

SETatWork in Practice in the Carbon Markets

Report on Cooperation

Deliverable 2.5

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1 Identification of national R&D Priorities

1.1 R&D priorities in Denmark

1.1.1 National framework for energy funding

- ForskVE provides funding for energy RD&D projects administered by *Energinet.dk*, the company responsible for the operation of the Danish electricity transmission system since January 2005 with focus on research into wind power, biogas, fuel cells, solar energy, wave power and Smart Grids. In 2010 around 180 million DKK (24 MEUR) are available for support to research activities. www.energinet.dk
- Danish Energy Association, a commercial and professional organisation for Danish energy companies, provides funding for energy RD&D projects concerning efficient use of electricity. Approx. 50 million DKK (6.5 MEUR) are available for project funding each year. Of this 30 million DKK (4 MEUR) is allocated for the Energy Saving Fond (Energisparepuljen) that support a broad spectrum of campaign- and advice activities, where one priority concerns energy savings in SMEs. Another 20 million DKK (2.5 MEUR) is allocated for ELFORSK that support research in the areas buildings, ventilation, lighting, cooling, monitoring equipment, industrial processes as well as analysis of behaviour, barriers and incentives. www.danskenergi.dk
- *The Danish Council for Strategic Research (DSF)*. According to the Act on the Research Advisory System, The Danish Council for Strategic Research supports research in areas politically defined. Programme Committees have been established, one dealing with Sustainable Energy and Environment. In 2009 – 2010 the focus is on research themes such as: future energy systems, competitive, environmental technology and the future climate, and a climate adaptation. www.ffi.dk
- *The Danish National Advanced Technology Foundation* was established by law in 2004. The general objective of this programme is to enhance growth and strengthen employment by supporting strategic and advanced technological priorities within the fields of research and innovation. The foundation shall make a special effort to promote research and innovation in small and medium-sized enterprises. Support is not restricted to energy technologies. So far between 20 % 30 % of the budgets have been allocated to energy technology projects. It also includes R&D projects in the energy field. www.hoejteknologifunden.dk

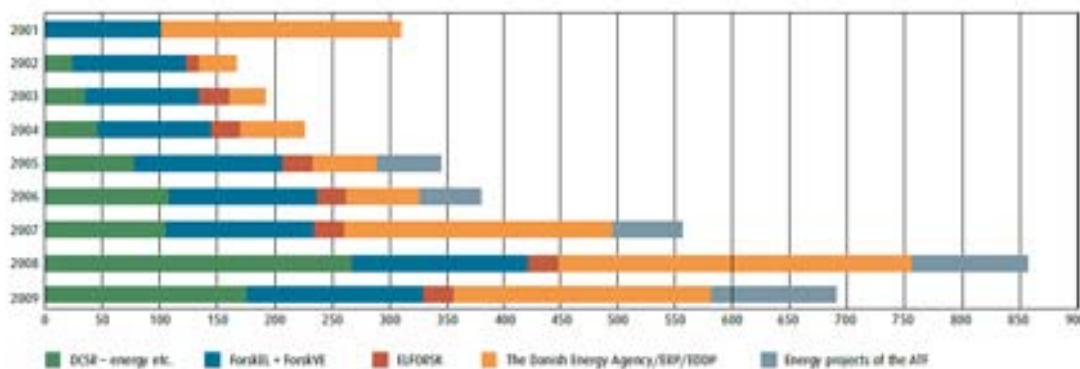
1.1.2 Funding priorities in R&D of energy

The following programme provides funding for Danish energy research and development:

- *The Energy Technology Development and Demonstration Programme (Det Energiteknologiske Udviklings- og Demonstrationsprogram - EUUDP)* provides funding for development and demonstration of new energy technologies. The programme aims at fulfilling the national energy and climate goals while supporting the development of new

production niches. The research priorities are most type of renewables and energy savings in buildings and industry with focus on research and demonstration close to market penetration. The programme is administrated by The Danish Energy Agency and has an independent board. The programme provide grants for around 100 million DKK (13.5 MEUR) in 2010. www.ens.dk/da-DK/NyTeknologi/om-eudp

The figure below shows the distribution of public funding to energy research in the period 2001-2009 (DKK million)



As it can be seen there has been a growth in the last years and the intention is to keep this growth in view of the energy and climate policy goals.

1.2 R&D priorities in Germany

Energy research must be seen within the wider context of the Federal Government's overall energy policy goal of ensuring a viable and subsidy-free energy supply. Priorities in the energy research sector are:

- *Reduction of energy consumption,*
- *Increase of energy efficiency, and*
- *Promotion of renewable energy sources.*

A profound and detailed summary of R&D policy in basic energy research is currently available on the homepage of the Federal Ministry of Education and Research (BMBF 2010).

1.2.1 National framework for energy funding

On the federal level, several public authorities are sharing responsibilities in energy research:

- *The Federal Ministry for Economy and Technology (BMWi) is taking the “programme responsibility” on the whole energy research policy. It is also in charge for project funding in the areas of non-nuclear energy research (excluding renewable energies), rational energy conversion, nuclear safety and repositories.*

- *The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) is responsible for project funding in the area of renewable energies.*
- *Project funding in the area of bioenergy is coordinated by the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV).*
- *The Federal Ministry of Transport, Building and Urban Affairs is in authority for the area of transportation and has partial responsibility with respect to building and housing.*
- *The Federal Ministry of Education and Research (BMBF) is responsible for project funding of fundamental research of energy technologies.*

1.2.2 Funding priorities in R&D of energy

The BMBF recently published the “Basic Energy Research 2020+” funding concept in order to support research work into efficient energy generation and conversion, including energy storage, transmission and consumption, as well as the reduction of greenhouse gases (Federal Ministry of Education and Research 2010). The funding concept for basic research focuses on these topics:

- *Utilisation of next generation solar energy, in particular photovoltaic and biomimetic hydrogen production,*
- *Bioenergy generation and conversion,*
- *Sustainable CO₂ storage and use.*

This concept is containing a list of specific technology-related funding notices, which are available from federal organisations in Germany.

The main energy research centres in Germany being funded by the BMBF in the field of basic energy research are:

- *Hahn-Meitner-Institute, Berlin*
- *Jülich Research Centre*
- *Fraunhofer Institute for Solar Energy Systems*

The Hahn-Meitner-Institute and the Jülich Research Centre are organized in the Helmholtz Association. Under this association, a programme on “Renewable Energies” was established. One main focus is research on photovoltaic (e.g. polycrystalline thin-film solar cells, new thin-film concepts at Hahn-Meitner, thin-film solar cells based on silicon and amorphous microcrystalline alloys at Jülich Research Centre). The Fraunhofer Institute is specifically researching on wafer-based silicon solar cells.

In the field of biomass and bioenergy conversion, the research goal is to optimise existing processes, to combine techniques (cascade utilisation) and to develop new processes for utilising the limited quantities of biomass raw material as efficiently and sustainable as possible. On the federal level, basic research on biomass is primarily carried out by the Karlsruhe Institute of Technology (KIT).

In biomass research, the following topics have been defined to be addressed in future cooperation with both universities and industries:

- *Basic molecular principles of biomass production*
- *Biomass preparation*
- *Biomass recovery using thermochemical and biotechnological methods*
- *Environmental impact, system analysis and technology impact assessment*

Another important area of energy research is “efficient conversion and use of energy.” Three centres of the Helmholtz association are involved in this field: German Aerospace Centre (DLR), Karlsruhe Institute of Technology (KIT) and Jülich Research Centre (FZJ). Individual programmes are funding several activities in the following areas (Federal Ministry of Education and Research 2010):

- *Power plant technology (efficient and environmentally friendly power generation)*
- *Fuel Cells (decentralised and environmentally friendly power generation)*
- *Superconductivity (reduction of electrical transmission losses in the grid)*

In all these areas future research is to be extended. Priorities will be the equipping and upgrading of existing power plants to incorporate CO₂-capture facilities.

In comparison to the BMBF, the project funding of the BMU and the BMWi is rather application-oriented. In the area of sustainable CO₂ storage and use, the BMWi is funding modern power plant technologies incl. CO₂ capture as part of its COORETEC programme. Further information on the inclusion of the COORETEC project into international activities can be found on the project homepage (<http://www.cooretec.de>). Apart from this, the BMBF focuses on research and development work into underground storage of CO₂ within the scope of the Federal Government’s CCS strategy.

In the framework of the National Integrated Energy and Climate Change Strategy, the BMU is specifically focussing funding activities on biomass pilot and demonstration projects. Funding in this field is targeted at the optimization of the energetic use of biomass. The BMU is supporting seven issues of this task. From the perspective of SETatWork, four of them are relevant:

- *Funding Priority 1: Improvement and advancement of the general framework and technologies for the efficient utilization of biogenic residues, e.g. by best practices of different flow patterns for materials and component substances*
- *Funding Priority 2: System studies and international cooperation projects for the development of best practises in the field of sustainable supply of biomass and bioenergy resources*
- *Funding Priority 3: Development and demonstration of gasification technologies for combined heat and power appliances based on the use of biomass*
- *Funding Priority 4: Development and demonstration of an European Biomethane Strategy (supply and import of biomethane from Middle and Eastern Europe via transnational gas grid)*

In the period from 2008 to 2010, the focus of funding was on the provision of an adequate data basis for respective projects. Another priority is the elaboration of concepts and feasibility studies. In the second funding period (2011-2012) the implementation and monitoring of promising pilot and demonstration projects will receive funding.

1.3 R&D priorities in Sweden

1.3.1 National framework for energy funding

Four Swedish organisations, The Swedish Energy Agency, the Swedish Environmental Protection Agency, the Foundation for Strategic Environmental Research and the Swedish Meteorological and Hydrological Institute, together fund climate policy research programmes of around 5 million € annually. The objective is to fund research that supports the Swedish climate strategy.

Relevant organisations are:

- *The Swedish Energy Agency is a government agency for matters concerning the supply and use of energy in Sweden.*
- *The Swedish Environmental Protection Agency is a government agency for environmental issues.*
- *The Foundation for Strategic Environmental Research, support strategic and long-term environmental research.*
- *The Swedish Meteorological and Hydrological Institute is a government agency that manages and develops information on weather, water and climate that provides knowledge and advanced decision-making data for public services, the private sector and the general public.*

1.3.2 Funding priorities in R&D of energy

The programmes:

- *The Swedish Climate Modelling Resource at the Rosby Centre develops advanced climate models and climate scenarios.*
- *The Land Use Strategies to Reduce Greenhouse Gas Emissions Programme, LUSTRA, aims at analysing different strategies for minimising greenhouse gases to the atmosphere from land use, especially forest soil.*
- *The CLIMATOOLS Programme, Adapting to climate change: tools and strategies for sectors and regions, is a five year multi-disciplinary research programme that started in late 2006. It will provide decision makers with guidelines and tools as helpers in their work on climate impacts and decisions on what and where to adapt.*
- *The International Climate Policy Research Programme will strengthen Swedish competence within research related to international processes on climate change and enhance Swedish participation in international networks.*

- *Mistra's Climate Policy Research Programme focuses on the knowledge in climate policy and international negotiation, and on the role of emissions trading in climate policy. Its Policy Forum will promote the dialogue between researchers and decision makers.*

In 2001, the Swedish Energy Agency initiated a research programme on International Climate Policy. During 2001-2006, the programme had a budget of 40 million SEK. For the new period 2006-2010 the budget is 50 million SEK.

The objective of the programme is to broaden Swedish contacts internationally, to provide relevant inputs to the international climate policy process, and to enhance the Swedish research and development competence in the field of international climate policy. The programme will assist in establishing and supporting research groups capable of conducting long-term climate policy research.

Among the areas of particular interest to this programme, are global climate change policy processes as well as the question of future commitments, for example, the definition of quantitative goals, the role of technology development and transfer, the cost-effectiveness of policies and measures as well as the role of project based mechanisms in the EU ETS and in the future commitment period of the Kyoto process.

The Swedish Energy Agency research programme General Energy System Studies has a socio-technical profile and plays an important part in the Swedish energy research portfolio.

The programme augments the technically oriented research, development and demonstration activities funded by the Swedish Energy Agency. The aim of the programme is to produce high quality research results and develop competence within the fields of energy policy analysis, energy system modelling, energy economics, energy market studies, innovation studies, and behavioural science.

The purpose of the programme is to establish and develop Swedish research groups within these areas, including international co-operation, and to disseminate and incorporate results from the research into energy policy analyses, energy technology analyses, energy forecasts, etc.

The first programme period that ended in June 30, 2005 and included research within the following areas:

- *History of technology studies related to the reform of the Swedish electricity market*
- *Political science studies of energy policy guidance measures*
- *Economic studies of the power market*
- *Energy technology innovations studies, including experience curve analyses*
- *Energy system modelling development*
- *Forecast studies related to the transport sector*

Energy-related R&D and demonstration work is characterised by a system-based approach. One goal is to further reduce the use of oil and electricity for heating purposes and another is to improve the efficiency of use of operational and household electricity in properties. The work aims to reduce the energy needs of buildings and replace fossil fuels with renewable alternatives. The goal of research

into buildings as climate shells is to boost the efficiency of energy consumption for heating, hot water and operational electricity by 50 per cent over 40–50 years.

The Swedish Energy Agency also works to improve cooperation between the research sector and trade and industry. Industrial organisations and research institutes have an important role to play in this context. The Swedish government supports research, development and demonstration work in industry through the Energy Agency, and research grants are supported by various policy instruments to help achieve energy policy goals and drive developments in Swedish trade and industry.

Studies show that there is major potential to further reduce energy losses and to utilise biofuels more efficiently in energy-intensive industry. The paper, pulp, iron, steel and chemicals industries are the most energy-intensive sectors, accounting for almost 70 per cent of the energy consumption of the entire industrial sector. The main priority therefore is energy efficiency improvement in fields where there is cooperation between research institutes and trade and industry.

This includes electricity production from the renewable energy sources of solar, wind, hydro and wave power as well as technology for the transmission, distribution and storage of electricity.

For *hydro power*, the goal is to accumulate and maintain knowledge and expertise necessary to ensure an efficient and reliable hydro power production as important part of Sweden's energy supply. This area also includes assured safety in dam operation. In *wind power*, the priority is large-scale technology, preferably sea-based (off-shore) systems. Technological progress through R&D measures is contributing to reducing costs of wind power and to increase the contribution of wind power to the overall power system. R&D covering *solar cells* aims to produce more efficient solar cells at lower cost. It also covers solar cell systems as an energy source and as a building component.

R&D covering the overall power system is required in order to create more secure and higher quality transmission and distribution systems adapting it for use in new applications. A robust power system is a prerequisite for the introduction of a large proportion of electricity production from intermittent sources in Sweden. R&D on power systems area covers new conversion techniques such as electricity from underwater currents and wave power.

The Swedish Energy Agency funds research and development aiming at increased cell and module efficiency and lower production costs as well as system studies of PV as an energy source and as a building component. The two largest research installations are:

- *Ångström Solar Center that includes research on thin film CIGS cells*
- *Grätzel solar cells*

The Swedish Energy Agency also participates in PV-ERA-NET, which is a European network aiming at increased collaboration and coordination between national PV RTD programmes. Sweden is also a member of the International Energy Agency's Photovoltaic Power Systems Programme.

A development platform covering power systems (UPKraft) was launched in 2005. About ten people from the Swedish Energy Agency and roughly the same number of representatives of power companies, other industry and public agencies participated in UPKraft. Its overall goal was to help shift the power system in a sustainable direction, i.e. towards the energy policy goals adopted by the Swedish Riksdag (Parliament) and the Swedish government. These goals are to be realised within the

framework of the platform. The platform began by formulating visions and goals for the power system area and thereafter looked to identify energy-related research, development and demonstration measures that need to be undertaken to achieve the goals.

Simultaneous production of electricity and heat is efficient in terms of resources and environmental benefit. Hence, *Combined Heat and Power* (CHP) is one of the Swedish Energy Agency's priority areas. The Agency's measures are focused on:

- *Research into and development of existing technology, as well as demonstration, with the focus on fuel flexibility, performance, cost-effectiveness and low emissions.*
- *R&D and demonstration of new (not yet launched) technology, with the aim of increasing electrical efficiency while retaining or improving environmental data at a competitive price*

The transport sector's share of Sweden's total CO₂ emissions amounts to about 45 per cent and continues to rise. Despite the fact that the energy efficiency of vehicles has been improving over a long period of time, overall fuel consumption in the transport sector is not falling. This is partly due to the increasing size and power of vehicles and partly because the volume of transport has increased.

The Swedish Energy Agency supports technical R&D in issues related to road vehicles and the production of renewable fuels. This work is focused on improving energy efficiency and replacing today's fossil fuels. In the long term, biofuels will be able to meet a significant part of the country's transport sector needs, but this approach has to be supplemented by the development of more energy-efficient vehicles.

Several important projects are under way to improve energy and environmental performance in vehicles. Hybrid vehicles are now available on the market, and marketing of fuel cells for road vehicles is likely to start around 2010. This is why the main priority is system and component issues in the hybrid drive train. The development of batteries, electric engines, fuel cells and combustion engines tailored to hybrid vehicles is becoming increasingly important. The Swedish Energy Agency is contributing to long-term knowledge-building in these new areas through its research programme *Energisystem i vägfordon* (Energy systems in road vehicles).

The Agency is also focusing broadly on the development of production technology for several biobased fuels and other renewable fuels. Prioritised work includes pilot plants for making ethanol from forestry raw materials, black liquor gasification and biomass gasification. Work in the last two areas aims to develop the manufacture of fuels such as dimethylether (DME), methanol, synthetic petrol, synthetic diesel and hydrogen gas.

1.4 R&D priorities in Portugal

1.4.1 National framework for energy funding

Innovation Agency (Agência de Inovação - Adi)

Agência de Inovação, SA (Adi) is a state-owned agency funded by the Ministry of Science, Technology and Higher Education and the Ministry of the Economy and Innovation.

Working within a network of administrative departments, technology centres, business associations and other S&T entities located in Portugal, Adi pursues a policy of promoting international co-operation. As such, it acts as a link between the EU, Asia, Latin America and various international R&D organisations [13]. The strategic objectives of Adi are:

- *Promotion and economic valorisation of R&D activities*
- *Support and promotion of technology based innovation*
- *Promotion and support of recruitment of highly qualified human resources by enterprises*
- *Support of technology transfer activities*

Adi provides support in the shape of various incentive schemes to applied research projects. Over the last few years Adi has managed programmes designed to support technological innovation.

1.4.2 Funding priorities in R&D of energy

National Energy Strategy for 2020

The Portuguese government recently launched a new national energy strategy for 2020 (March 2010). Several priorities are identified in order to reinforce Portugal's leadership in sustainable energy and to attain ambitious goals in energy and climate policy. Regarding the energy efficiency the priorities will be:

- *Smart grids,*
- *Electric vehicles,*
- *Smart buildings and,*
- *Public lighting.*

Another priority will be the increased use of renewable energy sources. The goals for 2020 are:

- *Hydro - Installed power of 8,600 MW (in 2009 the value was 4,821 MW);*
- *Wind - Installed power of 8,500 MW (in 2009 the installed power was 3,566 MW);*
- *Solar - Installed power of 1,500 MW (the value for 2009 was about 100 MW);*
- *Geothermal - Installation of 250 MW additional power;*
- *Wave - Ambition to have 250 MW of installed power.*
- *Biomass - Install the 250 MW of power already allocated.*

The government is also committed in the promotion of projects that integrate hydro and wind energy sources, in order to use the surplus wind power to feed a pumped hydro storage system. Due to its large solar energy source potential, the government aims to promote R&D in the solar technology area. Another important renewable resource for the country is biomass, so it is intended to develop a research centre related to the production of energy from biomass. Due to the importance of hydrogen as an energy vector, the government announced in the national energy strategy to support the development of hydrogen fuel cells, of R&D and projects related to the production of hydrogen by renewable energy sources. Another important priority of the government is to help and support the development of decentralized energy production, in order to help in the development of the regions.

Plan for the Promotion of the Electrical Energy Consumption Efficiency (PPEC)

The regulation and liberalization of the electricity and natural gas market increase the efficiency in the supply side. However, regarding the demand side, the growth of the efficiency was locked by some barriers, namely related with the participation of electricity utilities in activities of energy efficiency. One way to promote the electrical energy efficiency is the creation of tariffs that persuade the rational use of electrical energy and of its associated resources. Keeping this in mind, the Energy Services Regulatory Authority (ERSE) that has the responsibility to define mechanisms that seek the promotion of the energy efficiency in the demand side, established in the Tariff Regulation of the electric sector a competitive mechanism for the promotion of demand management actions called Plan for the Promotion of the Electrical Energy Consumption Efficiency (PPEC). The PPEC plan aims to promote measures that improve the electrical energy consumption efficiency. The actions will be implemented by suppliers, network operators and consumer associations, they are addressed to the consumers of different market sectors and result from proposed specific measures that are chosen by an evaluation process based in predefined criteria and budget established in the rules of the plan. ERSE is the entity responsible for the evaluation and selection of the measures.

Call for Proposals for Scientific Research and Technological Development Projects in all Scientific Domains – 2008

In the Portuguese science and technology policy it is clear that the growth, reinforcement, consolidation and improvement of the Scientific and Technological National System (SCTN) is a priority for the government, in order to make the system more competitive, at national and international level, and also in order to facilitate the articulation between centres of knowledge and business. In this sense, fostering and strengthening the capacities of scientific and technological institutions by enabling research teams to participate in scientific research and technological development (SR&TD) projects in all scientific fields is deemed particularly important. In this sense, the government launched in November 2008 a call for proposals for Scientific Research and Technological Development Projects in all Scientific Domains. The energy is one of the scientific domains covered by this call.

Energy Efficiency Fund 2008

The government launched in May 2008 an Energy Efficiency Fund that aims to promote and support projects in order to reduce the energy consumption.

1.5 R&D priorities in Slovakia

1.5.1 National framework for energy funding

The Government of the Slovak Republic coordinates state science and technology policies via the Ministry of Education and the Academy of Sciences. It's policy for the period by 2010 was specified in the Statement of Policy of the Government of the Slovak Republic.

Slovakia possesses 16 universities, whose links with the institutes of applied research and with SMEs have been strengthened over the last few years. R&D expenditure in the universities has more than doubled since 1994. About 2000 S&T projects are at present under way in the academic laboratories.

Some of these have a level of specialisation that is internationally recognised, such as the Slovak University of Technology and Comenius University in Bratislava.

In 2005 Slovak Research and Development Agency (SRDA) has been established on base of the Act No. 172/2005 on organization of state research and development. The Agency is a state non-profit-making organization with objective to financially support science, research and development.

SRDA is a non-profit making organisation of the Ministry of Education of the SR established in order to support research and development by providing financial resources for solving research and development projects and projects designed to improve the infrastructure of research and development.

The Agency co-operates with the Ministry of Education of the SR in the development and implementation of national science and technology policy, ensures the research and implementation of new programmes and forms of support of international co-operation in the area of research and development and implements European programmes and initiatives related to research and development in the SR – currently within the 7th Framework Programme for Research and Technical Development for 2007-2013.

The Operational Program of Research and Development in the Department of Education is in place for 2007-2013, financed by the EFRD. EFRD is one of the EU structural funds. This fund supports development and structural changes in regional economies, including transformation of declining industrial regions and less-developed regions and through support of cross-border, national and international co-operation. The OP implements the program document for support for research and development activities and for the infrastructure of universities to be provided in 2007 - 2013. Geographically, it covers the complete territory of the Slovak Republic. In the program period of 2007-2013, tasks of the managerial entity for the Operational Program of Research and Development are fulfilled by the Department of Entitlement of Costs of the EU structural funds at the section of European matters at the Ministry of Education of the Slovak Republic. The mediator under the managerial entity for the Operational Program of Research and Development is the Agency of the Ministry of Education of the Slovak Republic for the EU structural funds.

1.5.2 Funding priorities in R&D of energy

The Government prepared and approved a strategic framework document “Conception of state science and technological policy”. This document presents 3 main supporting models and systems. The coordinator of state supported R and D activities under this conception is the Slovak Ministry of Education.

- State programmes RTD: Target group: states, public and private organizations and companies. (Universities, R and D Centers, producers of technologies, agencies, state organizations). Aim (from the point of view of Setatwork project): “Utilization of the progressive tools and instruments in energy production”. (more information can be found on the website: www.veda-technika.sk).
- State orders for RTD. Target group: states organizations, universities
- RTD task initiated by applicants or customers (free topics)

RTD in Renewable Energy. The diverse landscape of Slovakia and its complex geological structure create opportunities for integrated renewable energy research. High forestation levels (44.3%) and advanced forestry studies at Technical Universities allow for extensive utilization of biomass.

Dozens of both small and large hydro power plants have been built, the Gabčíkovo-Nagymaros hydro power plant of 720 MW capacity being the largest. Dozens still are planned, creating a unique opportunity to concentrate the research on maximizing renewable energy power output.

New sources of geothermal energy have been discovered in the east of Slovakia in 2007, inciting further interest in renewable energy R&D activities. The total geothermal energy potential in Slovakia is now estimated at 5538 MWt.

RTD Framework programmes Slovak participation in projects within the Seventh Framework Programme (FP7) was focused mainly on energy, environment and sustainable development specific programme. More than 50 Slovak partners were involved with 20 Slovak partners participating in projects under part B (Energy) while 20 projects were approved with 30 Slovak partners under priority 6 (Climate change, energy, transport).

Priority – “Growth of competitiveness of industry and services using domestic growth potential” This priority is aimed at tackling problems in the development of existing forward-looking enterprises and development of new enterprises, improving their competitiveness within the EU economy and single market. It is also concerned with the adaptation of businesses in conditions of international labour markets.

Further industrial development will be enhanced by stimulating direct investments, promoting trade, information and communications technologies as well as through e-commerce.

Achieving these objectives should lead to a decrease in use of raw materials, energy and import by businesses, a lowering of their energy costs and so production costs, an increase in added share value, direct investment mobilisation, and an improvement in the quality of management and particular services.

Fulfilment will also be assisted by improved mobilisation of innovative, development and research capacities, involvement of SMEs in innovative business and development of flexible staff-training infrastructures.

Implementation of these priorities depends mainly on:

- *linking the development of industry, tourism and trade to research and innovations, using especially the potential of information technologies, and multiplier effects from FDI within the wider economy*
- *Modernisation, microeconomic adaptation and stimulation of enterprise and services development (modernization of productive technologies, appliances, products, etc.)*
- *Development of training, higher workforce adaptability, management capacity, and entrepreneurial spirit*
- *Increase in labour mobility and its entrepreneurial activities*
- *Increased utilisation of renewable and secondary energy sources, reduction in energy consumption and use of potential energy savings, reduction of energy costs*

- *Development of sectors based on advanced technologies and renewable sources improvement of water and air protection, restoration of environmental zones in production spheres, adequate waste management and removal of old ecological burdens to approximate to the EU standards*

Another goal of the priority is the use of potential energy saving in industry and services relating to it and the reduction of energy consumption, which could assist long-term sustainable development and economic growth in all areas of economic activity. This priority will also help increase the use of renewable energy sources, construction of small hydroelectric power stations as well as use of solar, wind and geothermal energy.

In recognition of restrictions to the building of industrial zones on green-field sites, it is necessary to concentrate on the revitalisation of regions and buildings of obsolete industries and related activities so as not to destroy them, but make further development possible.

Contribution of research & development to growth in competitiveness of industry and services should be reflected in a higher rate of innovation in Slovak economy and higher share of hi-tech-based businesses.

Priority: “Improvement and development of the infrastructure for the protection of air”

This measure aims to contribute to the reduction of air pollution, in particular by solid pollutants and sulphur dioxide, as well as contributing to the reduction of greenhouse gas emissions. The measure is also designed to improve the quality of air in population centres by introducing technology that reduces air pollution, as well as by introducing low-emission technology in various areas of production.

The implementation of these measures will be based on the following activities:

- *Change fuel base of energy resources, with focus on low-emission and renewable resources;*
- *Installation of technology to reduce release of air emissions including monitoring*

The particular objectives of this measure are to reduce the emissions of primary air pollutants (SO₂, NO_x, CO, CH₄, solid emissions), and heavy metals as well as to meet the obligations resulting from the Kyoto Treaty in the reduction of greenhouse gas emissions, use of environmentally favorable fuels and energy resources. It also supports the more intensive use of renewable energy resources and efficient use of non-renewable energy resources.

The final beneficiaries are regional self-governments, local self-governments (municipalities and towns) and their associates, state administration, business entities, etc.

1.6 R&D priorities in Bulgaria

1.6.1 National framework for energy funding

Scientific Research Fund has been created to support R&D in priority areas according National Plan for Economic Development, national pre-accession and accession programmes and ratified Framework programmes with certain priorities of the EU. SET are among these priorities. So far the following SET technologies were funded:

- Technology for solar photovoltaic elements based on A3B5 heterostructures;
- Combustion element metalhydrid-air;
- Development of modern technologies for heat and electricity production from organic wastes in view of increase of economic efficiency of final products;
- Research of energy efficiency of a system with steam-gas turbine and contact economiser at fuel pre-conversion in combustion chamber;
- Optical coating for effective photometric conversion of solar energy.

1.6.2 Funding priorities in R&D of energy

SET R&D priorities in Bulgaria are focused on:

- Renewable energies: biogas, biomass, CHP on biomass/biogas, solar PV, wind, hydrogen fuels cells;
- CHP – gas fired or biomass fired;
- Energy efficiency in buildings: bio-climatic building, low-emission windows, energy saving building materials and systems, energy efficient lighting;
- Energy efficiency in industrial processes: combustion optimization and regulation, compressed air systems efficiency, industrial wastes management and utilisation for energy production, insulation system for more energy efficient industrial electrical equipment, etc.

Following are the main national funding possibilities for SET R&D and the priorities that have been financed.

National Innovation Fund of Ministry for Economy and Energy.

Recent statistics showed that R&D activities financed by business were 26.8 % of total R&D expenditures, while in EU 25 this share is 54.3 %. So National Innovation Fund was created to support R&D activities in different priority areas, incl. SET. Strategic goals of the Fund are increase of compatibility of Bulgarian economy by stimulating of market oriented industrial R&D and creation of suitable condition for attracting private capital for R&D financing, in accordance with Innovation

Strategy of Bulgaria.

Following are SET R&D priorities:

- Production of biogas from organic wastes;
- Development of technology and a test module of automatic installation for production of wood-coal, gasification of wood wastes and co-generation;
- Development of technology and prototype equipment for fuel production from vegetation biomass;
- Installation for cogeneration based on landfill gas;
- Boilers for straw combustion with capacity of 150 kW and 400 kW

- Technology and prototypes for production of biofuels from vegetation biomass
- Energy saving low emissions windows films;
- Construction of bio-climatic building;
- Heat production from biogas;
- New technology for insulation system increasing energy efficiency for electrical equipment;
- Hydrogen fuel cell development with proton-exchange membrane;
- Technology for production of solar PV batteries;
- CHP on biogas from organic waste;
- Biomass based DH in small town;

Scientific Research Fund at Ministry of Education and Science:

The RTD assessment of energy efficiency and saving technologies in different types of industry is one main task of this Fund. The R&D priorities identified in different industries follow the national R&D policy as described above. The main focus of R&D needs related to energy efficiency and energy saving technologies in targeted ETS companies in Bulgaria are as follows:

- Poly-Generation;
- Industrial Combined Heat and Power;
- CHP - landfill gas or biomass fueled;
- Fuel switching, use of organic wastes and use of alternative fuels especially in the cement industry;
- Modern energy management systems and the way to be integrated in existing energy management systems;
- Modern tools for assessing energy savings;
- CO₂ management issues.

1.7 R&D priorities in Poland

1.7.1 National framework for energy funding

New circumstances in Poland forced by the EU accession and technological progress led to the necessity of reengineering the R&D financing system and its priorities. The Ministry of Science and Information Society Technologies (MSIST) issued therefore “A concept of the scientific, technological and innovation policy till 2020”. According to Eurostat, total expenditures on research and development within EU-27 countries amounted approximately to only 1.84% of GDP in 2005. Analysis envisions that this trend will continue and in 2010 will reach level from mid-1990s of less than 1.80%. In Poland, expenditures for R&D are one of the lowest among EU Member States. For business enterprises and higher education sectors, it was only 0.18% of GDP in 2005, while the

government sector spent slightly more, i.e. 0.21% of GDP. The reason behind is that priority within companies is not related to R&D, rather to recent economic situation. Moreover, high investment cost reduces the feasibility of R&D projects. Companies also do not cooperate closely with R&D institutions or higher education centres. The two most important issues of research and development in Poland are:

- Incomplete use of innovative high potential in this sector,
- Significant part of units of research and development sector has not consistently cooperated with enterprises, which in turn translates into ignorance of their actual needs innovation.

The situation is constantly improving, but there are still barriers to the development of several major units of the research and development. The most important are:

- Insufficient capital resources on both the science and on the economy,
- Low awareness of the importance of innovation in improving the competitiveness of enterprises
- Inadequate flow of information concerning the offer of units and scientific research for companies and the needs of businesses in this area,
- Mismatch between existing institutions offer services sector R & D in relation to the real needs of businesses.

However, some companies, especially those supported by foreign owners, are more focused on implementing new advanced technologies and in the past some investments in the scope of R&D were observed. Several topics should be highlighted to enhance the role of R&D, for example:

- New technologies that may be implemented in particular industry, including measures for energy efficiency and use of renewable energy sources
- Financing opportunities
- Enhancement of cooperation between industry and R&D organisations

1.7.2 Funding priorities in R&D of energy

SET opportunities - There are several opportunities for SET due to the legislation and allocation:

- Modest allocation and high CO₂ prices should stimulate carbon management activities in companies, as well as enhance faster uptake on cleaner technologies and renewable energy sources,
- In the short term (2008-2012), technological changes should be rather observed in smaller installations, mostly in the heating sector;
- The Polish power sector is a potentially target client for SETG activities, however, bearing in mind the capital requirements for investment and time schedule of such investments, rather international carbon credit trade would be in focus, not technology switch,

- Also, carbon asset management awareness actions may be of interest for ETS companies- in NAP I carbon restraints were not an issue due to huge over allocation and low carbon price, the situation slowly changes now,
- Some production sectors, especially cement industry, have made recently significant progress in terms of CO2 emission per production unit.

1.8 R&D priorities in Italy

1.8.1 National framework for energy funding

General national aspects [Source: EUREC report - Research priorities for Renewable Energy technology by 2020 and beyond]

Mapping of national R&D strategies and specific priorities for SET development

The priority of all national R&D strategies is to develop new technologies for energy generation and management.

National R&D projects and programmes supported by:

- National Government: short to long term
- Ministry of Productive Activities/Environment: short to medium term
- Ministry of Research: short to long term
- Regional Governments: short term

Screening and assessment of existing and new technologies at National level:

- Capture (pre combustion, post combustion, oxy firing)
- Storage, Monitoring and Verification (SMV) of geological storage
- Comparative economics of capture options

Main Research and Development Challenges at National level:

- Maintaining security of supply with a high penetration of renewable energy
- Moving from a passive to an active “smart” distribution network
- Mitigation against transmission and distribution losses
- Managing fluctuating energy sources efficiently as well as developing cost-effective electricity storage
- Developing new business models to encourage the uptake of renewable energy and the dynamic participation of consumers

It's very important to adapting the current energy system into a more sustainable, less dependent on imported fuels, based on a mix of energy sources, particularly renewable energy carriers and non-polluting sources, increase energy efficiency, including rationalizing the use and l' storage of energy

to meet the pressing challenges of security of supply and climate change, increasing the competitiveness of European industries.

Key national actions for R&D strategies:

- Cleaner energy systems, including renewable energy sources
 - Production of energy in large scale by reducing emissions of carbon dioxide, electricity generation from coal, from bio mass or other fuels, including combined heat and power
 - Development and demonstration, including for decentralized production and conversion technologies for major new and renewable energy sources, especially bio-mass, fuel cells, wind power and solar energy
 - Integration of new and renewable energy sources in energy production systems
 - Development of viable technologies to reduce environmental damage from the production of electricity
- Economic and Efficient Energy for a Competitive
 - Development of technologies for a final rational and efficient energy
 - Development of technologies for the transmission and distribution
 - Development of technologies for the storage of energy on macro and micro scale
 - Development of more efficient technologies for the exploitation, extraction and production of fossil fuels
 - Improving the efficiency of new renewable energy sources
 - Develop scenarios relating to technologies for supply and demand in the economy / environment / energy and their interactions, profitability analysis (based on costs and all life cycle) and efficiency of all energy sources

1.8.2 Funding priorities in R&D of energy

ENI AWARD 2009: Funding for Research on Energy and Environment

The Energy Efficiency and Sustainable Development for Eni are part of a broad path taken to identify and implement commitments and concrete actions with the aim of managing nell'eccellenza the complexity of a large integrated energy company.

Competition Eni Award 2009 reserved for scientific research and its applications with particular reference to issues of energy and the environment. Each year to promote research on the Eni awards 3 prizes, for a total of €700,000, the best researchers who have achieved significant results internationally in the fields:

- "New Frontiers of Oil";
- "Renewable energy and non-conventional";
- "Environmental protection".

Identification of on-going research and possibilities for using R&D results in the SETatWork project.

Research is oriented towards sustainable development, which has a climate and environment, but also economic development. For move towards more sustainable patterns of energy is necessary to proceed along two directions: greater efficiency and rationality in the end-use, a growing use of renewable sources of energy. With energy efficiency can cut 50 million tonnes of CO₂ compared to the trend scenario. The performance of R&D can fit in the draft SET through training and promotion; the objective is to implement and increase the tools necessary to carry dissemination activities. Through the results is easier and quicker ways in which new technologies of energy saving can penetrate the market and lead to sustainable energy. In SetatWork project it's possible to include the results of research and development with an interaction between promotional events, provision of training services, creation of material's dissemination and evaluation of future activities.

RTD assessment of energy efficiency and saving technologies for the different types of industry on a national level

[Source: Carbon Sequestration Leadership Forum, ENEA presentation: CO₂ IN ITALY]

[Source: EUREC-Research priorities for Renewable Energy technology by 2020 and beyond]

- R&D for plants based on new cycles and advanced technologies in gas turbines, boilers, gasifiers (medium – long term)
- R&D for decentralised poly-generation systems (short – medium term): Cogeneration and poly-generation, Hybrid systems with gas turbine and fuel cells, High flexibility in plant design and fuels burning
- R&D on electricity system: Power Plant Configurations, CO₂ Separation & Capture
- R&D on Building Technologies: low external heating demand, passive cooling, energy-efficient lighting
- R&D on energy supply system: solar thermal collectors, solar cells, heat pumps, district heating, solar assisted sorptive cooling, fuel cells

2 RTD Cooperation in SETatWork

2.1 Bulgaria

In the framework of SETatWork Project Sofia Energy Centre organized a matchmaking event on “European Emission Trading Scheme – History and Perspective in Bulgaria”. The event was held on 3 June 2010 in Sofia simultaneously with the International Ecoforum ”Save Energy, Save Water, Save the Planet” with the main aim to bring forward the technology transfer from Europe to Bulgaria in regard to the environment protection.

As part of cooperation between partners related to exchange of experience and facilitation of European ETS companies in different regions, the valuable Polish experience in launching and further development EU ETS in Poland was also presented at the event, with the major difficulties encountered and the ways to overcome them. The presentation of the Polish experience was prepared by Izabela Kielichowska, Primum Polska, Partner in SET@Work Project, and was delivered by Ivanka Pandelieva, SEC. Seminar participants were given information and get encouraged by the fact, that in Poland similar to Bulgaria, EU ETS has experienced a difficult start but nevertheless they managed to cope with the difficulties in initiation and development of Scheme.

Following are photos of the event:

