwarders and forwarders has also been increasing. Chipping of biomass and transport of chips is done by contractors. Commercial organisations buy biomass at the roadside and pay costs of chipping and transport and sell chips to the consumers, i.e. to the power plants.

In the second business model harvesting and chipping of biomass is done by companies owning biomass. Only transport of chips is done by contractors. Chips from forest owners and farmers are sold to the final consumer via commercial companies.

The third business model has been used by two companies, which are owners of several boiler houses with the thermal output of each boiler up to 1 MW. Because the consumption of chips in such small boilers is relatively low, logistics of chip procurement should fit to the needs and consumption of chips depending on the season and on actual temperatures. Therefore, those companies have their own machines for all operations and produce chips for their consumption.

Business model four is used for procurement of energy biomass from sawmills. Owners of sawmills sell by-products from timber production to commercial companies, which transport it to logistic centres or directly to the power plant, where they produce chips.

The most important companies in the region are:

Biomass production and procurement:

- AZ Lokomat Zvolen;
- Worldwood Slovakia;
- Intech Slovakia;
- Slovwood;
- ECOEN Slovakia;
- Forests of the Slovak Republic;
- Military Forests and Assets Pliešovce.

Biomass consumption:

- Zvolenská teplárenská, Zvolen;
- Dalkia Slovakia;
- Bučina Zvolen;
- Intech Slovakia;
- Kompala Banská Bystrica;
- RWE-KA Contracting Banská Bystrica;
- Energy Edge ZC Žarnovica;
- Handlovská energetika Handlová.

3.3.2 Feasibility studies as technical and economic analyses for the pilot projects

3.3.2.1 Association Bioenergia Bystricko, Banská Bystrica region

Bioenergia Bystricko is an association of eight municipalities in the Banská Bystrica region aiming at substitution of 15 coal heating plants for biomass facilities providing heat to 43 public buildings in eight villages. The idea came from the non-governmental organisation (NGO) CEPA (Friends of the Earth, Slovakia) who motivated and mobilised the stakeholders and organised fundraising activities (EU Structural Funds).

Figure 29. Some of the public buildings in L'ubietová heated by Bioenergia Bystricko association (Source: Otepka, 2014).

It has been difficult to convince stakeholders: one of the former nine villages dropped out of the project. Some problems occurred also with the lack of know-how on participation and coordination of stakeholders.

Other difficulties to overcome were the knowledge gap of stakeholders at the beginning of the project preparation and lack of trust from some partners. The knowledge gap was bridged by visits to places with biomass heating facilities and by training provided by the NGO. Involvement of the stakeholders in the formulation of the project brought new knowledge, financial benefits for the communities and a new energy infrastructure. The key drivers were: a full involvement of NGO during six years, including investment of their own funds into preparation and coordination of the project.

The non-profit organisation Bioenergia Bystricko, created for the project, has been in charge of implementation for the project and for its operation. Several organisations from civil society were involved. Cooperation between the NGO and the communities has been received positively by all stakeholders.

Technological requirements:

- biomass demand: 2,200 tonnes per year;
- total nominal capacity: 3.17 [MW_{th}];
- auxiliary electricity consumption: 9 [W/kW];
- thermal efficiency – hot water boiler: 85%.

3.3.2.2 Forest chip procurement in the state forest enterprise "Forests of the Slovak Republic", Banská Bystrica

State Forest Enterprise "Forests of the Slovak Republic" manages 938,617 ha of forest land. Annual removals amounted to 4,971,000 m^3 in 2010. The enterprise is territorially divided into 24 branch plants. In addition, there are also three specialised branch plants. One of them is the branch plant BIOMASA, specialised in procurement of forest biomass for energy.

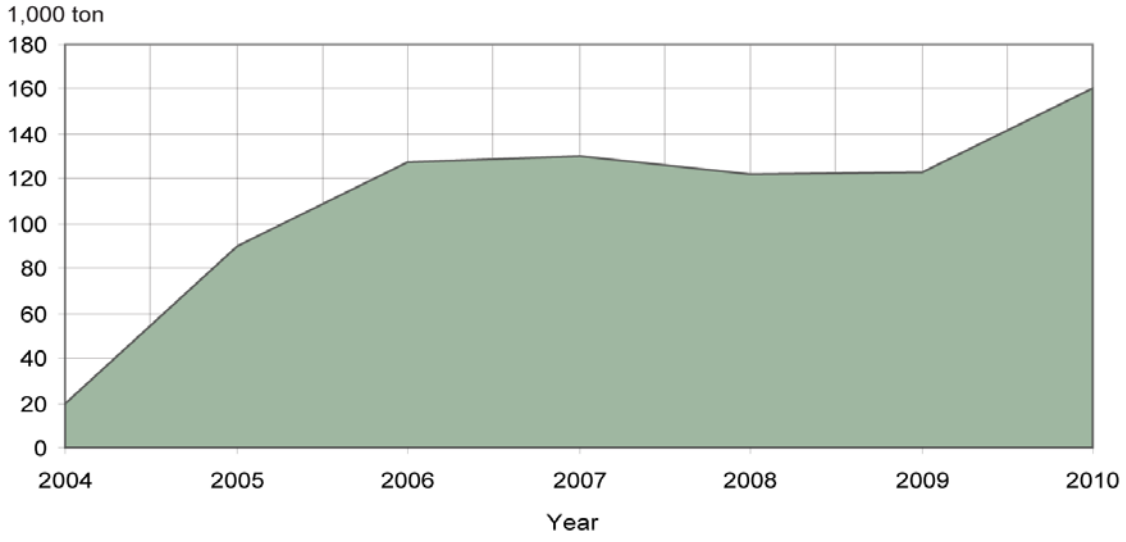


Figure 30. Development of wood chip production in the branch plants (BIOMASA) during 2004–2010.

Each regional centre has one mobile chipper and supplies chips to 5–7 customers in the region. The regional centres cooperate in the procurement of biomass to be chipped with 3–4 branch forest enterprises located in their territory. Main sources of biomass for chipping are residues from final cuttings, small

diameter trees from thinnings and residues from calamity harvesting from forests damaged by insects and storms. Biomass is collected to the roadside, where it is chipped.

Annual production of chips has been steadily increasing, along with the development of biomass markets for energy. Current annual production is around 160,000 m^3 of forest chips, of which circa 120,000 m^3 comes from salvage cuttings. Revenue in 2010 was €8.3 million. The branch plant BIOMASA became an important employer in rural areas, as it created 112 jobs for local foresters and entrepreneurs. Development of wood chip production by the branch plant BIOMASA is presented in Fig. 30.

Technological operations:

- annual production of forest chips: 160,000 m^3 (of which residues from salvage cutting: 120,000 m^3);
- number of chippers: 7;
- number of created jobs: 112;
- annual revenue: €8.3 million.

3.3.2.3 CHP plant Zvolenská teplárenská JSC, Zvolen

Zvolenská teplárenská joint-stock company had been operating the CHP plant in the town of Zvolen since 1954. Because of outdated technology, the power plant was not be able to meet the new limits for greenhouse gas emissions valid from 2007 without substantial improvement of technology with very high investment costs. Several alternatives of technical changes were analysed in a feasibility study. Switch from lignite to low-sulphur brown coal with co-firing of biomass was identified as the economically most feasible and environmentally acceptable solution.

Figure 31. Combined heat and power plant in Zvolen (Source: Otepka, 2013).

Two sloping grate boilers, each with an output of 108 MW_{th}, were converted to co-firing of milled low sulphur brown coal and biomass. Share of biomass would be up to 30% of the combusted fuel. One boiler remained with the same output of 108 MW_{th} and the output of the second boiler was reduced to 65 MW_{th} during the reconstruction. Power is produced by a back pressure turbine with an output of 25 MW_{el}. In addition to the reconstruction of boilers, fuel storage and feeding systems, information and controlling systems, registration and monitoring of emissions and optimisation of production control were modernised.

Fuel mix is comprised of 60–75% of brown coal and 25–40% of chips. Chips are stored in a new 9,000 m^3 open depot and in a 3,000 m^3 silo. Chips are fed into the boilers from a 720 m^3 silo. Average annual chip consumption has been around 70,000 tonnes.

3.3.2.4 District heating plant Banská Bystrica

A new boiler for biomass combustion was installed during the second half of 2011 in a district heating plant in Banská Bystrica – Radvaň. Installed thermal output of the boiler is 8 MW. The investment was implemented by the Consortium BB Radvaň, composed of three companies: DOS-TRADING Banská Bystrica, EVČ Pardubice and TENZA Brno.

Figure 32. Two biomass boilers (Kohlbach), each with four megawatt thermal output, in the district heating plant Banská Bystrica – Radvaň (Source: DOS-TRADING, Banská Bystrica).

The district heating plant is operated by a joint-stock company BBES Banská Bystrica. It supplies heat and hot water for housing estates Radvaň, Fončorda and Podháje. The plant has produced in average around 330 TJ annually during the last few years. The district heating system is operated as a hot water system with the temperature drop in winter 130/70°C and in summer 90/60°C. There were three LOOS hot water boilers installed combusting natural gas, each with the output of 3.7 MW_{th} and a gas turbine Taurus 60 with the output of 5.2 MW_{el}, followed by a boiler (IBS Brno) with the output 8.8 MW_{th}.

The joint-stock company KA Contracting SK has proposed investing in the installation of two biomass boilers, parallel to current gas boilers, which would replace about half of the heat produced from gas. This installation would reduce costs of heat for consumers and decrease CO_2 emissions. The new boiler would be in operation round the year and would replace half of the supplied heat and hot water for residents in those three housing estates.

Technical parameters of the biomass boilers:

- thermal output: 8 MW – two Kohlbach boilers, each with the output of 4 MW;
- efficiency: 88%;
- annual production of heat: 157 TJ;
- distribution of heat: hot water, primary distribution system 135/75°C by pressure 6 bar, secondary distribution system 130/70°C by pressure 25 bar, two Alfa Laval exchangers;
- dimensions of the building: 19 x 27 m;
- fuel: wood chips;
- maximum consumption: 3.7 tonnes/hour;
- maximum daily consumption: 89.3 tonnes;
- annual consumption: 20.263 tonnes;
- chip storage: 15 x 12 m;
- outside storage with supply of chips for 18 days – 1,629 m^2.

3.3.2.5 Heating based on renewable resources in the town of Hnúšťa

Heating system in the Hnúšťa was based on the operation of several networks. All these networks were dependent on natural gas representing 100% of the fuel base. The heating was secured by eight gas boiler houses.

Figure 33. View of the Hnúšťa heating plant with a fuel storage place and a boiler house (Source: INTECH, Slovakia).

As a consequence of complete dependence on natural gas, this system was unstable in terms of prices. A significant increase in natural gas prices was reflected in an increase in heat prices. The only solution to eliminate this unfavourable impact of the growth of natural gas prices was to intensify the fuel base. The expansion of the heating system by the industrial plant brings further stabilisation to the system of heat generation and distribution in the town. The use of biomass enhanced the security of supplies and stabilised the heat prices.

The project also included installation of household heat exchanger stations, which considerably increased the comfort of heat consumers. At the same time, the previously decentralised system of hot industrial water preparation changed, eliminating distribution losses and increasing the quality of hot industrial water supply. Thanks to these investments, the new heating system in Hnúšťa is one of the most up-to-date and effective systems in Slovakia. The new technology guarantees high efficiency of the entire system. The principal advantage is stability based on the use of three primary energy sources – biomass, solar radiation and natural gas. Within this scope, the municipal system in Hnúšťa is unique in the territory of Slovakia.

Technological characteristics:

- biomass demand: 9,000 tonnes per year;
- nominal capacity – thermal-oil boiler: 3.0 + 4.0 [MW_{th}];
- auxiliary electricity consumption: 9 [W/kW];
- thermal efficiency – hot water boiler: 85%.

3.3.2.6 Biomass heating system in the town of Hriňová

The heating of Hriňová and of the industrial park in the town is secured by a central boiler house. The boiler house was built as a part of the industrial company ZŤS in the 1950s. The boiler house originally used brown coal as fuel. A gas pipe system was later installed in the boiler house, creating a double fuel source. Heat was supplied to end customers through a system of primary and secondary distribution networks.

The whole system has been going through extensive renewal and reconstruction. The boiler house was equipped with a new VESKO-B boiler using woody biomass as fuel. The objective of this action was to reduce the consumption of coal and natural gas for environmental (reduction in CO_2 emissions) and economic (lower fuel cost) reasons.

Brown coal was totally eliminated from the fuel base of the boiler house. The boiler house was expanded by another VESKO-B boiler using woody biomass. Today, 95% of the heat is generated from woody biomass and the rest is generated by natural gas combustion. The overall system of modernisation included complex exchange of heat distribution networks within the system and installation of new heat supply stations at consumption points. The system was built as a double-pipe system.

Figure 34. Place for storage of biomass close to the heating plant in Hriňová (Source: Otepka, 2013).

Technological characteristics:

- biomass demand: 7,000 tonnes per year;
- nominal capacity – thermal-oil boiler: 1.9 + 3.0 [MW_{th}];
- auxiliary electricity consumption: 9 [W/kW];
- thermal efficiency – hot water boiler 85%.

3.3.2.7 Biomass heating system used in the town of Žarnovica

The heating in the town was originally secured by the central gas boiler house which provided for the heating needs of the entire town. The boiler house was dependent on natural gas. The boiler house area is located on the outskirts of a housing area. The generated heat was distributed from the central boiler house to the points of consumption by several hot water pipeline networks. Hot industrial water was prepared centrally and distributed by means of hot industrial water pipeline networks.

Figure 35. View of the Žarnovica heating plant (Source: INTECH, Slovakia).

The first stage of reconstruction was focused on the diversification of the fuel base. A major part of heat generation from natural gas was replaced by heat generation from biomass. In the premises of the current gas boiler room, a VESKO-B boiler for wood biomass combustion was installed. This boiler will substitute over 80% of heat generation from natural gas. Also, a daily biomass storage bin was installed in the boiler house yard and a biomass dumpsite was created. The second stage of reconstruction involved a complex exchange of the hot water pipeline network in the town. The current four-pipe system was replaced with a double-pipe system and was made of pre-insulated pipelines.

The objective of all these measures was to ensure complete modernisation of the entire system of heat generation and distribution in Žarnovica; eliminate excessive losses in heat distribution; increase heat generation safety by diversifying the fuel base; and provide customers with the lowest heat price possible.

Technological characteristics:

- biomass demand: 3,800 tonnes per year;
- nominal capacity – thermal-oil boiler: 2.0 [MW_{th}];
- auxiliary electricity consumption: 9 [W/kW];
- thermal efficiency – hot water boiler: 85%.

3.3.3 Conclusions

Slovak PromoBio partner promoted the wood-based bioenergy initiatives at regional level. Outcomes of these selected pilot projects are presented in the below table.

Table 8. Concrete impacts in Slovakia by the project.

Concrete impacts	Slovakia
Increased RES-based heat and power production during the project cycle (2011–2014)	1,832.5 x 10^4 (a)
Increased RES-based heat and power production by 2020	32,578.2 x 10^5 (b)
Biomass mobilised (tonnes/m^3) during the project cycle (2011–2014)	823.0 x 10^6 (c)
Biomass to be mobilised (tonnes/m^3) by 2020	18,326.5 x 10^7 (d)
Type of biomass mobilised (tonnes/m^3) during the project cycle (2011–2014)	Wood chips and saw dust
Type of biomass to be mobilised (tonnes/m^3) in the near future by 2020	Wood chips and saw dust
Employment created during the project cycle (2011–2014), number of new jobs	6
Employment to be created by 2020, number of new jobs	18

(a) Heat production in MWh of the biomass heating plants in operation with PromoBio support.

(b) Heat production in MWh of the total biomass heating plants which benefited from PromoBio support (2014–2020).

(c) Biomass quantity (wood chips and sawdust) in tonnes of the biomass heating plants in operation with PromoBio support.

(d) Biomass quantity (wood chips and sawdust) in tonnes of the total biomass heating plants which will benefit from PromoBio support (2014–2020).

4 Conclusions and recommendations for transfer of experience

4.1 Momentum

It takes time to build understanding and trust, and then to deliver results. Forest owners not already engaged in actively managing their woodlands take time to understand what might be needed to bring their woodlands back into management, and how they can supply fuel wood for energy purposes in a profitable way. Private forest owners have started the management of their forests after decades of socialist periods, thus their knowledge of forest management towards economic profitability is low. Similarly, public or private bodies interested in using bioenergy need enough time and knowledge of biomass heating systems and business models before they can seriously consider investing in the system. The duration of one project is not long enough to develop a truly sustainable model for all target regions. However, it is vital to have this kind of project to boost regional and local efforts to increase energy wood supply and enhance wood-based heat business. Local advisory resources are often limited and they might lack expertise in giving technical and business-oriented support.

Momentum is vital. The PromoBio project shows a positive impact on the use of bioenergy in the target regions, increasing both the number of initiated bioenergy business projects as well as policy measures supporting the use of biomass for energy. However, it is vital that consideration is given to developing a long-term way of operating, rather than just focusing on a three year programme. Unfortunately, as with many EU-funded programmes, although future targets are set within the performance management framework, without the delivery of those targets being conditional at the outset, it is uncertain whether they will be delivered. This is particularly true where many of the partners are in effect contracting organisations who can only afford to do what they are being paid to do. Without a longer term approach, short-term projects will not help build the momentum needed to develop sustainable business and supply chain models. In each target region in particular, and at the EU level in general, the recommendation is to establish a local support service that does not involve high costs but provides further contact for those interested in supplying or using energy wood. Project web pages will provide help for the interested stakeholders two years after the project lifetime. Networking support and regional activities boost the interest in biomass business activities and key actors profit largely from regionally available experience. Agricultural and forestry organisations, preferably non-profit, can well serve in this in the long term. They do not have to be experts in technology or business, but just able to provide initial help and guidance for the following steps, and when necessary to further direct to professional expertise.

4.2 Seeing is believing

The study tours and training in Austria and Finland were a key part of the overall project and therefore identifying delegates who would make best use of the training was a priority. Seeing best practice examples and proven solutions and hearing directly from experts and entrepreneurs is one of the most effective ways to convince potential investors and decision makers to believe that the decentralised bioenergy system can be a very feasible and economic alternative. This practical training with many site visits, covering all main principles of biomass heating technology, biomass supply, business models, contracts and daily operations, provided a good, concise information package that can be used in any part of Europe. Carefully prepared training materials tailoring to the local conditions and the Guidebook on Local Bioenergy Supply Based on Woody Biomass can easily be used to train local bioenergy advisors to share proven concepts and help

modify them for any local situation. Study tours also enable effective interaction between stakeholders and can serve as a stepping stone for new business relationships. Furthermore, the training materials can be used for capacity building, i.e. as a tool that allows for the transfer of the knowledge and the experiences gathered in five European countries to other countries not involved in the project. The classification of the frameworks enables biomass business initiators to identify best practice examples from Eastern European countries with similar frameworks and deduce helpful recommendations for their own situations.

4.3 Stability of political situation and predictability of operational environment are important issues

Energy markets are never stable but can be easily tipped in any direction with changes in fuel prices or incentives affecting energy generation. Policies, subsidies and incentives can significantly change after national elections or new EU directives. Because bioenergy investments are usually very capital intensive, investors should be able to predict the future development for at least 10–20 years. Constant changes in policies and subsidies tend to stall investments in new systems. In Eastern European countries, there is a need for an overall strategy for bioenergy which clarifies operation of the markets; identifies target groups, and technologies that the country should focus on; sets clear targets; and coordinates individual actions, so that national and EU targets can be met.

Energy wood markets do not only depend on the general economic situation, but are also highly affected by the demands of the forestry industry. Most timber and energy wood supply chains as well as prices are linked together. The wood processing industry and energy utilities using wood fuels are increasingly competing for roundwood and by-products from forest owners and sawmills. Therefore, future projects should also cover forest residue and the cascading use of wood in order to decrease the competition for industrial timber. In addition, the actors have to adapt to a rapidly changing biomass market. For instance, the increased demand for woody biomass on an international level has also led to an increase in biomass trade with large biomass trade flows inside Europe and between continents. Furthermore, incentives can radically change the market balance; delaying an anticipated incentive scheme can stall the energy wood market.

4.4 Public–private partnerships are challenging

In more advanced bioenergy using countries such as Austria and in Finland's municipalities, wood processing industries or other similar customers were the key actors making investments in biomass heating systems some twenty years ago when heating started to rapidly evolve. The use of biomass-based fuels in private households even has a long tradition in both countries. Strong promotion programs were launched and generous investment subsidies were available. In those early phases entrepreneurs or farmers often supplied biomass fuels and operated the plant or boiler. This business model, also often called "contracting", was more appealing to the entrepreneur because investor bore a much larger economic risk. Later on when entrepreneurs and enterprises had gained experience and confidence, they were willing to take a bigger economic risk and invest in own plants. On the other hand, bigger investment should also enable bigger profit.

Public–private partnership almost sounds like an ideal way of starting a biomass heating enterprise. The downside, however, is that often public investments involve political decisions and the whole decision making process may easily take several years. The situation becomes even more complicated if local elections take place during such a process. Regional emphases may change and often negotiations have to be started over again. It seems Eastern European countries are not yet used to public–private partnerships in energy services. There is still a certain amount of suspicion among both customers and public decision makers about leaving the running of such a basic service in private hands. Would the service be reliable and

energy prices decent? Supply of wood fuel has to be secured. How can the service be secured for a long term with predictable benefits for both the supplier and consumer of energy?

Most challenges regarding supplier/customer relationships can be dealt with in a detailed written contract. Experienced regions and countries can provide good examples. It should always be emphasised, however, that heating business involves a long term. Returns on investment times are long, often at least ten years, so there should be contracts between the suppliers and customers. Terms can be changed but both parties should have confidence in a continuous, mutually beneficial business deal.

4.5 Entrepreneurship to be encouraged

Regional and local authorities responsible for public services, such as heating+, are seldom experts in building or operating heating systems. Therefore outsourcing such service to professionals is very reasonable. In countries where bioenergy production is advanced, municipalities and similar public bodies have been key players in the establishment of biomass heating enterprises that have taken the responsibility of heating public buildings, such as hospitals, schools, offices and retirement homes.

This privatisation and mixing of responsibilities in municipal heating is part of the division of responsibilities between the state and private sector for the delivery of public goods and services. With decentralised heat supplies, heating can be outsourced to so-called heat entrepreneurs or heat enterprises. Heat entrepreneurs or enterprises are single entrepreneurs, a cooperative, a limited liability company or an entrepreneur consortium that supplies customers with heat. Investments in the heating plant can be made by the public partner or private entrepreneur, or investments can be shared. Possible business models for heat entrepreneurs include:

- single entrepreneur;
- limited company;
- cooperative;
- energy saving company;
- franchise;
- network model (entrepreneur consortium) – several companies make contracts with each other to provide part of the whole supply chain;
- contractor.

Privatisation of heating provides mutual benefits. For heat entrepreneurs, this provides an extra or even the main source of income; use for fuel wood; benefits of improved forest management; more use for underutilised harvesting equipment and unutilised wood resources; as well as increased and balanced employment. For the municipality, heat entrepreneurship provides increased security of heat supply and savings on operational and investment costs of energy production when more expensive fossil fuels are replaced with renewable ones. Naturally increased use of local labour and creation of new business opportunities, support for existing employment, environmental benefits and induced economic impacts of local spending should be taken into account as well.

As mentioned above public investment processes often take a lot of time and political changes may further complicate such decision making. Usually, private investors and enterprises are much more agile in making quick decisions if business opportunities seem feasible. However, because many bioenergy enterprises are small and some quite new in this business, practical advisory help and encouragement should be provided. Ideally, impartial basic consultation should be available in all potential bioenergy regions at very modest costs or even free of charge. Close cooperation between stakeholders, like biomass supply organisations, technology providers and energy companies, is recommended.

4.6 Other challenges or possibilities in Eastern Europe

Particularly in Eastern Europe there is huge potential to increase the use of biomass for energy. The locally sourced fuels are stable in price compared to imported fuels. The adaption of renewable energy solutions could play an important role for the revitalisation of less favourable remote and declining areas; for the improvement of life quality levels; and for the creation of new jobs. Forest land ownership issues, entrepreneurship culture and networking skills between business partners are the key issues for successful project performance in the Eastern European cultures, as they can remarkable differ from the conditions in the countries playing a supporting role in the project consortiums. Knowledge transfer projects need sound financing instruments to provide grants for investments, e.g. EBRD (European Bank for Reconstruction and Development) and NEFCO (Nordic Environmental Finance and Cooperation). The following issues are common preconditions for successful projects:

- availability of wood fuels (small diameter wood, logging residue, residue from mechanical wood processing) as well as creating demand for such assortments;
- usually existing municipal district heating systems and networks;
- employment and positive impact on local economy;
- mitigation of net GHG emissions contributing to meeting regional and national targets;
- improving air quality;
- forest management, forest conditions and structure.

There are some projects focusing on the development of supply chains regarding suitable fast-growing energy crops and alternative biomass. Projects based on the best practices and best available technologies provide possibilities to tailor existing technology for local conditions. These kinds of projects are like lighthouses giving models for biomass harvesting chains and heating plants.

Figure 36. The final project group meeting was organised in Brussels, Belgium 21 May 2014. Participants in the front of European Commission; Bartłomiej Asztemborski, Poland, Juha Laitila, Finland, Christa Kristöfel, Austria, Pavol Otepka, Slovakia, Adriana Milandru, Romania, Marius Duca, Romania and Pasi Poikonen, Finland.

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ACRONYMS

a = year (annual)
ADR Centru = Centru Regional Development Agency, Romanian partner of PromoBio project
ASFOR = Association of Romanian Timber Harvesting and Processing Companies
BE2020+ = Bioenergy 2020 + GmbH, Austrian partner of PromoBio project
CEPA = Friends of the Earth, Slovak non-governmental organisation
CHP = Combined Heat and Power Production
CO_2 = Carbon dioxide
DH = district heating
DHS = district heating system
€ = e Euro, European Currency Unit, EUR
E = East
EC = European Community
EL = Polish Energy Law
EBRD = European Bank for Reconstruction and Development
ERO = Energy Regulatory Office in Poland
ESCo = Energy Service Company
EU = European Union
Gcal = giga = 10^9, cal = calories
GDP = Gross domectic product per capita
GHG = greenhouse gas
GJ = giga = 10^9, joule = basic SI unit of energy
GWh = gigawatt-hour; giga = 10^9
ha = hectare
ICAS = Institute of Forest Research and Management in Romania
ICEMENERG = National Research and Development Institute for Energy in Romania
IEA = International Energy Agency
IEE = Intelligent Energy Europe –programme
IPCC = Intergovernmental Panel on Climate Change
ISPE = Institute for Studies and Power Engineering, Romanian partner of PromoBio project
KAPE = Polish National Energy Conservation Agency, Polish partner of PromoBio project
km^2 = kilometre squared
ktoe = kilo = 10^3, toe = tons (ton = 1 000 kg) oil equivalent
kW = kilowatt
kWh = kilowatt-hour
kWh_{el} = kilowatt-hours electricity energy
Lei = Romanian National Currency Unit, RON; €1 = 4.43 lei
MECC = Ministry of Environment and Climate Change in Romania
Metla = Finnish Forest Research Institute, Finnish Coordinator of PromoBio project

MJ = mega = 10^6, joule = basic SI unit of energy
MW = megawatt
MW_{el} = megawatts of electricity energy
MWh = megawatt-hour
MWh_{th} = megawatt-hours thermoenergy
MW_{th} = megawatt thermoenergy
N = North
NEFCO = Nordic Environmental Finance and Cooperation
NGO = non-governmental organisation
NREAP = National Renewable Energy Action Plan
PJ = peta = 10^{15}, joule = basic SI unit of energy
PLN = Polish National Currency Unit, złoty; €1 = 4.21 złoty
poviat = administrative district in Poland
PPS = purchasing power standard
RES = Renewable Energy Sources
ROMSILVA = National Forestry State-Owned Company in Romania
RON = Romanian National Currency Unit
SMEs = small and medium-sized enterprises
SRL = Romanian company form
SUA = Slovak University of Agriculture, Slovak partner of PromoBio project
t CO_2 = tons carbon dioxide
TJ = tera = 10^{12}, joule = basic SI unit of energy
UNIAG = Slovak University of Agriculture, Slovak partner of PromoBio project
VAT = Value Added Tax
voivodeship = province in Poland
VTT = Technical Research Centre of Finland, Finnish partner of PromoBio project
W = watt
zł = Polish National Currency Unit, PLN, złoty; €1 = 4.21 złoty

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In 2008, the European Commission launched an action plan for the promotion of the use of energy from renewable sources (RES directive). The objective is to reach 20% of the EU's energy consumption through renewable energy sources by 2020. Each member state has specific objectives. Poland, Romania, and Slovakia are the most recent new members of the EU. The objective of the three-year (2011–2014) PromoBio project is to launch concrete project plans and to include entrepreneurs from the three target countries (Poland, Romania, and Slovakia) in the acquisition of woody biomass and investment in heating plants. The best bioenergy practices and successful business models from partner countries Austria and Finland will be tested and transferred to the target regions of the project in Poland, Romania and Slovakia. The aim is to provide the local stakeholders with the grounds to make informed decisions about developing the bioenergy markets of their region. This final report tells concretely about the pilot projects initiated during the project lifecycle.