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# RESCUE

*Project full title:*

**"Central & Eastern European SMEs towards RES" - Action Plan for stimulating research and innovation in SMEs from CEECs in the renewable energy field**

Specific Support Action
Research and Innovation (Stepping up Economic and Technological Intelligence)

Project report (Deliverable 1.1) for public consultation:

# Identification of regional competences in renewable energy sector in CEEC

## *Development of RTD priorities & strategies for SMEs*


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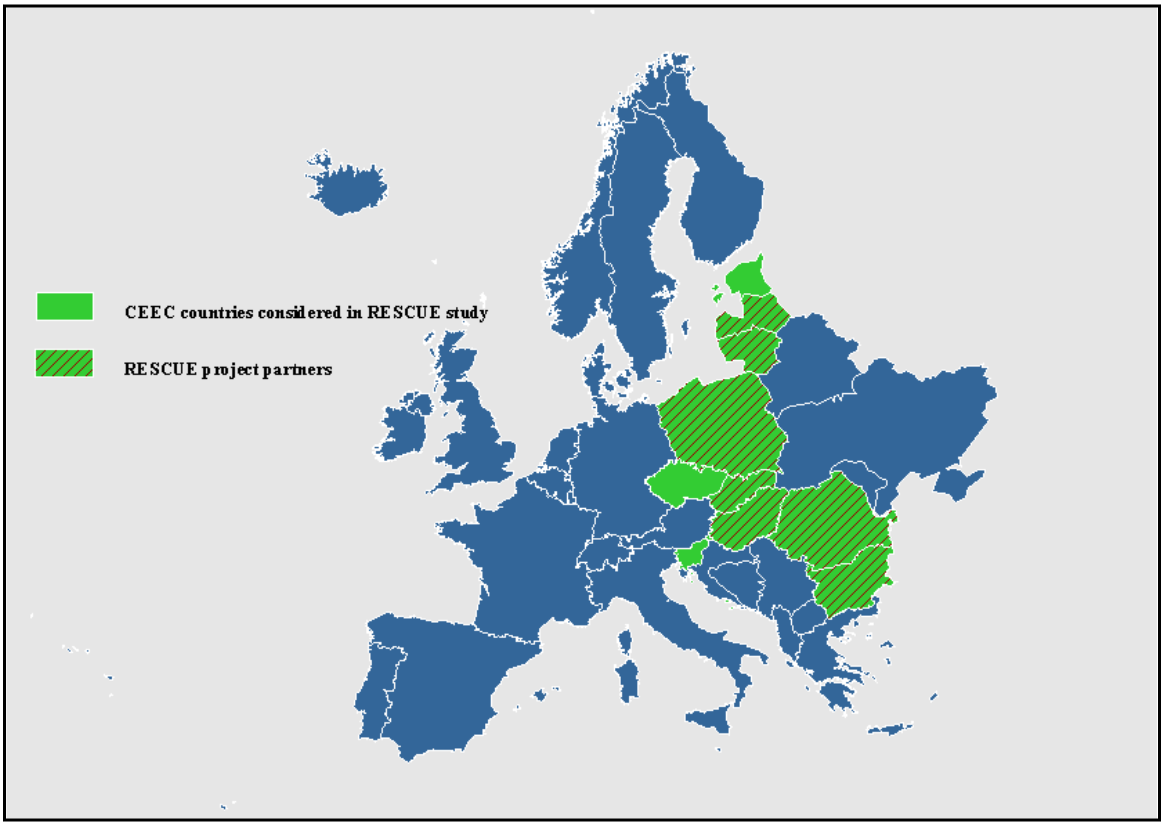
## 1. INTRODUCTION

The EU new Member States (NMS), especially the former Soviet Union countries have significant population of researchers; however most of these countries are characterized by very low energy RTD budget and absence of explicit non nuclear energy (NNE) RTD policies. Being geographically close does not mean that central and eastern European countries (CEEC) necessarily have been working together. The western orientation of NNE RTD collaboration within the NMS and ACC was apparent since the EU integration processes started and especially the EU RTD framework programmes had been fully opened for most of CEEC, where RTD sector suffered from national under funding.

Since a few years only, the co-operation appears again, however it is rather slow process and based rather on cross border co-operation (Baltic States, Czech Republic and Slovakia) than pan-regional approach. This comparative analysis focuses on the opportunities for defining common interest in energy RTD problems and research priorities in CEEC in NNE, and especially renewable energy. A thesis has been set up that the RTD problems of the innovative SMEs working in CEEC in renewable energy sector are specific and in some extend different to the official EU research priorities (reflected so far during the development of FP7), however there are not fully used opportunities to work on and to solve research problems with the usage of existed EU frameworks like FP6 or FP7 and instruments.




*Geographical coverage of the RESCUE project and the study.*

Very few information is available on research, demonstration and innovation in renewable energy sector in the CEEC. To gain a relevant picture of renewable energy research the RESCUE consortium done desk research on the base of analysis of national energy policies and scattered publication and statistic available, as well as on the base of national questionnaires fulfilled by the partners and SMEs from RESCUE data base. The RTD priorities of the CEEC were developed by RESCUE partners (representing 7 countries: PL, LV, LT, RO, BG, SK, HU) out of 10th CEE countries considered; the missing 3 ones (SL, ET, CZ) were analysed on the based of data available from literature and general statistics). The results of the 7 country by country questionnaires concerning technological priorities were analysed and summarised in the final part of the report.

On the base of this research, identification of regional competences and analysis of demands, the opportunities for cooperation and clustering between countries and SMS and RTD institutions have been proposed as well we the general recommendations were formed.

## 2. CHARACTERISTIC OF ENERGY SECTORS AND RENEWABLE ENERGY PROSPECT IN CEEC

The Central East European Region consists of 10 countries: Bulgaria, Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, Romania, Slovakia and Slovenia, of which 8 have already become the Member States of the European Union on 1 May 2004. Bulgaria and Romania are the EU Candidate Countries.

The total area of the Region countries is equal to 1077 th.km$^2$ and the population amounted to 102.5 million in 2004. The largest countries are: Poland – 312.7 th.km$^2$, population 38.2 million, Romania – 238.4 th.km$^2$, population 21.7 million, Czech Republic – 78.9 th.km$^2$, population 10.2 million, and Hungary – 93.0 th.km$^2$, population 10.1 million. The average population density of CEEC is app. 100 inhabitants/km$^2$. The total area of Region countries constitutes 4.7% of Europe's area, and the total population 20% of Europe's population.

The primary energy resources in the Region except of coal in Poland, Czech Republic, Bulgaria and Romania are not very large. Region is reach in agricultural land and covered with forests: potential for biomass. Significant wind resources can be found along the Baltic and Black seas and the mountains area in Central Europe. The main energy source for Estonia is the oil shale. In the remaining countries liquid fuels and natural gas constitute the high shares of primary energy consumption. Nuclear energy plays the substantial role in covering the electricity demand in Bulgaria, Czech Republic, Hungary, Lithuania, Slovakia and Slovenia. Also Romania has the nuclear power plant but its output covers only 4% of country's primary energy demand.

The shares of the particular sources of gross inland energy consumption in 2004 are presented on fig. 1.

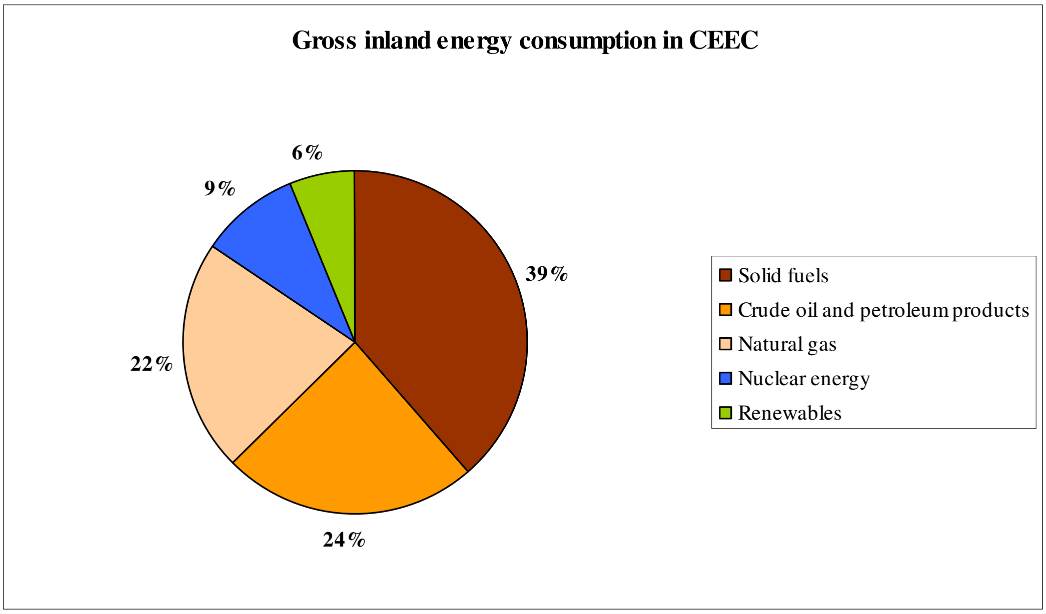



*Fig.1 Gross inland energy consumption in CEEC, 2004 (source: Eurostat)*

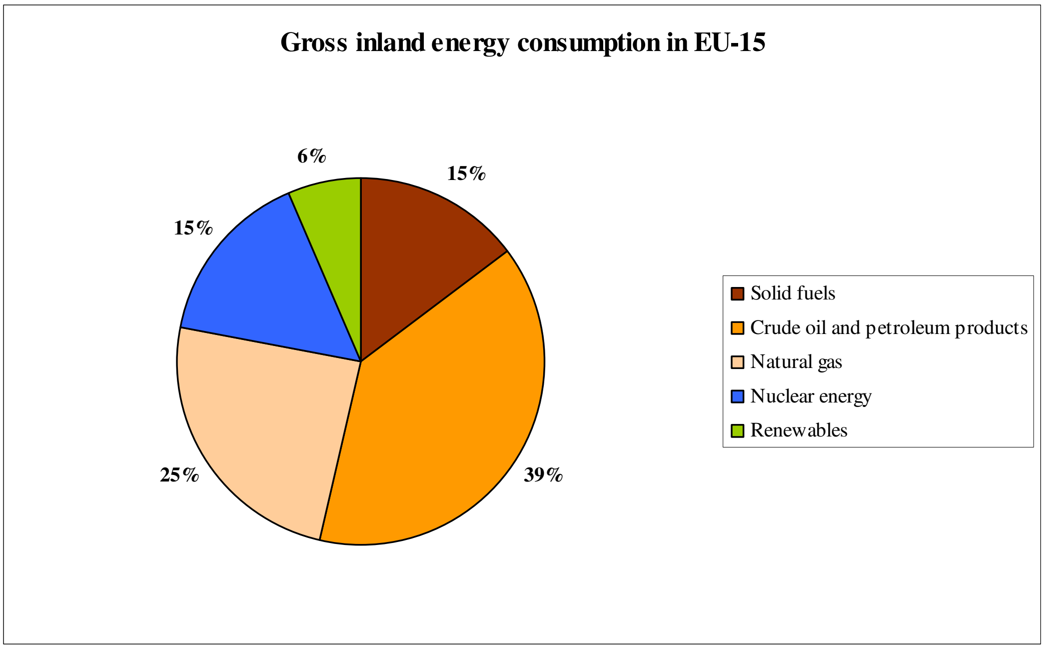



*Fig.2 Gross inland energy consumption in EU-15, 2004 (source: Eurostat)*

Compared with respective energy consumption in EU-15 (fig. 2) the specific of CEEC countries is visible mainly in significantly larger share of fossil fuels in the consumption. However the CEEC countries are not uniform in the structure of the consumption (fig.3). The solid fuels are in fact covering most of the consumption in countries like Poland, Czech Republic and Estonia. There is also visible group of countries using nuclear energy (especially Lithuania, Slovakia and Bulgaria) as well as the group of non-nuclear countries. Also natural gas is in several countries used more to higher extend than in EU-15 (especially in Hungary and Romania).

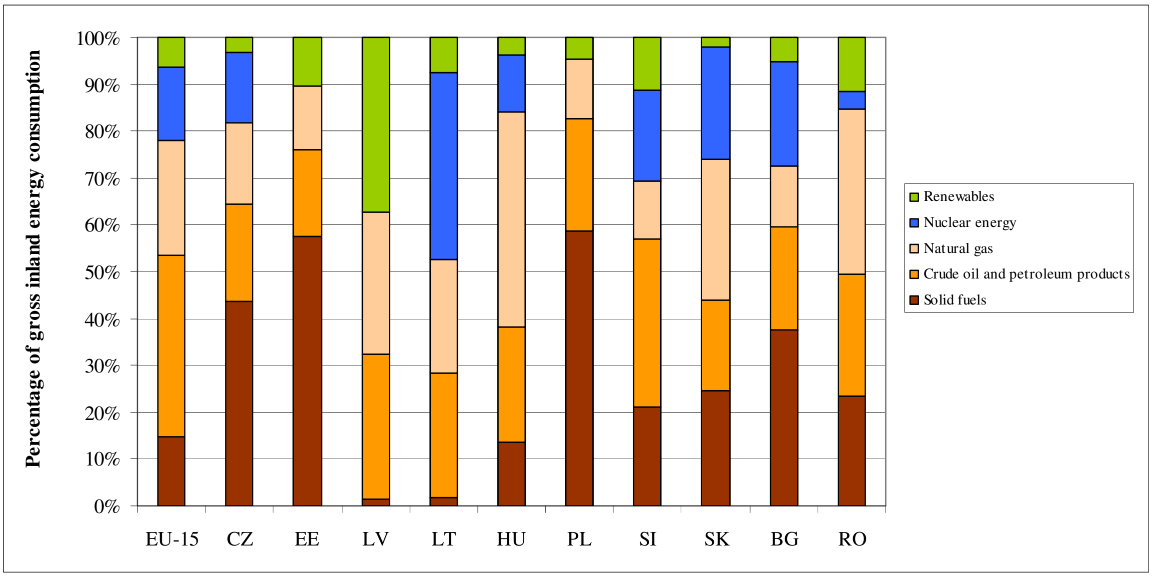



*Fig.3 Structure of gross inland energy consumption in CEEC and EU-15, 2004(source: Eurostat)*

Average gross inland energy consumption per capita amounted to 2.6 toe in the Region, what was close to 65% of the average consumption of West European countries (fig 4). In 2004 the average per capita consumption of electricity (being the indicator of the level of economic development) in the Region was 225 kgoe, with large differences between the countries (fig. 5).

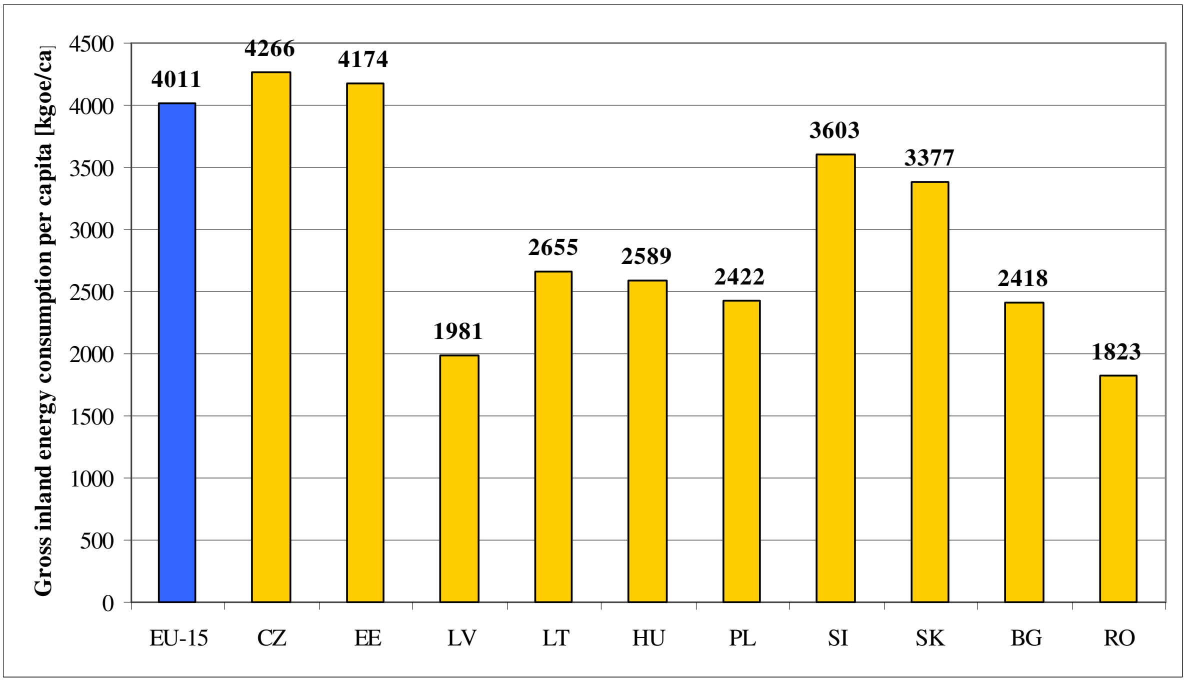



*Fig.4 Gross inland energy consumption per capita in EU-15 and CEEC countries, 2004 (source:Eurostat)*

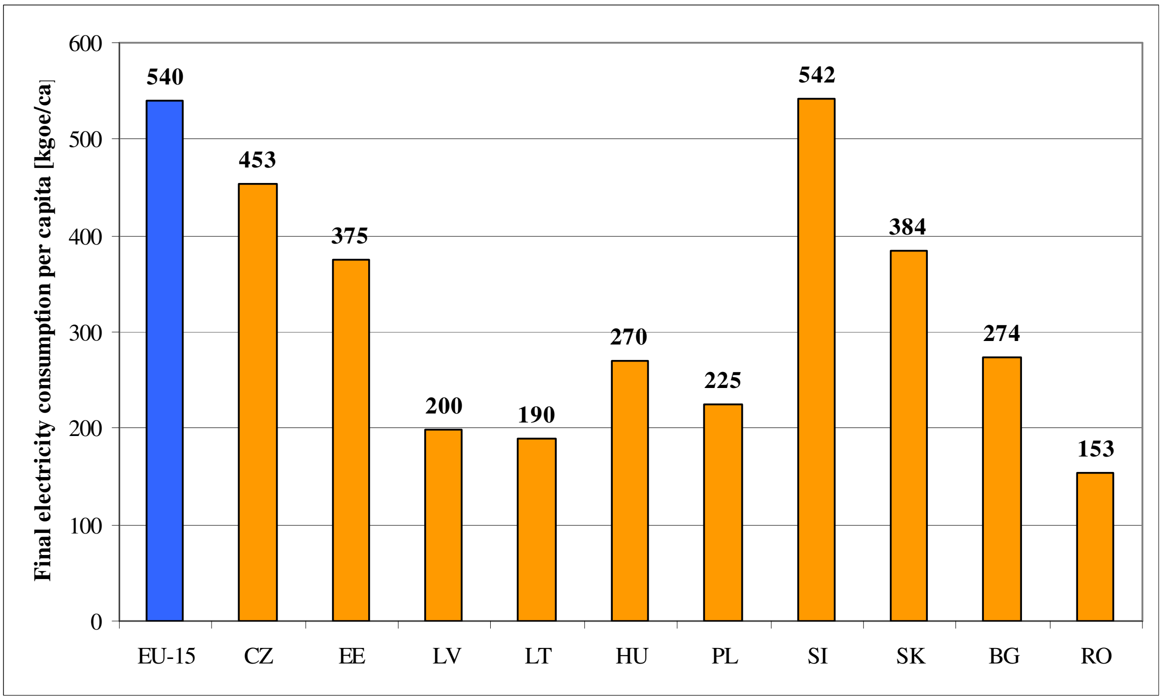



*Fig.5 Final electricity consumption per capita in EU-15 and CEEC countries, 2004 (source:Eurostat)*

Consumption was the highest, close to the consumption in the West European countries, in: Czech Republic – 453 kgoe, Slovenia – 542 kgoe, Estonia – 375 kgoe and Slovakia – 384 kgoe. Consumption was the lowest in Latvia – 190 kgoe and in Romania – 153 kgoe. The countries in the region are characterised by high energy intensity of GDP. It shall be also noted, that most of the largest countries in the region (Poland, Romania, Hungary) have rather low level of electricity consumption and it is to expect that this indicator will grow during further economic development following to the necessity of looking for new sources of supply.

Bulgaria, Czech Republic, Estonia, Lithuania, Poland and Romania are net exporters of electricity while Hungary, Latvia, Slovakia and Slovenia are net importers.

The total share of renewables in the gross inland energy consumption is similar in CEEC and EU-15 (fig. 1 and fig.2), however the structure of primary production from renewables is significantly different (fig. 6). The CEEC countries use mainly the biomass as renewable energy source, the hydro power share is significantly lower than in EU-15, and other renewables play the marginal role. Especially visible is the small share of wind energy, where the rest Europe is from some years the leading world market.

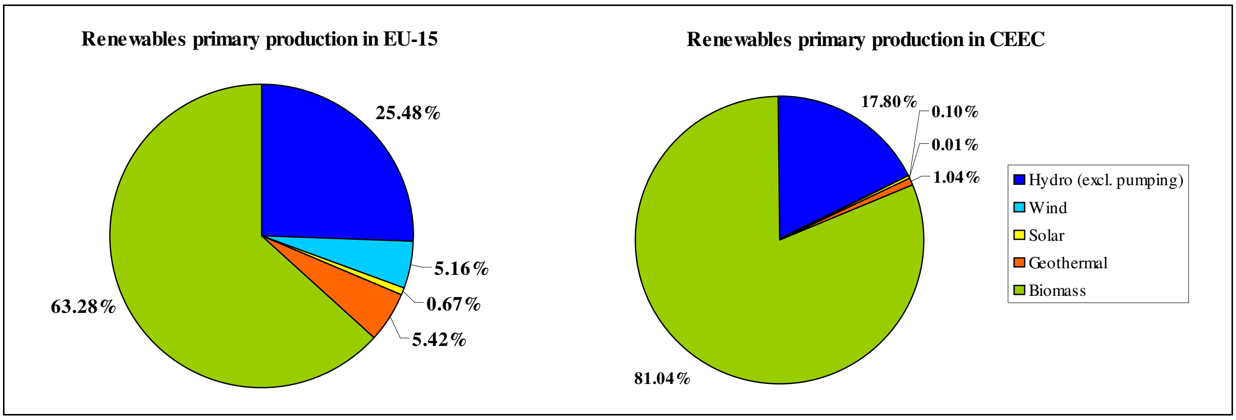



*Fig.6 The structure of renewable energy production in EU-15 and CEEC, 2004 (sourc: Eurostat)*

The structure of renewable energy production (fig. 7) shows that there are some groups (caused by natural resources distribution) to identify in CEEC, though the general domination of biomass use. There are "biomass countries" (Czech Rep., Baltic States, Hungary and Poland), "hydro countries" (Slovenia, Slovakia, Bulgaria and Romania), also some countries using geothermal energy (Hungary, Slovakia and Bulgaria)

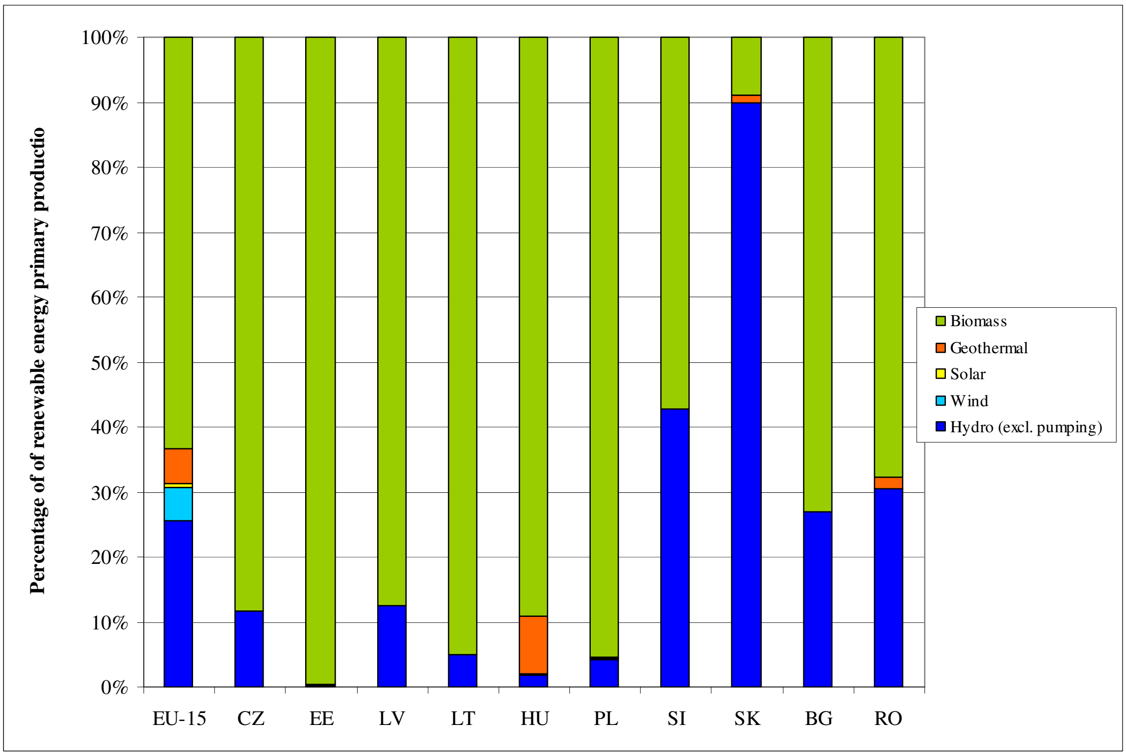



*Fig.7 Structure of renewable energy production in EU-15 and specific CEEC countries*

The data of European Commission comparing of the renewable energy targets of CEEC countries with the share of RES in electricity production (tab. 1) are showing that in the period 2003-2010 large effort is requested to meet the target – some of the countries (Poland, Hungary) have to grow the share of renewables 3-4 times. This will result in growing investment in renewable technologies for electricity production.

*Tab.1 General overview of the energy related issues in CEEC.*

| Country | Population (1000) | Gross inland energy consumption/GDP(95) kgoe/1000EUR | Gross inland energy consumption per capita kgoe/cap | Final electricity consumption per capita, kgoe/cap | National RES target for 2010[2] | 2003 share of RES[3] |
|---|---|---|---|---|---|---|
| **Czech Republic** | 10212 | 852 | 4266 | 453 | 8% | **2.8%** |
| **Estonia** | 1351 | 1140 | 4174 | 375 | 5.1% | **0.5%** |
| **Latvia** | 2319 | 696 | 1981 | 200 | 49.3% | **35.4%** |
| **Lithuania** | 3446 | 1136 | 2655 | 190 | 7.0% | **2.9%** |
| **Hungary** | 10117 | 534 | 2589 | 270 | 3.6% | **0.9%** |
| **Poland** | 38191 | 597 | 2422 | 225 | 7.5% | **1.6%** |
| **Slovenia** | 1996 | 329 | 3603 | 542 | 33.6% | **23.1%** |
| **Slovakia** | 5380 | 854 | 3377 | 384 | 31.5% | **12.1%** |
| **Bulgaria** | 7801 | 1628 | 2418 | 274 | | **7%** |
| **Romania** | 21711 | 1227 | 1823 | 153 | | **23.4%** |

In the short and medium perspective, in the questionnaires from RESCUE partners, among renewable energy resources, highest priority has been given to bio-energy. This is partly motivated by the flexibility of biomass used for energy purposes (green electricity and transportation fuels) and its relatively low cost (especially for heating and CHP). However such opinion is very much driven by rather common understanding that CEEC are biomass reach, with very strong and extensive agriculture and considerable wood resources. Figure 8 presents the land availability for agriculture and forestry in NMS (including CEEC) in comparison to the EU-15. After Bulgaria i Romania join the EU, agricultural and forestry role in NMS will increase additionally.

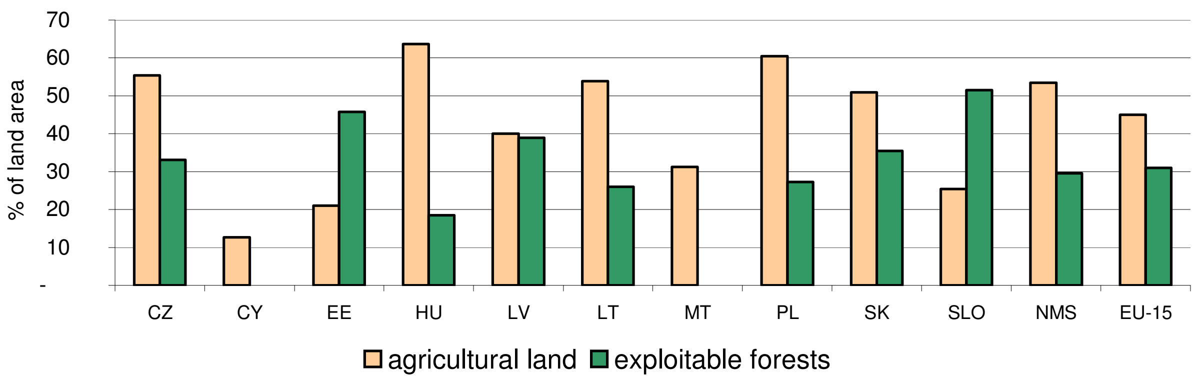



Fig 8. Land use for agriculture and forestry in NMS in 2000. Sources: FAO, adopted from presentation of G. Wisniewski "Bioenergy in NMS", Proceedings of the conference "Bioenergy – the EU enraged perspective", Budapest, October '2003.

[2] Source: DG TREN

[3] Source: DG TREN

There is also expected that considerable land availability for biomass production (energy crops) in NMS/CEEC will provide considerable opportunity for exporting of pre-processed biomass and biofuels to the EU-15. Such opportunities are especially attractive for CEEC with lower fuel dependence – fig. 9.

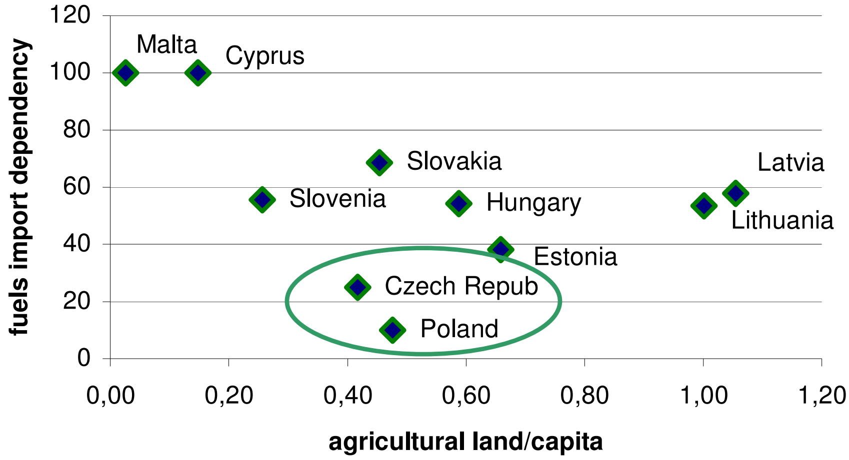



Fig. 9: Availability of agricultural land for energy crops in NMS and their fuel dependency and opportunities for biofuels export. Sources: Source: G. Wisniewski "Bioenergy in NMS", Proceedings of the conference "Bioenergy – the EU enraged perspective", Budapest, October '2003, adopted from FAO and Danyel Reich.

Other renewable energy resources (wind, hydro, geothermal, solar) have lower attention and perhaps will play lower role in the short term renewable energy mix in CEEC. Bioenergy, being the official renewable energy priority in all CEEC and RESCUE countries, becomes important RTD priority as well (see chapter 3). It creates call for action and demand for innovation at SMEs, because it reduces temporarily (short term) system' risk for SMEs involved in bioenergy development. However, in medium term, strong and common bioenergy priorities in all CEEC and foreseen considerable new investment in bioenergy production capacities would bring problems with biomass (and agriculture) market distortions terms and would result in underdevelopment of other renewable energy markets and technologies.

## 3. OVERVIEW OF THE REGIONAL (CEEC) ENERGY RTD SECTORS AND PRIORITIES

There are not so many data and studies concerning energy RTD in CEEC. The latest available data can be found in a "Study on ways of improving complementarities and synergy between national and community research in the field of non-nuclear energy" prepared in 2004 on the base of research done within a tender OJ S 43 of 01/03/2003. Major findings of the study were included in the EC report "Non-Nuclear Energy Research in Europe" (Publication EUR 21614/1, DG Research '2005).

The study confirmed that energy RTD is not well established in many o the new member states and the NMS are starting from a very low baseline in terms of energy RTD. Few of the NMS have the heritage of a strong R&D programmes, but they have been evolved without clear focus of the new technological challenges. Europe therefore has the opportunity to help the NMS to put place energy RTD programmes that are focused and prioritized and which benefit from the experience of others in terms of program management and evaluation.

There are no two CEEC countries having integrated energy RTD programs and they differ from energy resources and have individual nations, however there are commonalities concerning:

- changes of political system
- corresponding, often drastic downsizing of research programmes
- particularities of the liberalization of energy markets in this context
- process of accession to the EU, implying a negotiation process that covers the energy system and environmental targets.

The short survey of the energy RTD systems and programmes in CEEC is leading to data presented in table 2, describing the commonalties and individual differences.

On the base of the summary of the above overview it could be concluded that energy RTD priorities are coming from the EU, however the weaknesses of domestic priority setting can be seen in difficulty of NMS and AC in imposing their technical priorities in European programme design. Considering specific circumstances in CEEC and EU15, the energy RTD priorities were not combined with the EU ones so easily. Very common problem with the integration and co-ordination of the energy RTD is lack of RTD programmes and project based system of research financing in CEEC.

There is no statistical data available about the specific energy RTD, so some data are presented about general RTD sector in CEEC. The RTD spending as share of gross domestic product (fig. 10) is in all CEEC countries lower than in EU-15, for most of the countries (except Czech Rep. and Slovenia) even lower than 1%.

*Table 2 General characteristic of RTD systems in CEEC*

| Country | RTD spending % of GDP[4] | Energy/RES RTD general characteristics |
|---|---|---|
| **Hungary** | 0.89% | 30% of research budget comes from the business sector and 70% from state budget. The country has its target to increase the RTD rate to 1,8% by 2010. The main renewable RTD potentials are biomass, wind, geothermal and solar thermal energy. |
| **Lithuania** | 0.76% | No specific energy RTD programme out of nuclear. Only some projects are being carried out in sphere of RES from time to time with low financial support. Currently researches on solid and liquid biofuels have a certain priority. |
| **Poland** | 0.58% | Coal mentioned major RTD theme and biomass as a main renewable resource perceived as a candidate for RTD priority (National Research Framework Programme) |
| **Slovakia** | 0.53% | RTD themes and priorities not clearly defined. |
| **Latvia** | 0.42% | RTD themes in line with the EU priorities (except of peat). Latvian Renewable Energy Strategy 2006-2010 defined 4 priorities for support of RES. The target is to increase R%D funding by 0.15% of GDP per year until it reaches 1% of GDP. Decreasing of researchers populations and RTD spending in the 90-thies.. |
| **Bulgaria** | 0.51% | No apparent NNE RTD policy, solar, hydro and wind seems as attractive RTD themes. |
| **Romania** | 0.40% | No apparent NNE RTD policy. Romania is the largest producer of oil in CEEC (has gas and coal resources as well). Solar, hydro, energy efficiency and cogeneration seems as attractive RTD themes |
| | | |
| **Slovenia** | 1.61% | Quite high spending for research and in the front of high energy dependence of oil and coal, there is strong focus in NNE RTD priorities on hydro energy and renewable (11% in the national primarily energy balance), including eco-buildings, geothermal, integration of RES, PV |
| **Czech Rep.** | 1.28% | Moderate spending for research but marginal use of RES and other sustainable energy and there is bigger governmental interest in nuclear energy than RES or RUE. |
| **Estonia** | 0.91% | Current NNE RTD themes much elated to oil shale, peat and process of setting up priorities in fuel cells and H2 has started. |

[4]In 2004, source: Eurostat

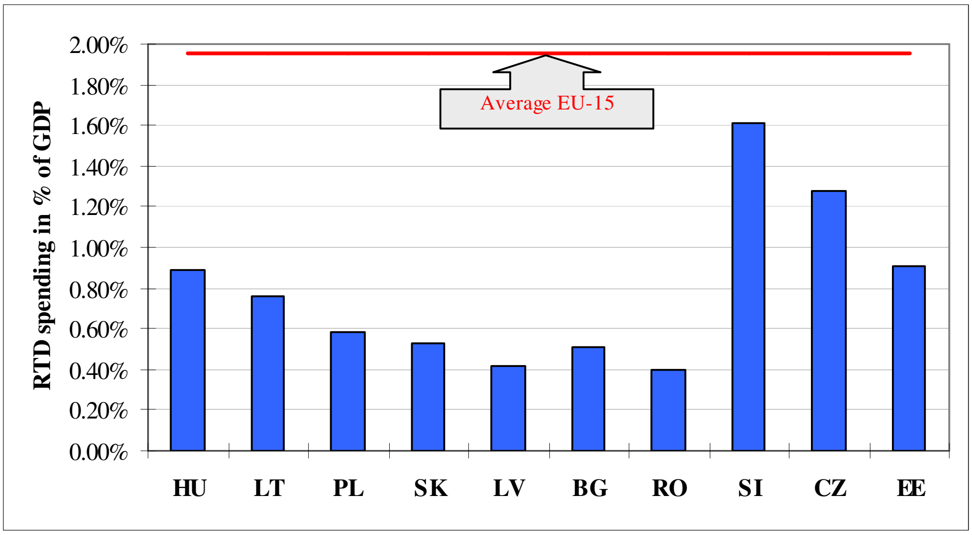



*Fig.10 RTD spending in CEEC, in % of GDP, 2004 (source: Eurostat)*

Also significant is the share of spending covered by business and enterprise sector (fig. 11), however some of the countries are close to EU-15 average.

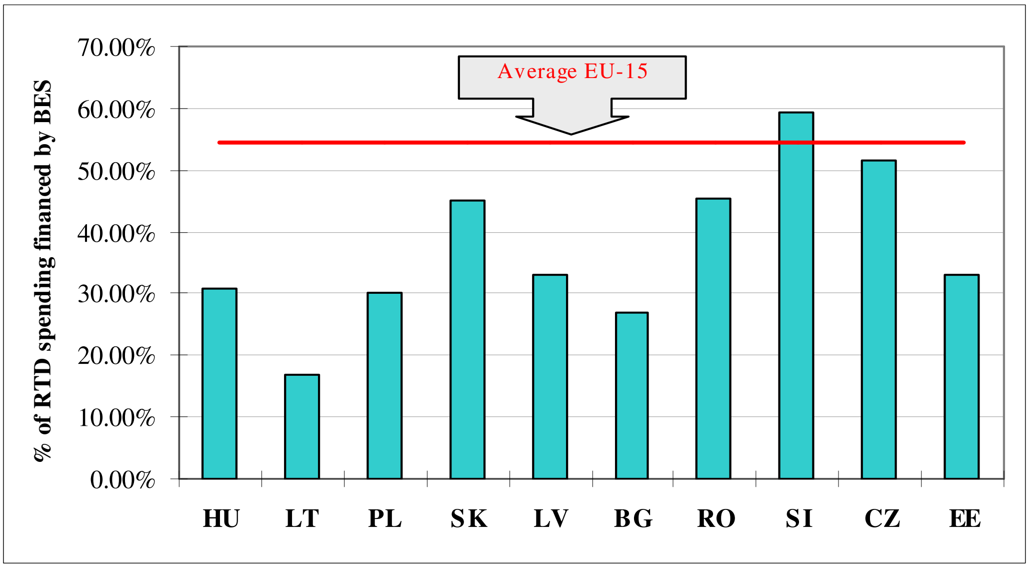



*Fig. 11 RTD spending financed by business and enterprise sector, in % of total RTD spending, 2004 (source: Eurostat)*

Looking on the sector where most of the RTD activities takes place, CEEC countries shows some differences (fig. 11). There is the group of countries with strong higher education sector (Baltic States, Hungary, Poland), also with governmental research institutes (Bulgaria, Romania, Poland, Slovakia, Hungary) as well as with visible business sector activity (Czech Rep., Slovenia, Slovakia, Romania). But in all of the countries most of research personnel is still employed by governmental institutions and higher education sector (fig.12)

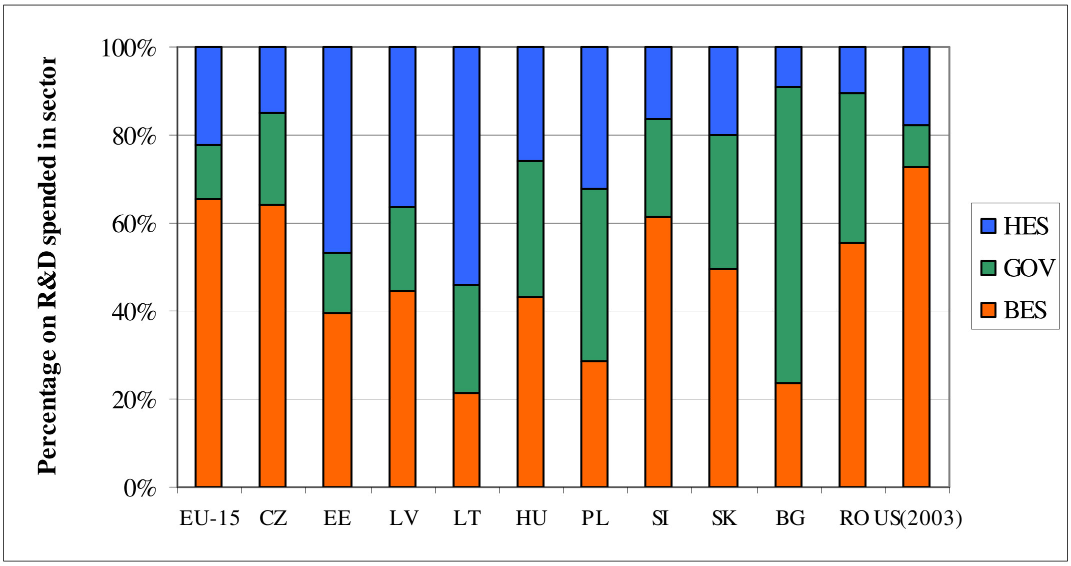



*Fig. 11 The percentage of R&D expediture in CEEC, EU-15 and US by sector of performance, 2004 (source: Eurostat)*

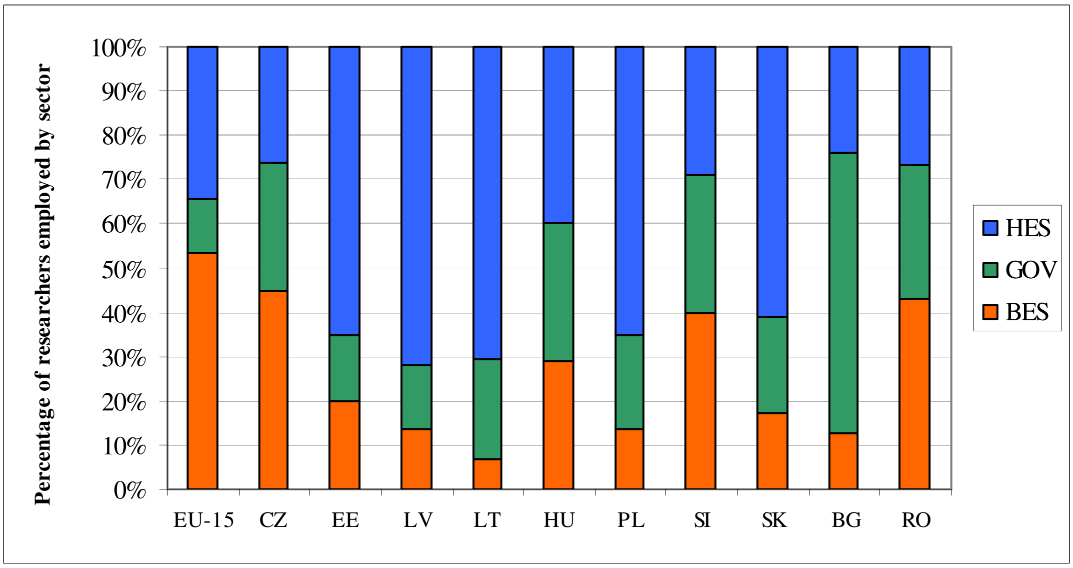



*Fig. 12 R&D personnel employed, by sector of research performace, 2004 (source: Eurostat)*

As in EU-15 the business and enterprise sector in CEEC is covering the RTD expenditures mostly from own capital (fig.13). Except of Latvia, Lithuania and Hungary, the rest of the countries is characterized by lower than EU-15 use of the abroad funds. Especially in Poland, Slovakia and Slovenia it looks like those countries does not use to available extend the opportunities created by EU support programmes for the enterprise sector. Some countries (Romania, Slovakia, Poland) seem to compensate this effect with governmental support for research in BES.

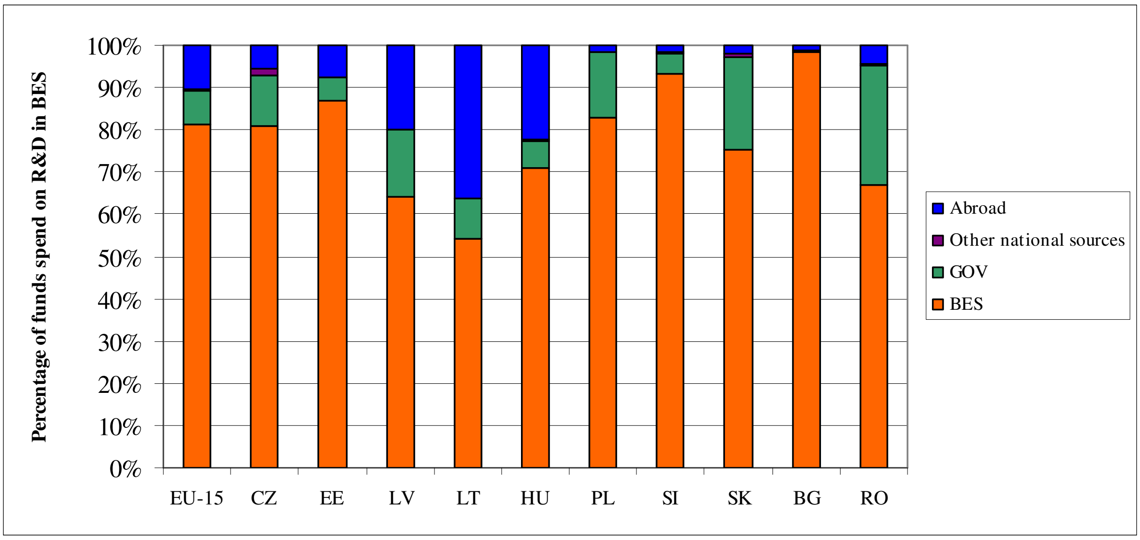



*Fig. 13 R&D expeditures in business and enterprise sector, by sources of funding, 2004 (source: Eurostat)*

The most interesting statistics is showing how the expenditures in business and enterprise sector is distributed by enterprise size class (fig.14). **In all the CEEC countries percentage of spending in SME's is larger than in EU-15.** In Latvia, Estonia, Slovakia, Romania even over 30% of expenditures is taken by SME's, also in other countries this indicator is close to 20%. Even taking into consideration that the percentage of GDP spent in those countries for RTD is lower, there is visible activity of innovative SME's, mainly not supported by governmental and abroad sources of funds.

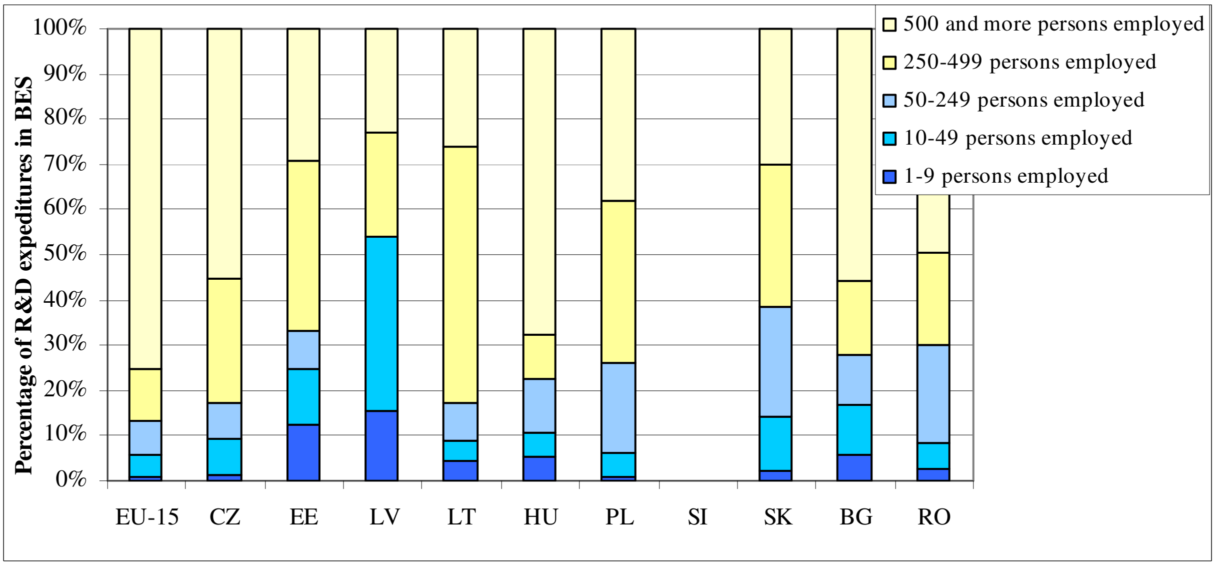



*Fig.14 Structure of R&D expediture in business and enterprise sector, by enterprise size class, 2004 (source: Eurostat)*

The above analysis follows to some conclusions:

- Most of the RTD expenditures in CEEC countries is still spent by governmental and higher education sector, which is also employing most of RTD personnel.
- The enterprises does not yet use all available support sources, including EU funds, however there seem to be effective governmental schemes for support in some countries.
- All the CEEC countries have very high potential of active innovative SME's

Above presented trends and figures in terms of spendings, might become much more promising for SMEs, RTD and innovation in CEEC within the new EU financial perspective 2007-2013, especially due to the use of EU structural funds. The general role of the new round of structural funds in pushing through RTD effort and innovations in Poland and other EU NMS from CEEC was emphasised by Commissioners Ms Danuta Huebner and Mr Janez Potocnik at the conference "research and innovation – an opportunity for convergence regions". Structural funds support for RTD&I (I-Innovations) in the form of grants. The financial support falls into four type of activities: research projects, technology transfer (both will app. 55% (relatively 20% and 25% of the total), scientific and business partnership networks (app. 35% of the total budged) and others including training of researchers (app. up to 5%).

Within the general framework of the EU financial perspective 2007-2013 (see table below), DG REGIO of the European Commission proposed for the first time "renewable energy" (together with sustainable transport and environment) as the highest priority level for the EU Cohesion Fund.

| **Programmes and Instruments** | **Eligibility** | **Eligibility** | **Allocations** |
|---|---|---|---|
| Objective 1. Convergence objective 1.7% (EUR 251.33 bn) | | | |
| Regional and national programmes<br>ERDF<br>ESF | Regions with a GDP/head <75% of average EU25 | • innovation;<br>• environment/ risk prevention;<br>• accessibility;<br>• infrastructure;<br>• human resources;<br>• administrative capacity | *57.6%*<br>*EUR 177.29 bn* |
| | Statistical effect: Regions with a GDP/head <75% of EU15 and >75% in EU25 | | *4.1%*<br>*EUR 12.52 bn* |
| Cohesion Fund including phasing-out | Member States GNI/head <90% EU25 average | • transport (TENs);<br>• sustainable transport;<br>• environment;<br>• **renewable energy** | *20.0%*<br>*EUR 61.42 bn* |
| Objective 2. Regional competitiveness and employment objective 15.8% (EUR 48.79 bn.) | | | |
| Regional programmes (ERDF) and national programmes (ESF) | Member States suggest a list of regions (NUTS I or II) | • Innovation<br>• environment/risk prevention<br>• accessibility<br>• European Employment Strategy | *15.5%*<br>*EUR 38.4 bn* |
| | "Phasing-in" Regions covered by objec- tive 1 beween 2000-06 and not covered by the convergence objective | | *3.4%*<br>*EUR 10.38 bn* |
| Objective 3. European territorial co-operation objective 2.44% (EUR 7.5 bn.) | | | |
| Cross-border and transnational programmes and networking (ERDF) | Border regions and greater regions of transnational co-operation | • innovation;<br>• environment/ risk prevention;<br>• accessibility<br>• culture, education | *of which:*<br>*77.6% cross-border*<br>*18.5% transnational*<br>*3.9% interregional* |

The RES related EU budged for SMEs and innovations is usually encompassed within two types "operational programmes" at the national level in CEEC: one "horizontal" devoted strictly for research and innovations and the second one "technological" devoted for energy, environment or infrastructure and. The tables 3 and 4 below summarise the budged available for innovative SMEs active in RES sector in RESCUE countries. The tables do not cover the relevant priorities of smaller actions/projects proposed at the regional (local) level (NUTS-2). All information in both tables are based on drafts of the national strategy for usage of EU structural and cohesion funds in 2007-2013 updated for the 30 of September. Generally, the budgets for modern renewable energy investment (BAT or equivalent) and for the development and implementation of more innovative technological solutions are grouped in operational programmes related to: a) environmental protection and/or infrastructure, b) research and innovations and such kind of distinctions has been made for table 3 and table 4, which directly refers to research and technology development budged.

Considering the preliminary data in tab. 3 and 4 it can be conclude, that only in a few cases renewable energy is considered as separate "action" with predefined budged for supporting of such kind of investment, e.g. Poland – the Operational Programme "Infrastructure and Environment", action 10.2 "Increased generation of energy from RES". In principle the renewable energy related projects proposed by SMEs will be eligible for financial support within a number of actions and general or horizontal (e.g. innovations) priorities in CEEC, however without a predefined budged build on the base "must run" (clearly defined "action") they will have to compete with others, more economically attractive options, including conventional energy options. Such conclusions must to be revived after the final approval of the national operational programmes by the governments and the European Commission. At this stage of operational programmes development in NMS and Bulgaria and Romania it is difficult to assess if there are complementary to FP7 or they substitute FP7 opportunities.

More detailed information on the EU budged for innovation dedicated to CEEC within the financial perspective 2007-20013 is given for the RESCUE partners in Annex II.

Tab.3. EU budged 2007-2013 (including ERDF and Cohesion Found) and national budged (accompanied by required privet financing) for RES and SMEs in **technology/infrastructure environment** devoted operational programmes in RESCUE countries.

| **Country** | **Operational programme title** | **RES related priorities/activities** | **Projects type eligible for SMEs (as beneficiaries)** | **Available funds: EU/national/privet cintributions, mln Euro** |
|---|---|---|---|---|
| Poland | "Infrastructure and environment" | Priority 10 "***Energy infrastructure friendly to environment***", **action**: 10.2 "***Increased generation of energy from RES***" | Biomass electricity up to 10 $MW_e$<br>Biomass and geothermal CHP<br>Green heat production<br>Biofuels (biodiesel) production<br>Investment RES (all type) equipment production<br>Note: *all project supported from the national level should have the budged over the threshold of Euro 5 mln* (smaller project can be supported from regional programmes) | 334,2/59/219 |
| Hungary | Environment and Energy | **Priority *Environmentally friendly energetic development*** | *No data available yet* | Total funding: 3900-5400<br>*The ratio of EU/national/ private contributions are not defined yet* |
| Lithuania | Stimulation of cohesion | ***Energy*** | Renewable energy sources: biomass energy | 32,94/tbd/tbd |
| Latvia | "Infrastructure and services" | **Priority 4** "***Provision of qualitative environment life and economic activities***" – Action 4.4 "Energy efficiency in dwellings".<br><br>**Priority 5** "***Facilitation of environment infrastructure and environmentally friendly energetics***" – Action 5.2 "***Energy***" | Investment in the actions for energy efficiency – isolation and renovation of heat supply systems, reconstructed energy resources and heat supply grids.<br><br>Investment in modernising heat supply systems to increase energy efficiency.<br>Investment in development of renewable and alternative energy technologies and traditional energy networks.<br>Investment for the use of biomass in the energy sector.<br>Investment in the production of electric power in co-generation facilities. | 358,4/63,2/0<br><br>606,4/107,2 |
| Slovakia | *No data available yet* | *No data available yet* | *No data available yet* | *No data available yet* |
| Bulgaria | *No data available yet* | *No data available yet* | *No data available yet* | *No data available yet* |
| Romania | *No data available yet* | *No data available yet* | *No data available yet* | *No data available yet* |
| TOTAL | | | | |

Tab. 4 EU budged 2007-2013 (including ERDF and Cohesion Found) and national budged (accompanied by required privet financing) for RES and SMEs **in research, development and innovation** devoted operational programmes in RESCUE countries

| Country | Operational programme title | RES related priorities/activities | Projects type eligible for SMEs (as beneficiaries) | Available funds: EU/national/privet cintributions, mln Euro |
|---|---|---|---|---|
| Poland | "Innovative economy" | **Priority 4** "Investment in innovative technologies and products" (including especially those having positive impact on environment) | Support for RTD and innovation implementation<br>Development and implementation of own know-how.<br>Investment in modern (national scale at least)<br>Investment support for industrial and private research and development centres<br>Support in the creation of industrial and privet research and development centre | 2 838/425/0 |
| Hungary | Development of Economy | *No data available yet* | *No data available yet* | Total funding: 2200-3300<br>*The ratio of EU/national/ private contributions are not defined yet* |
| Lithuania | "Development of economy" | **Priorities 03-09**: "RTD, innovations and business" | Technology transfer and improvement, investments for strengthening ties between SMEs and research institutions<br>Support of RTD and innovation, especially in SMEs<br>Support of SMEs solving the environmental problems (clean technologies, prevention of pollution, etc.)<br>Investments in SMEs related with RTD activities<br>Other measures for stimulations of RTD, innovations and business | 703,72/tbd/tbd |
| Latvia | **"**Entrepreneurship and innovation" | **Priority 1**: "***Science and Innovation***". Both of **Actions**:<br>1. ***Science, research and development***;<br>***2. Innovation.*** | Support for research and science implementation.<br>Facilitation of international cooperation projects in science and technology (FP7, EUREKA etc).<br>Investment in research and science infrastructure.<br>Investment of establishment of a coordinated establishment of a coordinated technological transfer system.<br>Increasing access to funding and granting funding for the creation of new knowledge-based enterprises.<br>Support for the formation of clusters and centres of excellence, establishment and modernisation of scientific laboratories.<br>Support for purchasing facilities and equipment to launch the manufacturing process of new<br>and innovative products.<br>The promotion of R&D in the private sector by implementing awareness campaigns and<br>granting access to funding.<br>Recruit high qualified labour force. | 447,2/78,9/206,3 |

| | | | | |
|---|---|---|---|---|
| | | **Priority 2** – "***Promotion of Entrepreneurship***" – Action 2.1 "***Raising of entrepreneurship activities and competitiveness"*** | Facilitate the development of innovative products and technology by elaborating and implementing a programme of technology incubators.<br>Developing and implementing a support programme for the establishment of business<br>incubators, industrial (scientific and technological) parks, as well as attracting investments<br>to regions. | 270,9/47,8/113,9 |
| | "Human resources and employment" | **Priority 1** – "***Improvement of quality in education and science development***" – Action 1.1 – "***Development of science and research potential"*** | Support of international cooperation and relationship in science.<br>Attraction of human resources to the science.<br>Foster motivation of society to take part in science activities. | 255,3/45,06 |
| Slovakia | *No data available yet* | *No data available yet* | *No data available yet* | *No data available yet* |
| Bulgaria | *No data available yet* | *No data available yet* | *No data available yet* | *No data available yet* |
| Romania | *No data available yet* | *No data available yet* | *No data available yet* | *No data available yet* |
| Total | | | | |

## 4. EXPERIENCES FROM THE PARTICIAPTION OF CEEC IN FP 6

In 2003-2005 1540 entities from CEEC participated in the submitted projects of FP 6 Programme, 326 of them participated in projects, which successfully overcame the evaluation and were accepted to financing (Fig.13). However this numbers and success rates for CEEC seems to be not significantly worse than results for some EU15 states, the share of CEEC in submitted projects is only 14.1% (10.7% in successful projects).

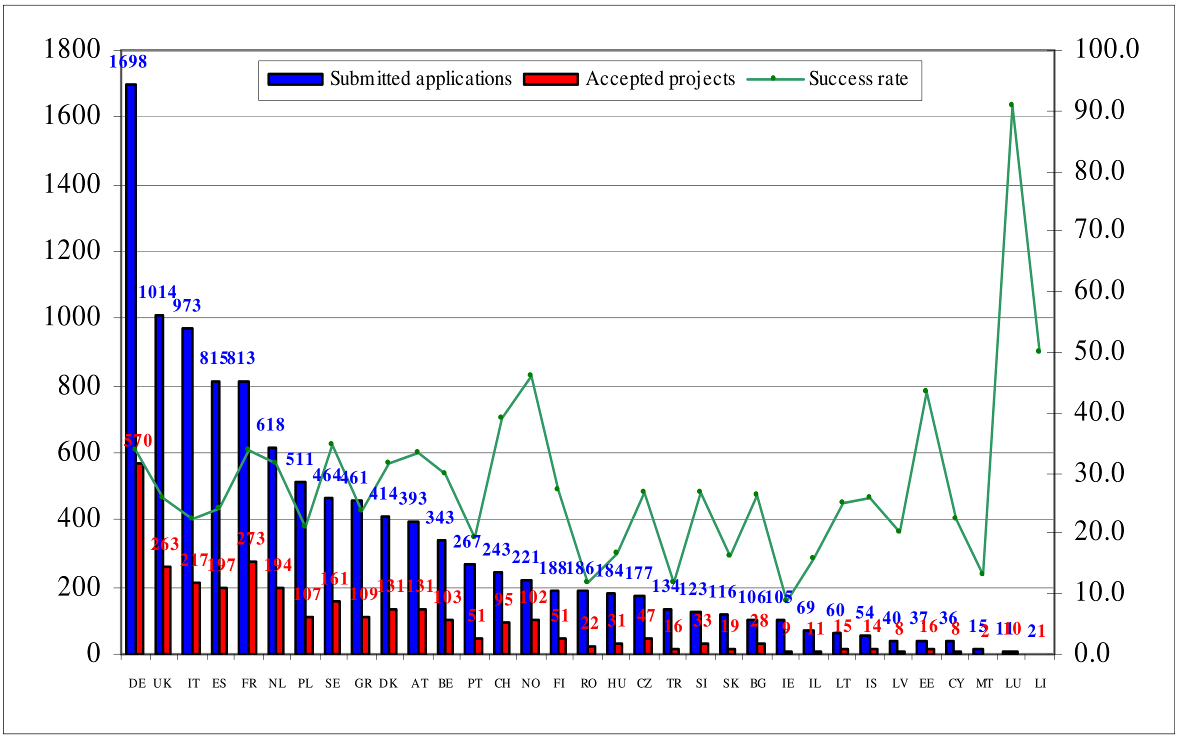



*Fig.13Number of partners from different EU countries in FP 6 projects (submitted in first 3 years); Source – FP6 National Contact Point in Poland, adjusted by ECBREC IEO*

Another significant factor is the share of CEEC in the budget distribution (Fig 14) - only approx. 4.5% of budget research budget comes to entities from CEEC.

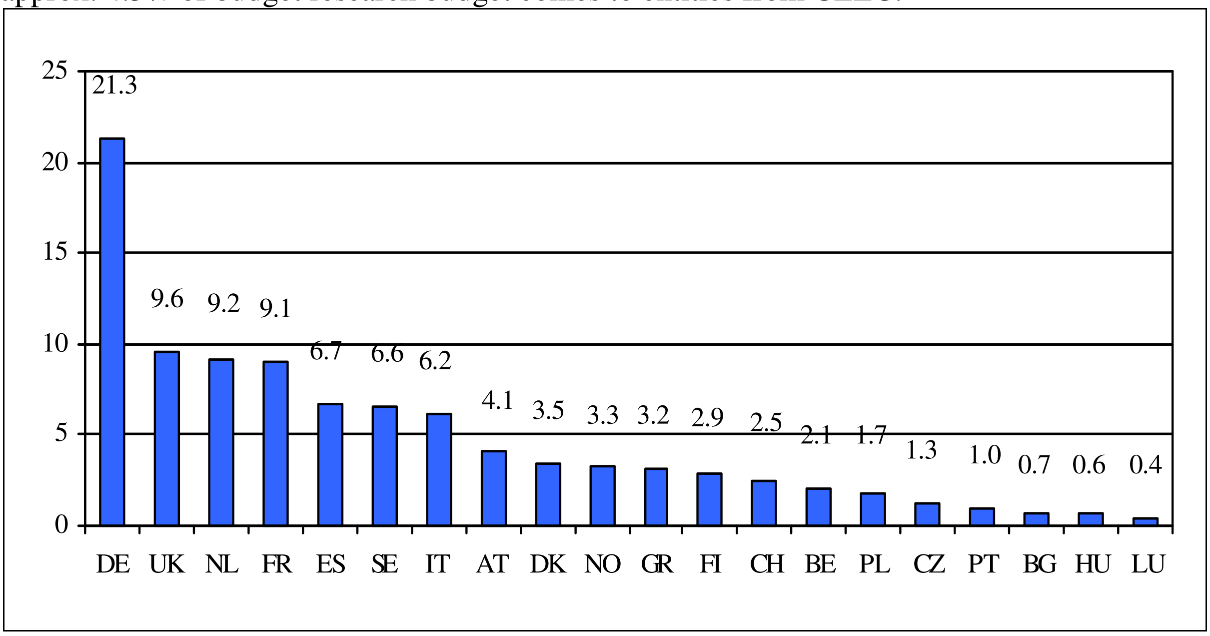


Fig. 14 Share of EU countries in the total budget of projects selected for financing in 6FP (first 3 years of FP6) *Source – FP6 National Contact Point in Poland, adjusted by ECBREC IEO*

Similar situation to the total FP6 concerns horizontal research activities involving SME's (Fig.15). CEEC partners are present in many projects (success rates are here in general on usually lower level than in total FP6), however in total they constitute only 13.8% of partners in submitted projects and 11.7% of partners in financed projects. The situation becomes more clear when looking on a budget distribution (Fig.16) – the CEEC countries have got 7.7% of budget. It is better than average in FP6, but still CEEC countries are at the end of the queue of beneficients of programme. Also important is (Fig.17) insufficient participation of CEEC in CRAFT Programme (co-operative research).

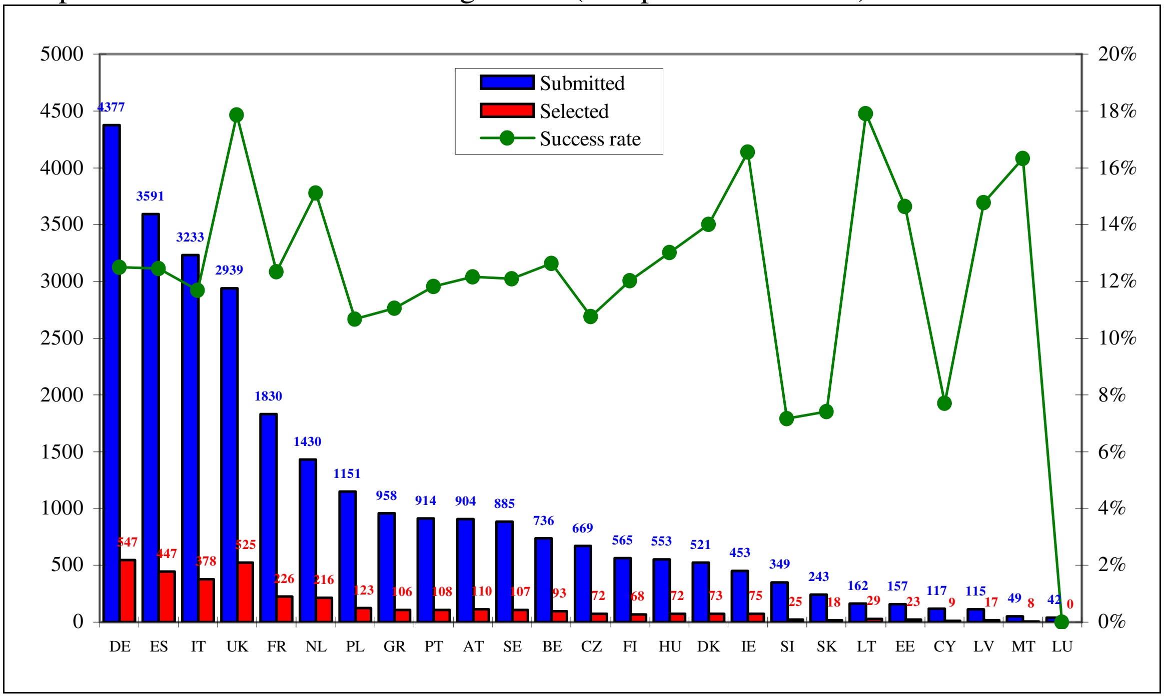



Fig 15 Number of participants from EU countries in projects submitted and selected for financing in the area of horizontal research activities involving SME's *Source – FP6 National Contact Point in Poland, adjusted by ECBREC IEO*

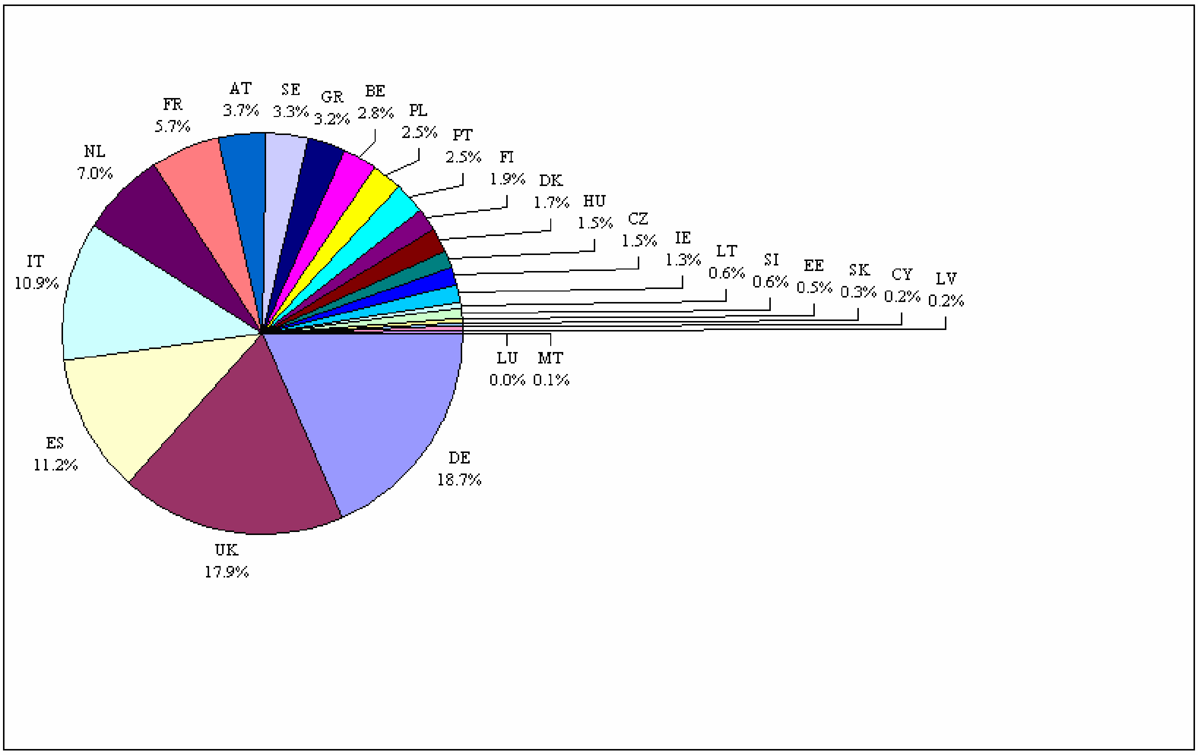



Fig .16 Distributions of EU financial contributions in projects selected for financing in the area of horizontal research activities involving SME's. *Source – FP6 National Contact Point in Poland, adjusted by ECBREC IEO*

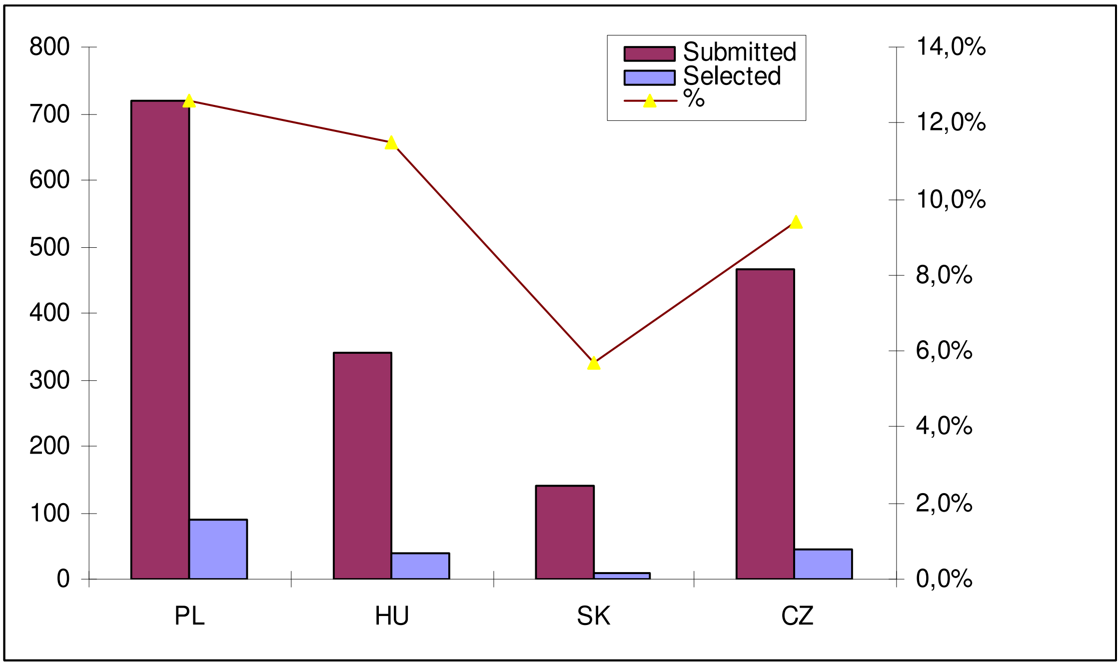



Fig. 17 Number of participants from CEEC in CRAFT projects submitted and selected for financing, *Source – FP6 National Contact Point in Poland*

To briefly summarize the current data, it is clearly visible, that though the CEEC entities are very active in submitting proposals and participating in FP6, their share is still insufficient, and budget significantly lower than used by EU15. It must be also emphasized, that most of partners (and corresponding amount of budget) are Polish entities (which is to some level justified by the size of the country). The only possible conclusion at this moment is, that the SME's from CEEC did not use the opportunities created by EU support programs to grow their competitiveness on international market.

## 5. RTD PRIORITIES FOR RENEWABLE ENERGY AND SMEs IN CEEC COUNTRIES MIRRORED AGAINST FP7 RESEARCH PRIORITIES – RESULTS OF RESCUE SURVEY

Europeans are clearly in favour of clean and sustainable energy production from renewable. Renewable energy is now a high-tech sector crucial to the emergence of the competitive, environmentally-benign, knowledge-based economy. 250 million EUR (to compare the total budget for FP4 - 110 M EUR, FP5, 100-110 M EUR and FP6- 90-100 M EUR) should be the average annual expenditure on renewable energy research under the 7$^{th}$ Framework Programme. Raising the renewable research budget to this level is crucial to helping the sector sustain its high growth rate.

The role of the Community funding in NNE RTD is important (20% of the total funding), however the key founders of the EU research are the EU members states. According to EUROSTAT, the yearly public funding for NNE RTD in Europe is app. 1 bln Euro. The more detailed data are available for the "old" EU Member states. According the European Commission report "European research spending for renewable energy sources" (DG Research, Brussels '2004 – publication EUR 21346), the overall EU 15 and centralised EU financing of RTD for renewable energy sources in '2001 was app. Euro 900 mln, including Euro 700 mln from MS (50% from the governments and 50% from the private sector). So far there are no yet detailed consolidated data concerning spending for sustainable energy RTD in CEEC, but there are negligible in confront to the above data.

In April '2004 European Commission published the "Commission proposal for 7$^{th}$ research framework programme" (COM (2005) 119 final) and shaped the energy part of it called simply "Energy". The EU spending for the energy under FP7 (2007-2013) is Euro 3,5 billions. There are 9 activities (thematic priorities) proposed:

1) Hydrogen and fuel cells: stationary, portable and for transport application
2) Renewable electricity production
3) Renewable fuel production (liquid fuels and biogas in transport)
4) Renewables for heating & cooling
5) CO2 capture for zero emission power generation
6) Clean coal technologies
7) Smart energy networks
8) Energy efficiency and saving
9) Knowledge for energy policy making

The above mentioned priorities (thematic areas) were assessed against the national priorities, from the CEEC RTD and SMEs points of view (see annex 1 and recommendation in the next chapter).

In June '2006 European Parliament adopted an amendment calling for approximately two thirds of the funding for non-nuclear energy research in the Seventh Framework Programme for Research, Development and Technical Demonstration ('FP7') to be directed towards renewable energy technologies and energy efficiency and savings.

MEPs voted through a budget of €50 bln for the 7th framework programme for research and development (2007-13) in a first reading. This is a substantial increase compared to FP6, which had an overall budget of €16 billion. Energy and health were identified as priority areas. MEPs also passed an amendment that earmarks two-thirds of a €2.4billion budget for energy to "research conducted under three renewable energy activities and energy efficiency and savings". Hence, some €1.6 billion would flow into renewable energies and energy efficiency projects, representing an average annual budget of €228 million.

To gain a relevant picture of renewable energy research the RESCUE consortium done desk research on the base of analysis of national energy policies and scattered publication and statistic available, as well as on the base of national questionnaires fulfilled by the partners and SMEs from RESCUE data base. The results of questionnaire survey on that issue among project partners are given in the Annex I. There were also compared and mirrored against the EU activities and technology trends and especially were compared to the official FP7 priorities.

The summary of the survey concerning technical priorities for RTD in renewable energy are presented in table below.

Table 5: Technical priorities for RTD in renewable energy, results of the survey (importance: L-low, M-medium, H-high, Z- zero)

| **Energy technology** | **PL** | **BG** | **HU** | **LT** | **LV** | **RO** | **SK** |
|---|---|---|---|---|---|---|---|
| **General power technology** | **M** | **M** | **M** | **M** | **M** | **M** | **M** |
| Decentralised power generation | H | H | H | H | H | H | H |
| Electricity grid control system | M | L | M | M | M | M | M |
| Power distribution | M | M | M | M | H | L | M |
| Power transmission | L | L | L | L | M | L | M |
| Powerline communication system | M | L | M | M | L | M | M |
| **Storage** | **M** | **M** | **M** | **M** | **M** | **L** | |
| Energy storage | M | M | M | M | M | M | M |
| Cold storage | Z | Z | Z | Z | Z | Z | L |
| Electrochemical storage | L | Z | L | L | L | L | M |
| Batteries | M | L | M | M | L | M | M |
| Battery active materials | M | L | M | M | L | L | H |
| Gas Storage | L | L | L | L | M | M | H |
| Heat Storage | M | L | M | M | H | M | M |
| Mechanical storage | L | L | L | L | L | L | L |
| Compressed air technology | L | L | L | L | L | L | M |
| **Combustion** | **M** | **M** | **M** | **M** | **M** | **M** | |
| Fuel combustion | H | M | H | H | H | H | H |
| Combustion control systems | M | M | M | M | M | M | H |
| Combustion monitoring systems | M | M | M | M | M | M | M |
| **Others** | **M** | **L** | **M** | **M** | **M** | **M** | |
| Gas cleaning | M | M | M | M | M | L | M |
| Natural resources exploration | M | M | M | M | M | M | L |
| Deep water exploitation | L | L | L | L | Z | L | L |
| Offshore technology | M | L | M | M | L | L | L |
| Pipeline technology | M | L | M | M | M | M | M |
| Generation of electricity | M | H | M | M | H | M | H |
| Combined heat power systems | H | H | H | H | H | H | M |
| Generation of heat | M | H | M | M | H | H | H |
| Heat pumps | M | H | M | M | L | M | M |
| Hybrid energy systems | M | M | M | M | M | L | M |
| Rational use of energy | M | H | M | M | H | H | L |
| **Renewable Energies** | | | | | | | |
| **Bioenergy** | **H** | **H** | **H** | **H** | **H** | **H** | |
| Biofuels | H | H | H | H | H | H | H |
| Gaseous biofuels | H | H | H | H | H | H | H |
| Liquid biofuels | H | H | H | H | H | H | H |
| Solid biofuels | H | H | H | H | H | H | H |
| Biomass | H | H | H | H | H | H | M |
| Anaerobic fermentation | H | H | H | H | H | M | H |
| Biofuels for transport | H | H | H | H | H | H | H |
| Biomass combustion | H | H | H | H | H | H | M |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Biomass gasification | M | H | H | M | M | M | M |
| Biomass hydrolysis fermentation | M | H | H | M | M | L | H |
| Biomass pre-processing | H | H | H | H | M | H | M |
| Biomass pyrolysis | L | L | H | L | L | L | M |
| Bioresidues | H | H | H | H | M | M | M |
| Energy crops | H | H | H | H | M | H | H |
| Biogas production | H | H | H | H | H | M | H |
| **Geothermal Energy Technology** | **M** | **M** | **H** | **M** | **L** | **M** | |
| Deep drilling | M | L | M | M | L | M | M |
| Deep geothermal resources | M | M | H | M | L | M | M |
| Direct geothermal heat use | H | M | H | H | Z | H | M |
| Enhanced geothermal systems | L | L | L | L | Z | L | M |
| Geothermal electricity generation | L | L | M | L | Z | M | M |
| Hot fractured rock | Z | Z | Z | Z | Z | Z | L |
| Reservoir management | M | L | M | M | L | L | L |
| **Hydropower** | **M** | **H** | **L** | **M** | **H** | **M** | |
| Hydroturbine technology | M | H | M | M | H | M | M |
| Micro hydropower | H | H | M | H | H | H | L |
| Small hydropower | H | H | M | H | H | H | M |
| Ocean energy technology | Z | Z | Z | Z | Z | Z | Z |
| **Photovoltaics** | **L** | **M** | **M** | **L** | **M** | **M** | |
| PV building applications | M | L | M | M | M | H | H |
| PV cells | L | L | L | L | H | L | M |
| PV components | Z | Z | L | Z | H | Z | H |
| PV concentrators | Z | Z | L | Z | M | Z | L |
| PV integration | M | L | M | M | M | M | M |
| PV mains grid connection | L | L | L | L | M | L | M |
| PV manufacturing processes | M | L | M | M | M | L | M |
| PV materials | M | M | M | M | H | L | M |
| PV modules | M | M | M | M | M | M | M |
| PV socio-economics | M | L | M | M | M | M | L |
| PV systems | M | M | M | M | M | M | L |
| **Solar thermal technology** | **M** | **M** | **M** | **M** | **M** | **M** | |
| Solar concentrating technology | Z | H | Z | Z | M | Z | L |
| Solar chemical reactors | L | M | L | L | L | L | M |
| Solar dish technology | Z | Z | Z | Z | M | Z | L |
| Solar tower technology | Z | Z | M | Z | M | Z | L |
| Solar trough technology | M | M | M | M | M | M | L |
| Solar flate-plate collectors and systems | H | H | H | H | M | H | M |
| **Wave Energy** | **L** | **L** | **Z** | **L** | **Z** | **L** | |
| Tidal current technology | Z | Z | Z | Z | Z | Z | Z |
| Wave energy technology | L | L | Z | L | Z | L | Z |
| Offshore mooring | L | L | Z | L | Z | Z | Z |
| Offshore power transmission | Z | Z | Z | Z | Z | Z | Z |
| Submersible turbine technology | L | L | Z | L | Z | L | Z |
| Wave hydrodynamics | L | L | Z | L | Z | L | Z |
| Wells turbine technology | Z | Z | Z | Z | Z | Z | Z |
| **Wind energy technology** | **H** | **H** | **H** | **H** | **H** | **H** | M |
| **Environmental technology** | **M** | **M** | **H** | **M** | **H** | **M** | M |

As shown in chapter 2 the bioenergy is the main priority in the CEEC countries, which is presented in technical priorities only. Almost all the bioenergy issues are choosen as important by all the project partners. Also the common opinion about high importance is expressed about fuel combustion issues and combined heat and power systems. The heat generation seems to be another important problem (as seen in assessment of solar thermal technology). Technologies like hydro, geothermal and PV are assessed different way, depending on the country, which is connected with distribution of local resources (i.e.

geothermal in Hungary, PV in Romania). There are no significant perspectives for use of wave energy in analysed countries. The important conclusion considers wind energy which is specified as important RTD priority by all the respondents. This technology, treated in FP6 rather as being fully market and commercial, is just starting in CEEC countries and need many RTD activities concerning local specific and using the good praxis from EU-15. Being mainly the rural countries, and in need of refurbishment and modernisation of power distribution system the respondents expressed also the importance of RTD in this area, especially in decentralised generation.

Basing on results of the survey the technical priorities the technical priorities for CEEC could be split into 3 groups:

1) The "historical" problems to be solved during the economic development and reaching the EU-15 level, using best available technology fitted to local specific (transmission grid, distributed generation)
2) The effective use of specific local resources and growing competitiveness on EU market in this area (biomass technologies for all the countries, another technologies for some groups of interested countries)
3) The maximum benefit absorption of technologies developed formerly in another countries (wind energy)

As stated before in chapter 3, all the CEEC countries have very active SME's, involved in RTD and innovation. The respondents are of the opinion, that the problems related to FP7 priorities may be important for SME's. Almost all the priorities may create the opportunity for SME's. There is a special focus on renewable electricity, which shows the awareness of necessity of growing RES share and the expected significant role of SME's in meeting national RES targets.

Table 6: Importance of problems related to FP7 priorities for SME's in CEEC (importance: L-low, M-medium, H-high, Z- zero)

| | PL | BG | HU | LT | LV | RO | SK |
|---|---|---|---|---|---|---|---|
| Area 1: Hydrogen and fuel cells | L | L | L | L | L | L | M |
| Area 2: Renewable electricity generation | H | H | H | H | H | H | M/H |
| Area 3: Renewable fuel production | H | M | M | H | H | H | M |
| Area 4: Renewables for heating and cooling | M | H | M | M | H/Z | H | M |
| Area 7: Smart energy networks | M | M | M | M/H | M | H | M |
| Area 8: Energy efficiency and savings | M | H | M | M | H | H | M |
| Area 9: Knowledge for energy policy making | M | H | M | M | H | H | M |

From this study results that all the RESCUE countries have very high interest and reasonable potential of innovative SME's in the participation in all RES related FP7 priorities except of are 1 (hydrogen and fuels cells). However, FP7 does not cover properly such important for SMEs in CEEC areas like wind energy and decentralised electricity generation (e.g in rural areas.).

# 6. CONCLUSSION AND RECOMMENDATION FOR RENEWABLE ENERGY RTD COOPERATION IN CEEC AND BETTER INVOLVEMENT OF SMEs

***General conclusions***

There is the need for some sound socio-economic studies in order to foster this sub-continental co-operation. CEEC decision-makers and market players know EU countries and relevant partners more than they know their neighbours. During this study there is no document can be found yet to replace the former soviet scientific reports, which still provided some information. It was therefore particularly striking to learn that no one level of NNE RTD, virtually no serious collaboration exists between these countries, and that all oriented towards western partnerships. This is all the more a pity since CEEC should be further consolidated before setting-up deep collaborations with western countries.

Per capita GDP is low in most of the CEEC and research budgets are also low and small percentage of those small budged is used for renewable energy and innovations so far. A general problem is the weak position of companies in international (pan- European) RTD co-operation. As a consequence, in NMS the participants in EU projects often represent universities, research institutes and Academia of Sciences. Therefore SMEs do not benefit proportionally from the EU framework programmes and even from EU cohesion policy.

The priority setting process and evaluation in NNE-RTD in NMS and two ACC is weak. National RTD projects are often small and very close to the application, which does not necessarily correspond to the EU claim of scientific excellence. Such countries like Poland faces a strong dependence on coal, a technology so far not covered in the EU research programs. So without stronger co-operation with other CEEC, the domestic priority setting can be seen in the difficulty in NMS and ACC in imposing their technical priorities in FP7 and others European programs design.

Apart from the clean coal technologies, among the RES sector, generally speaking, the common energy RTD priorities for CEEC in short and medium terms seems to be research and bioenergy including biofules for transportation and for CHP production (for renewable elegy),, green electricity production and integration with local grid as well as energy efficiency in the housing sector. Such areas are in line with the FP7 priorities. However there are others specific areas of scientific interests and areas of innovations, including wind energy.

***Energy sectors***

Average gross inland energy consumption per capita amounted to 2.6 toe in the Region, what was close to 65% of the average consumption of West European countries. The countries in the region are characterised by high energy intensity of GDP. All CEEC and especially the largest countries in the region (Poland, Romania, Hungary) have rather low level of electricity consumption and it is to expect that this indicator will grow during further economic development following to the necessity of looking for new sources of supply.

CEEC countries are not uniform in the structure of the consumption. The solid fuels are in fact covering most of the consumption in countries like Poland, Czech Republic and Estonia. There is also visible group of countries using nuclear energy (especially Lithuania, Slovakia and Bulgaria) as well as the group of non-nuclear countries. Also natural gas is in several countries used more to higher extend than in EU-15 (especially in Hungary and Romania).

In some groups of countries (caused by natural resources distribution) in CEEC, the general domination of biomass use dominates. There are “biomass countries” (Czech Rep., Baltic States, Hungary and Poland), “hydro countries” (Slovenia, Slovakia, Bulgaria and Romania), also some countries using geothermal energy (Hungary, Slovakia and Bulgaria). In the period 2003-2010 large effort is requested to meet the EU renewable, especially green electricity targets – some of the countries (Poland, Hungary) have to grow the share of renewables 3-4 times. This will result in growing investment in renewable technologies for electricity production.

**General RES RTD context**

Energy RTD priorities are coming from the EU, however the weaknesses of domestic priority setting can be seen in difficulty of NMS and AC in imposing their technical priorities in European programme design. Considering specific circumstances in CEEC and EU15, the energy RTD priorities were not combined with the EU ones so easily. Very common problem with the integration and co-ordination of the energy RTD is lack of larger RTD programmes and project based system or *institution based* of research financing in CEEC.

The RTD spending as share of gross domestic product is in all CEEC countries lower than in EU-15, for most of the countries (except Czech Rep. and Slovenia) even lower than 1%.

Taking account the institutional structure of RTD spendings, there is the group of countries with strong higher education sector (Baltic States, Hungary, Poland), also with governmental research institutes (Bulgaria, Romania, Poland, Slovakia, Hungary) as well as with visible business sector activity (Czech Rep., Slovenia, Slovakia, Romania). But in all of the countries most of research personnel is still employed by governmental institutions and higher education sector.

***SMEs role in RTD and innovation***

As in EU-15 the business and enterprise sector in CEEC is covering the RTD expenditures mostly from own capital. Except of Latvia, Lithuania and Hungary, the rest of the countries are characterized by lower than EU-15 use of the abroad funds. Especially in Poland, Slovakia and Slovenia it looks like those countries does not use to available extend the opportunities created by EU support programmes for the enterprise sector. Some countries (Romania, Slovakia, Poland) seem to compensate this effect with governmental support for research in BES (business & enterprises sector RTD activities). In all the CEEC countries percentage of spending in SME’s is larger than in EU-15. In Latvia, Estonia, Slovakia, Romania even over 30% of expenditures is taken by SME’s, also in other countries this indicator is close to 20%. Even taking into consideration that the percentage of GDP spent in those countries for RTD is lower, there is visible activity of innovative SME’s, mainly not supported by governmental and abroad sources of funds. Most of the RTD expenditures in CEEC countries is still spent by governmental and higher education sector, which is also employing most of RTD personnel. The enterprises does not yet use all available support sources, including EU funds, however there seem to be effective governmental schemes for support in some countries.

In principle the renewable energy related projects proposed by SMEs will be eligible for financial support within a number of actions and general or horizontal (e.g. innovations) priorities in CEEC, however without a predefined budged build on the base “must run” (e.g. clearly defined “action” exists in Poland) they will have to compete with others, more economically attractive options, including conventional energy options.

Despite some question marks (as long as the financial perspective 2007-2013 for RES related operational programmes and not fully approved), there are clear indicators that innovative SMEs in CEEC have much better now and very high potential of development in the near future.

***International cooperation – EU framework RTD&D programmes***

In 2003-2005 1540 entities from CEEC participated in the submitted projects of FP 6 Programme, 326 of them participated in projects, which successfully overcame the evaluation and were accepted to financing. However this numbers and success rates for CEEC seems to be not significantly worse than results for some EU15 states, the share of CEEC in submitted projects is only 14.1% (10.7% in successful projects). Similar situation to the total FP6 concerns horizontal research activities involving SME's. CEEC partners are present in many projects (success rates are here in general on usually lower level than in total FP6), however in total they constitute only 13.8% of partners in submitted projects and 11.7% of partners in financed projects. The situation becomes clearer when looking on a budget distribution – the CEEC countries have got 7.7% of budget. CEEC entities are very active in submitting proposals and participating in FP6, their share is still insufficient, and budget significantly lower than used by EU15.

Almost all the bioenergy issues are chosen as important by all the project partners. The common opinion about high importance is expressed about fuel combustion issues and combined heat and power systems. The heat generation seems to be another important problem (as seen in assessment of solar thermal technology). Technologies like hydro, geothermal and PV are assessed different way, depending on the country, which is connected with distribution of local resources (i.e. geothermal in Hungary, PV in Romania). There are no significant perspectives for use of wave energy in analysed countries. The important conclusion considers wind energy which is specified as important RTD priority by all the respondents. This technology treated in FP6 rather as being fully market and commercial, is just starting in CEEC countries and need many RTD activities concerning local specific and using the good praxis from EU-15. Being mainly the rural countries, and in need of refurbishment and modernisation of power distribution system the respondents expressed also the importance of RTD in this area, especially in decentralised generation.

Despite those historical disparities, all the RESCUE countries have very high interest and reasonable potential of innovative SME's in the participation in all RES related FP7 priorities except of are 1 (hydrogen and fuels cells). However, FP7 does not cover properly such important for SMEs in CEEC areas like wind energy and decentralised electricity generation (e.g. in rural areas.).

***Results of SWOT analysis of RES active SMEs in RESCUE countries***

<u>Problems for RTD:</u>

- absence of clear strategy on RES development and RES dedicated research programmes;
- low level of national RTD funding;
- strong fossil fuels lobby;
- lack of knowledge on the RES and modern technologies;
- lack of specific information dedicated for SMEs;
- language barriers;
- lack of experience in use external financial resources (missed opportunities from 2004-2006)

Barriers:

- low percentage innovation/GDP: per capita and in terms of budged (especially after taking into account the real purchasing power);
- downsizing of research programmes;
- "brain drain"
- weak structures for technology transfer;
- insufficient financing for innovations;
- insufficient ties and co-operation of SMEs with universities and other research institutions;
- only a few percent of the total number of SMEs participating in RTD.
- bad market knowledge of the RTD sector.
- underdeveloped research infrastructure
- more declarative than enforced attitudes of the national energy policy makers to renewables

Challenges:

- obligations arising from White paper /12 % RES/, Green paper and Directive 2001/77/EC / 22.1 % E-RES/ in 2010;
- enlargement of EU: fulfilment of EU RES related obligations as well as development and competitiveness of own industry;
- improvement of the coherence of new members and EU RTD activities in RES field.

Potential for success:

- high intellectual potential;
- cheaper than in the EU-15 availability of RTD services and labour
- considerable EU structural funds available for innovative SMEs and RES investment within the financial perspective 2007-2013
- grooving international networking;
- increasing number of off-grid systems.
- high current and forecasted GDP growth and positive structural changes in national economies

***General policy recommendations:***

1. Demand for clear research policy dedicated for RES, focusing on effective use of local renewable energy resources and effective use of national research infrastructure (existing and planned) and industrial potential.
2. Creation of legal and institutional framework for innovation based on easy to understand and clear instruments (preferential taxes, subsidies, loans, financial support, advisory and information systems), suited to the needs and skills of innovative SME's in the region, to increase their competitiveness on the national and international markets.
3. Implementation of support mechanisms for RES (preferential tariffs for heat and electricity, tax exemption for biofuels integrated with financial support from structural funds as well as full execution by energy regulators of priority access of independent power producers to the grid)
4. Integration of activities of all the countries of the region to concentrate on regional specific priorities (technological and economic) and effective use of EU funds as well

as providing significant common economic and research input to development of EU market.

5. Support for innovative SME's networking and integration activities on regional and national level: creation of associations representing their economic interest (chamber of commerce), technology clusters, research centres etc.

***Recommendation for RESCUE SMEs participation in FP7***

On the base of the questionnaires, consultation and the institutional capacity of the RESCUE consortium such priority areas subjects and scientific problems seems to be the common interest and opportunities' for SMEs in the 7th EU RTD Framework Programme:

1. Energy efficiency – retrofitting of residential areas, applications of high efficiency poly-generation with RES, energy efficiency in manufacturing industry
2. Smart energy networks on rural areas, including integration of small scale electricity generation from RES
3. Small scale of fuel production on rural areas – bioethanol and biodiesel (contribution of SME's to technology development for second generation fuel from biomass, pre-treatement, hydrolisis and fermentation of lignocellulosic biomass, syngas production, development of biorefinery concepts)
4. Innovative concepts for small to medium scale biomass plants (advanced gas cleaning technologies, electricity production in IGCC)
5. Strategic activities as well as development of new components and concepts for hydro-power

**SOURCES**


1. CENERG Report, Final Report of the Study on Energy Sector of the Central and East European Countries. Present Situation and Outlook to 2030.
2. Analyses of the EU renewable energy sources evolution up to 2020 (FORES 2020) Karlsruhe, 2005
3. Energy for the future renewable sources of energy. White paper for a Community Strategy and Action Plan. COM (1997) 599.
4. Green Paper on security of supply in Europe. EC COM (2000) 769 final.
5. Directive 2003/96/EC of 27 October 2003 on restructuring the Community framework for the taxation of energy products and electricity.
6. World Energy Outlook to 2030. International Energy Agency , Paris
7. Directive 2001/77/EC of the European Parliament and the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market.
8. Directive 2003/30/EC on the promotion of the use of biofuels for transport.
9. FP7 Research Priorities for the Renewable energy Sector . EUREC Agency , 2005.

# <u>ANEX I</u>: Questionnaires addressed to RESCUE project partners and SMEs in CEEC

### RESPONDEE ADMINISTRATIVE DETAILS

<table>
<tr><th colspan="4">Institution</th></tr>
<tr><td>Name</td><td colspan="3">EC BREC Institute for Renewable Energy</td></tr>
<tr><td>Country</td><td colspan="3">PL</td></tr>
<tr><td>Postal address</td><td colspan="3">Mokotowska 4/6, 00-641 Warszawa, Poland</td></tr>
<tr><td>Type of organization, mark YES, where appropriate</td><td>SME,<br>Yes</td><td>RTD,<br>Yes</td><td>Other,</td></tr>
<tr><td colspan="4">Contact person</td></tr>
<tr><td>Name</td><td colspan="3">Wisniewski</td></tr>
<tr><td>First name</td><td colspan="3">Grzegorz</td></tr>
<tr><td>Telephone</td><td colspan="3">+48 22 825 46 52</td></tr>
<tr><td>Fax</td><td colspan="3">+48 22 875 86 78</td></tr>
<tr><td>e-mail</td><td colspan="3">gwisniewski@ieo.pl</td></tr>
</table>

| | |
|---|---|
| **Consultation with (if was done also out of the host organisation):** | • The Polish Research Network on Sustainable Energy Systems<br>• The Polish Economic Chamber of Renewable Energy |
| **Distribution agreement (Yes/No)** | Yes |

## *A) Energy and renewable energy technological RTD priorities in CEEC - Poland*

| **Energy technology** | **Priorities:**<br>*Mark: high (H), medium(M), low(L), zero(Z)* |
|---|---|
| General power technology | M |
| Decentralised power generation | H |
| Electricity grid control system | M |
| Power distribution | M |
| Power transmission | L |
| Powerline communication system | M |
| Storage | M |
| Energy storage | M |
| Cold storage | Z |
| Electrochemical storage | L |
| Batteries | M |
| Battery active materials | M |
| Gas Storage | L |
| Heat Storage | M |
| Mechanical storage | L |
| Compressed air technology | L |
| Combustion | M |
| Fuel combustion | H |
| Combustion control systems | M |
| Combustion monitoring systems | M |
| Others | M |
| Gas cleaning | M |
| Natural resources exploration | M |
| Deep water exploitation | L |
| Offshore technology | M |
| Pipeline technology | M |
| Generation of electricity | M |
| Combined heat power systems | H |
| Generation of heat | M |
| Heat pumps | M |
| Hybrid energy systems | M |
| Rational use of energy | M |
| | |
| Renewable Energies | |
| Bioenergy | H |
| Biofuels | H |
| Gaseous biofuels | H |
| Liquid biofuels | H |
| Solid biofuels | H |
| Biomass | H |
| Anaerobic fermentation | H |
| Biofuels for transport | H |
| Biomass combustion | H |
| Biomass gasification | M |
| Biomass hydrolysis fermentation | M |
| Biomass pre-processing | H |
| Biomass pyrolysis | L |
| Bioresidues | H |

| | |
|---|---|
| Energy crops | H |
| Biogas production | H |
| Geothermal Energy Technology | M |
| Deep drilling | M |
| Deep geothermal resources | M |
| Direct geothermal heat use | H |
| Enhanced geothermal systems | L |
| Geothermal electricity generation | L |
| Hot fractured rock | Z |
| Reservoir management | M |
| Hydropower | M |
| Hydroturbine technology | M |
| Micro hydropower | H |
| Small hydropower | H |
| Ocean energy technology | Z |
| Photovoltaics | L |
| PV building applications | M |
| PV cells | L |
| PV components | Z |
| PV concentrators | Z |
| PV integration | M |
| PV mains grid connection | L |
| PV manufacturing processes | M |
| PV materials | M |
| PV modules | M |
| PV socio-economics | M |
| PV systems | M |
| Solar thermal technology | M |
| Solar concentrating technology | Z |
| Solar chemical reactors | L |
| Solar dish technology | Z |
| Solar tower technology | Z |
| Solar trough technology | M |
| Solar flate-plate collectors and systems | H |
| Wave Energy | L |
| Tidal current technology | Z |
| Wave energy technology | L |
| Offshore mooring | L |
| Offshore power transmission | Z |
| Submersible turbine technology | L |
| Wave hydrodynamics | L |
| Wells turbine technology | Z |
| Wind energy technology | H |
| Environmental technology | M |

## *B) How Seventh Framework Programme (Priority 5. ENERGY, renewable energy related areas only) fits to Poland and SMEs*

| Area **"1": Hydrogen and fuel cells** | |
|---|---|
| The integrated research and deployment strategy developed by the European Hydrogen and Fuel Cell Technology Platform provides the basis for a strategic, integrated programme for transport, stationary and portable applications, aimed at providing a strong technological foundation for building a competitive EU fuel cell and hydrogen supply and equipment industry. The programme will comprise: fundamental and applied research and technological development; large-scale demonstration ("lighthouse") projects to validate research results and provide feedback for further research; cross-cutting and socioeconomic research activities to underpin sound transition strategies and provide a rational basis for policy decisions and market framework development. The industrial applied research, demonstration and cross-cutting activities of the programme will preferably be implemented through the Joint Technology Initiative. This strategically managed, goal-oriented action will be complemented and closely co-ordinated with more upstream collaborative research effort aimed at achieving breakthrough on critical materials, processes and emerging technologies. | |
| 1. Area importance for Poland (high, medium, low, zero) | Low to Medium. |
| 2. Problems important for Polish research community | Demonstration facility with different types of fuel cells mainly: PEM, SOFC.<br>Fuel cells fed with gas derived from coal, hydrogen production from coal.<br>More intensive hydrogen technologies development and deployment (apart from "coal to hydrogen" research)<br>Comparison of efficiency of various technologies of satisfying final demand for transport or electricity supply<br>Research on hydrogen production from biomass |
| 3. Problems important for Polish economy and society | Evaluation of possibilities for common hydrogen economy in Poland and hydrogen supply from domestic resources.<br>Increasing of the efficiency of "coal to hydrogen" technologies and the assessment of their role in hydrogen generation.<br>Application of hydrogen for mobile vehicles<br>Hydrogen production from off pick wind energy generation |
| 4. Problems important for Polish SMEs. Select importance: (high, medium, low, zero) **– low importance** | Fuel cells for stationary applications, based on biogas, bio-ethanol and bio-diesel |

| Area "2": Renewable electricity generation | |
|---|---|
| Development and demonstration of integrated technologies for electricity production from renewables, suited to different regional conditions, in order to provide the means to raise substantially the share of renewable electricity production in the EU. Research should increase overall conversion efficiency, significantly drive down the cost of electricity, enhance process reliability and further reduce the environmental impact. Emphasis will be on photovoltaics, wind and biomass (including biodegradable fraction of waste). Furthermore, research will aim at realising the full potential of other renewable energy sources: geothermal, thermal solar, ocean and small hydropower. | |
| 1. Problems important for Polish research community | Biomass and waste co-firing for electricity and heat production in co-generation<br>Biomass and waste gasification for electricity and heat production in co-generation<br>Use of lignocelluloses based ethanol and rape derived esters for electricity production in heat and power industry<br>Choice of the optimal technology for biomass co-firing based on the economic and ecological evaluation (LCA analysis). |
| 2. Problems important for Polish economy and society | Sustainability of co-firing of biomass with coal in large scale power units<br>Elaboration of methods of quick and efficient upgrading of electrical grid and local networks to survive the peak input (in short time) from wind parks<br>The need for SO2, NOx i CO2 emission reduction resulting from Polish EU accession (Accession Treaty, LCP Directive and Kyoto Protocol) as well as maintaining high self-sufficiency factor justifies increasing interest in renewable electricity generation in Poland. |
| 3. Problems important for Polish SMEs<br>Select importance: (high, medium, low, zero)<br>**-high importance** | Development of agricultural biogas (co-fermetiation) technologies<br>Development of power electronic converters and their related control for wind power and photovoltaics as well as small scale biogas<br>Pretreatment and preparation of biomass derived solid fuels (pellets, briquettes) for large (e.g biomass toerfication) and small scale electricity generation. |

<table>
<tr><th colspan="2">Area “3”: Renewable fuel production</th></tr>
<tr><td colspan="2">Development and demonstration of improved conversion technologies for the sustainable production and supply chains of solid, liquid and gaseous fuels from biomass (incl. biodegradable fraction of waste), in particular biofuels for transport. Emphasis should be on new types of biofuels as well as on new production and distribution routes for existing biofuels, including the integrated production of energy and other added-value products through biorefineries. Aiming to deliver ‘source to user’ carbon benefits, research will focus on improving energy efficiency, enhancing technology integration and use of feedstock. Issues such as feedstock logistics, pre-normative research and standardisation for safe and reliable use in transport and stationary applications will be included. To exploit the potential for renewable hydrogen production, biomass, renewable electricity and solar energy driven processes will be supported.</td></tr>
<tr><td>1. Problems important for Polish research community</td><td>Development of technologies for hydrogen separation from gases generated by different conversion methods of biomass and wastes<br>integrated production of energy and other added-value products through biorefineries (so called agro-energy complexes)<br>New production and distribution routes for biofuels (existing and new ones)</td></tr>
<tr><td>2. Problems important for Polish economy and society</td><td>Rational exploitation of agricultural potential to cultivate biomass used for energy production<br>Increasing of employment in agriculture sector through larger introduction of biomass plantation and biomass processing for energy purposes<br>Lowering the level of biodegradable wastes landfilling<br>Research on the evaluation of rational policy and instruments towards biofuels promotion.</td></tr>
<tr><td>3. Problems important for Polish SMEs<br>Select importance: (high, medium, low, zero)<br>- high importance</td><td>Utilization (combustion) of liquid biofuels in engines and stationary boilers (due to the high price of heating oil)<br>Biomass pre-treatment in relation to EU standards development for solid biofuels<br>Local/small scale production of liquid biofuels for transportation<br>Cleaning, purification and utilization of biogas for transportation purposes</td></tr>
</table>

<table>
<tr><th colspan="2">Area “4”: Renewables for heating and cooling</th></tr>
<tr><td colspan="2">Development and demonstration of a portfolio of technologies to increase the potential of heating and cooling from renewable energy sources to contribute to sustainable energy. The aim is to achieve substantial cost reductions, increase efficiencies, further reduce environmental impacts and optimise the use of technologies in different regional conditions. Research and demonstration should include new systems and components for industrial applications (incl. thermal seawater desalination), district and/or dedicated space heating and cooling, building integration and energy storage.</td></tr>
<tr><td>1. Problems important for Polish research community</td><td>Solar passive systems – eco-buildings<br>Solar energy storage: short and long term, including UTES – Underground Thermal Energy Storage and other technologies for heat storage (e.g. PCM – Phase change materials)<br>Evelopment od Trigeneration and polygeneration concepts<br>New technologies for windows, reduction of solar energy input in summer (shading), increase of solar energy input in winter.<br>Heat and cool seasonal storage</td></tr>
<tr><td>2. Problems important for Polish economy and society</td><td>District and/or dedicated space heating and cooling, building integration and energy storage.<br>Adequate balancing of centralized (district heating and cooling) and decentralized systems for heating and cooling<br>Competition over biomass resources for heating with its use for transportation fuels and electricity generation</td></tr>
<tr><td>3. Problems important for Polish SMEs<br>Select importance: (high, medium, low, zero)<br>-medium importance</td><td>Small scale biomass boilers for heating and cogeneration of heat and power based on renewables and especially biomass (gasification)<br>Combination of solar collectors with heat pumps and energy storage<br>Development of more efficient and cheaper solar thermal collectors</td></tr>
</table>

| Area "7": Smart energy networks | |
|---|---|
| To facilitate the transition to a more sustainable energy system, a wide-ranging R&D effort is required to increase the efficiency, flexibility, safety and reliability of the European electricity and gas systems and networks. For electricity networks, the goals of transforming the current electricity grids into a resilient and interactive (customers/operators) service network and removing the obstacles to the large-scale deployment and effective integration of renewable energy sources and distributed generation (e.g. fuel cells, microturbines, reciprocating engines), will also necessitate the development and demonstration of key enabling technologies (e.g. innovative ICT solutions, storage technologies for RES, power electronics and HTS devices). For gas networks, the objective is to demonstrate more intelligent and efficient processes and systems for gas transport and distribution, including the effective integration of renewable energy sources. | |
| 1. Problems important for Polish research community | Demonstration of effective integration of renewable energy sources and distributed generation (e.g. fuel cells, microturbines, reciprocating engines)<br>Development and demonstration of key enabling technologies (storage technologies for RES, power electronics, storage devices (supercapcitors, flywheels, batteries).<br>Development of converters permitting bidirectional power flow |
| 2. Problems important for Polish economy and society | Integration of large-scale deployment of distributed power generation<br>based renewable energy sources, both at national and regional (distribution and low voltage systems)<br>Integration of the development of distributed generation with refurbishment and development of low voltage grid |
| 3. Problems important for Polish SMEs<br>Select importance: (high, medium, low, zero)<br>**- medium importance** | Creation of local electricity balancing areas based on renewable energy generation<br>Integration of small scale renewable energy electricity generation technologies<br>Development of supporting schemes for introduction of net metering and development of own on site electricity generation |

| Area "8": Energy efficiency and savings | |
|---|---|
| The vast potential for energy savings and improvements in energy efficiency need to be harnessed through the optimisation, validation and demonstration of new concepts and technologies for buildings, services and industry. This incorporates the combination of sustainable strategies and technologies for increased energy efficiency, the use of renewable energy and poly-generation and the integration of demand management systems at large scale in cities and communities. These large-scale actions may be supported by innovative R&D addressing specific components or technologies, e.g. for poly-generation and ecobuildings. A key aim is the optimisation of the local community energy system, balancing a significant reduction in energy demand with the most affordable and sustainable supply solution, including the use of new fuels in dedicated fleets. | |
| 1. Problems important for Polish research community | Development of methodologies for EM (energy management) and DSM (demand site management)<br>Optimization, validation and demonstration of new concepts and technologies for residential and tertiary buildings<br>Development of intelligent buildings<br>Demonstration of eco- cities and eco-communities<br>LCA – Life Cycle Assessment of energy systems |
| 2. Problems important for Polish economy and society | Revitalization of districts, cities and communities (building sector consumes 40% of final energy consumption in Poland)<br>Thermal modernization of buildings with implementation of solar architecture and renewables<br>Refurbishment and optimization of local community district heating energy systems |
| 3. Problems important for Polish SMEs<br>Select importance: (high, medium, low, zero)<br>- **medium importance** | Introduction of better methods on line energy consumption measurement (buildings and industrial processes) and its on line visualisation<br>Implementation of efficient and proved method of energy auditing in housing sector and in industry<br>Integration of solar energy with traditional energy conservation schemes |

| Area "9": Knowledge for energy policy making | |
|---|---|
| Development of tools, methods and models to assess the main economic and social issues related to energy technologies. Activities will include the building of databases and scenarios for an enlarged EU and the assessment of the impact of energy and energy-related policies on security of supply, environment, society and competitiveness of the energy industry. Of particular importance is the impact of technological progress on EU policies. | |
| 1. Problems important for Polish research community | Assessment of energy External Costs<br>Techno-economic optimization of thermal processes and energy management.<br>Grid integration of renewable energy sources – policy issues and legislation<br>Implementation of presently used tools and models for energy policy appraisal as well as participation in their development<br>Exergy analysis, studies of cumulative energy and exergy consumption.<br>Thermodynamic and economic problems of environmental protection.<br>Mathematical modeling of market support mechanisms for renewable and CHP electricity – modeling technical, economic and policy measures of RES-E support |
| 2. Problems important for Polish economy and society | Scientific support for the development long-term energy policy, especially with regard to energy security and role of domestic resources including especially RES, which would be followed by all political groups<br>Harmonization and coordination of support policies devoted for the implementation of the EU RES directives and programs<br>Efficient support for distributed generation in relation to RES-E and CHP<br>Sustainable biomass availability for various energy and non energy purposes |
| 3. Problems important for Polish SMEs<br>Select importance: (high, medium, low, zero)<br>**- medium importance** | Market studies and loner term competitiveness of small scale technologies (standing alone and grid connected)<br>Barriers removal and competitiveness of distributed generation<br>Introduction of technology innovation model with public support into business model of SMEs active on renewable energy market |

**RESPONDEE ADMINISTRATIVE DETAILS**

| Institution | | | |
|---|---|---|---|
| **Name** | **European Labour Institute** | | |
| **Country** | BG | | |
| **Postal address** | Kniaz Boris I, 162 Str. 1000 Sofia, Bulgaria | | |
| **Type of organization,** *mark YES, where appropriate* | NGO<br>Yes | RTD,<br>Yes | Other, |
| **Contact person** | | | |
| **Name** | Terzyiska | | |
| **First name** | Irina | | |
| **Telephone** | 00359 983 35 34/ mobile: 00359 887 807 691 | | |
| **Fax** | 00359 987 74 94 | | |
| **e-mail** | eli.bulgaria@gmail.com, eli.bulgaria@mbox.bol.bg | | |

| | |
|---|---|
| **Consultation with (if was done also out of the host organisation):** | Agency of Energy efficiency |
| **Distribution agreement (Yes/No)** | Yes |

## *A) Energy and renewable energy technological RTD priorities in CEEC - Bulgaria*

| **Energy technology** | **Priorities:** *Mark: high (H), medium(M), low(L), zero(Z)* |
|---|---|
| General power technology | M |
| Decentralised power generation | H |
| Electricity grid control system | L |
| Power distribution | M |
| Power transmission | L |
| Powerline communication system | L |
| Storage | M |
| Energy storage | M |
| Cold storage | Z |
| Electrochemical storage | Z |
| Batteries | L |
| Battery active materials | L |
| Gas Storage | L |
| Heat Storage | L |
| Mechanical storage | L |
| Compressed air technology | L |
| Combustion | M |
| Fuel combustion | M |
| Combustion control systems | M |
| Combustion monitoring systems | M |
| Others | L |
| Gas cleaning | M |
| Natural resources exploration | M |
| Deep water exploitation | L |
| Offshore technology | L |
| Pipeline technology | L |
| Generation of electricity | H |
| Combined heat power systems | H |
| Generation of heat | H |
| Heat pumps | H |
| Hybrid energy systems | M |
| Rational use of energy | H |
| | |
| Renewable Energies | |
| Bioenergy | H |
| Biofuels | H |
| Gaseous biofuels | H |
| Liquid biofuels | H |
| Solid biofuels | H |
| Biomass | H |
| Anaerobic fermentation | H |
| Biofuels for transport | H |
| Biomass combustion | H |
| Biomass gasification | H |
| Biomass hydrolysis fermentation | H |
| Biomass pre-processing | H |
| Biomass pyrolysis | L |
| Bioresidues | H |

| | |
|---|---|
| Energy crops | H |
| Biogas production | H |
| Geothermal Energy Technology | M |
| Deep drilling | L |
| Deep geothermal resources | M |
| Direct geothermal heat use | M |
| Enhanced geothermal systems | L |
| Geothermal electricity generation | L |
| Hot fractured rock | Z |
| Reservoir management | L |
| Hydropower | H |
| Hydroturbine technology | H |
| Micro hydropower | H |
| Small hydropower | H |
| Ocean energy technology | Z |
| Photovoltaics | M |
| PV building applications | L |
| PV cells | L |
| PV components | Z |
| PV concentrators | Z |
| PV integration | L |
| PV mains grid connection | L |
| PV manufacturing processes | L |
| PV materials | M |
| PV modules | M |
| PV socio-economics | L |
| PV systems | M |
| Solar thermal technology | M |
| Solar concentrating technology | H |
| Solar chemical reactors | M |
| Solar dish technology | Z |
| Solar tower technology | Z |
| Solar trough technology | M |
| Solar flate-plate collectors and systems | H |
| Wave Energy | L |
| Tidal current technology | Z |
| Wave energy technology | L |
| Offshore mooring | L |
| Offshore power transmission | Z |
| Submersible turbine technology | L |
| Wave hydrodynamics | L |
| Wells turbine technology | Z |
| Wind energy technology | H |
| Environmental technology | M |

## *Annex B:/ How PF7 / priority 5 – Energy, RES areas only / fits to Bulgaria and SMEs*

Upon the release on behalf of the EC of the formal proposal on the FP7, the Bulgarian Ministry of education and Science will organize a country-wide discussion with the participation of all stakeholders in the field of research and innovations to discuss the nature and relevance of the measures planned.

## *B) How Seventh Framework Programme (Priority 5. ENERGY, renewable energy related areas only) fits to Bulgaria and SMEs*

| **Area "1": Hydrogen and fuel cells** | |
|---|---|
| 1. Problems important for Bulgaria research community | Research on hydrogen production from biomass |
| 2. Problems important for Bulgarian economy and society | Hydrogen production from off pick wind energy generation |
| 3. Problems important for Bulgarian SMEs. Select importance: **low importance** | Fuel cells for stationary applications, based on biogas |

| Area "2": Renewable electricity generation | |
|---|---|
| 1. Problems important for Bulgarian research community | Biomass for electricity and heat production in co-generation<br>Biomass for electricity and heat production in co-generation<br>Choice of the optimal technology for biomass co-firing based on the economic and ecological evaluation (LCA analysis). |
| 2. Problems important for Bulgarian economy and society | Elaboration of methods of quick and efficient upgrading of electrical grid and local networks to survive the peak input (in short time) from wind parks<br>The need for SO2, NOx i CO2 emission reduction resulting from the Kyoto Protocol. |
| 3. Problems important for Bulgarian SMEs<br>Select importance: **high importance** | Development of agricultural biogas (co-fermentation) technologies<br>Development of power electronic converters and their related control for wind power and photovoltaics as well as small scale biogas<br>Pre-treatment and preparation of biomass derived solid fuels (pellets, briquettes) for large and small scale electricity generation. |

| Area “3”: Renewable fuel production | |
|---|---|
| 1. Problems important for Bulgarian research community | Development of technologies for hydrogen separation from gases generated by different conversion methods of biomass and wastes<br>integrated production of energy and other added-value products through biorefinery (so called agro-energy complexes) |
| 2. Problems important for Bulgarian economy and society | Rational exploitation of agricultural potential to cultivate biomass used for energy production<br>Increasing of employment in agriculture sector through larger introduction of biomass plantation and biomass processing for energy purposes<br>Research on the evaluation of rational policy and instruments towards biofuels promotion. |
| 3. Problems important for Bulgarian SMEs Select importance: **medium importance** | Biomass pre-treatment in relation to EU standards development for solid biofuels<br>Local/small scale production of liquid biofuels for transportation |

| Area "4": Renewables for heating and cooling | |
|---|---|
| 2. Problems important for Bulgarian economy and society | District and/or dedicated space heating and cooling, building integration and energy storage.<br>Adequate balancing of centralized (district heating and cooling) and decentralized systems for heating and cooling<br>Competition over biomass resources for heating and electricity generation |
| 3. Problems important for Bulgarian SMEs Select importance: **high importance** | Small scale biomass boilers for heating and cogeneration of heat and power based on renewables and especially biomass (gasification)<br>Combination of solar collectors with heat pumps and energy storage<br>Development of more efficient and cheaper solar thermal collectors |

| Area "7": Smart energy networks | |
|---|---|
| 1. Problems important for Bulgarian research community | Development and demonstration of key enabling technologies<br>Development of converters permitting bidirectional power flow |
| 2. Problems important for Bulgarian economy and society | Integration of large-scale deployment of distributed power generation<br>based renewable energy sources, both at national and regional (distribution and low voltage systems)<br>Integration of the development of distributed generation |
| 3. Problems important for Bulgarian SMEs Select importance: **medium importance** | Creation of local electricity balancing areas based on renewable energy generation<br>Integration of small scale renewable energy electricity generation technologies |

| Area "8": Energy efficiency and savings | |
|---|---|
| 1. Problems important for Bulgarian research community | Development of methodologies for EM (energy management) and DSM (demand site management)<br>Optimization, validation and demonstration of new concepts and technologies for residential and tertiary buildings<br>Development of eco- cities and eco-communities<br>LCA – Life Cycle Assessment of energy systems |
| 2. Problems important for Bulgarian economy and society | Thermal modernization of buildings with implementation of solar architecture and renewables<br>Refurbishment and optimization of local community district heating energy systems |
| 3. Problems important for Bulgarian SMEs Select importance: **high importance** | Introduction of better methods on line energy consumption measurement (buildings and industrial processes)<br>Integration of solar energy with traditional energy conservation schemes |

| Area "9": Knowledge for energy policy making | |
|---|---|
| 1. Problems important for Bulgarian research community | Assessment of energy External Costs<br>Techno-economic optimization of thermal processes and energy management.<br>Grid integration of renewable energy sources – policy issues and legislation<br>Implementation of presently used tools and models for energy policy appraisal as well as participation in their development<br>Thermodynamic and economic problems of environmental protection.<br>Mathematical modeling of market support mechanisms for renewable and CHP electricity – modeling technical, economic and policy measures of RES-E support |
| 2. Problems important for Bulgarian economy and society | Scientific support for the development long-term energy policy, especially with regard to energy security and role of domestic resources including especially RES, which would be followed by all political groups<br>Harmonization and coordination of support policies devoted for the implementation of the EU RES directives and programs<br>Efficient support for distributed generation in relation to RES-E and CHP<br>Sustainable biomass availability for various energy and non energy purposes |
| 3. Problems important for Bulgarian SMEs Select importance: **high importance** | Market studies and loner term competitiveness of small scale technologies (standing alone and grid connected)<br>Barriers removal and competitiveness of distributed generation<br>Introduction of technology innovation model with public support into business model of SMEs active on renewable energy market |

## RESPONDEE ADMINISTRATIVE DETAILS

| Institution | | | |
|---|---|---|---|
| **Name** | **The Hungarian Science and Technology Foundation** | | |
| **Country** | Hungary | | |
| **Postal address** | Pf. 38., 1255 Budapest, Hungary | | |
| **Type of organization,** *mark YES, where appropriate* | SME, | RTD, | Other, Not for profit organization |
| **Contact person** | | | |
| **Name** | Karácsonyi | | |
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| | |
|---|---|
| **Consultation with (if was done also out of the host organisation):** | Géza Mészáros, Central Hungarian Innovation Centre |
| **Distribution agreement (Yes/No)** | Yes |

## *A) Energy and renewable energy technological RTD priorities in CEEC- Hungary* (Questionnaires addressed to RESCUE project partners and SMEs in CEEC)

| **Energy technology** | **Priorities:**<br>*Mark: high (H), medium(M), low(L), zero(Z)* |
|---|---|
| General power technology | M |
| Decentralised power generation | H |
| Electricity grid control system | M |
| Power distribution | M |
| Power transmission | L |
| Powerline communication system | M |
| Storage | M |
| Energy storage | M |
| Cold storage | Z |
| Electrochemical storage | L |
| Batteries | M |
| Battery active materials | M |
| Gas Storage | L |
| Heat Storage | M |
| Mechanical storage | L |
| Compressed air technology | L |
| Combustion | M |
| Fuel combustion | H |
| Combustion control systems | M |
| Combustion monitoring systems | M |
| Others | M |
| Gas cleaning | M |
| Natural resources exploration | M |
| Deep water exploitation | L |
| Offshore technology | M |
| Pipeline technology | M |
| Generation of electricity | M |
| Combined heat power systems | H |
| Generation of heat | M |
| Heat pumps | M |
| Hybrid energy systems | M |
| Rational use of energy | M |
| | |
| Renewable Energies | |
| Bioenergy | H |
| Biofuels | H |
| Gaseous biofuels | H |
| Liquid biofuels | H |
| Solid biofuels | H |
| Biomass | H |
| Anaerobic fermentation | H |
| Biofuels for transport | H |
| Biomass combustion | H |
| Biomass gasification | H |
| Biomass hydrolysis fermentation | H |
| Biomass pre-processing | H |
| Biomass pyrolysis | H |

| | |
|---|---|
| Bioresidues | H |
| Energy crops | H |
| Biogas production | H |
| Geothermal Energy Technology | H |
| Deep drilling | M |
| Deep geothermal resources | H |
| Direct geothermal heat use | H |
| Enhanced geothermal systems | L |
| Geothermal electricity generation | M |
| Hot fractured rock | Z |
| Reservoir management | M |
| Hydropower | L |
| Hydroturbine technology | M |
| Micro hydropower | M |
| Small hydropower | M |
| Ocean energy technology | Z |
| Photovoltaics | M |
| PV building applications | M |
| PV cells | L |
| PV components | L |
| PV concentrators | L |
| PV integration | M |
| PV mains grid connection | L |
| PV manufacturing processes | M |
| PV materials | M |
| PV modules | M |
| PV socio-economics | M |
| PV systems | M |
| Solar thermal technology | M |
| Solar concentrating technology | Z |
| Solar chemical reactors | L |
| Solar dish technology | Z |
| Solar tower technology | M |
| Solar trough technology | M |
| Solar flate-plate collectors and systems | H |
| Wave Energy | Z |
| Tidal current technology | Z |
| Wave energy technology | Z |
| Offshore mooring | Z |
| Offshore power transmission | Z |
| Submersible turbine technology | Z |
| Wave hydrodynamics | Z |
| Wells turbine technology | Z |
| Wind energy technology | H |
| Environmental technology | H |

## *B) How the Seventh Framework Programme (Priority 5. ENERGY, renewable energy related areas only) fits to CEEC (Hungary) and SMEs*

*As per the 'Proposal for a COUNCIL DECISION Concerning the Specific Programme "Cooperation" implementing the Seventh Framework Programme (2007-13) of the European Community for research,technological development and demonstration activities, 5. ENERGY, Sept 2005'*

| **Area "1": Hydrogen and fuel cells** | |
|---|---|
| The integrated research and deployment strategy developed by the European Hydrogen and Fuel Cell Technology Platform provides the basis for a strategic, integrated programme for transport, stationary and portable applications, aimed at providing a strong technological foundation for building a competitive EU fuel cell and hydrogen supply and equipment industry. The programme will comprise: fundamental and applied research and technological development; large-scale demonstration ("lighthouse") projects to validate research results and provide feedback for further research; cross-cutting and socioeconomic research activities to underpin sound transition strategies and provide a rational basis for policy decisions and market framework development. The industrial applied research, demonstration and cross-cutting activities of the programme will preferably be implemented through the Joint Technology Initiative. This strategically managed, goal-oriented action will be complemented and closely co-ordinated with more upstream collaborative research effort aimed at achieving breakthrough on critical materials, processes and emerging technologies. | |
| 1. Area importance for Hungary (high, medium, low, zero) | Low to Medium |
| 2. Problems important for the Hungarian research community | Co-ordinated national research program.<br>Creating financial resources for the hydrogen energy related research activities.<br>Improving the connections to the European organisations dealing with the hydrogen and fuel cell R&D (eg. Hungarian participation in the work of the European Hydrogen and Fuel Cell Technology Platform). |
| 3. Problems important for the Hungarian economy and society | Increasing the importance of the hydrogen and fuel cells in the Hungarian national energy policy.<br>Improving the publicity and knowledge about the future hydrogen oriented society. |
| 4. Problems important for the Hungarian SMEs. Select importance: (high, medium, low, zero)<br>**– low importance** | Creating financial resources for the successful participation in the international research programmes – high importance<br>Enlarge the capacities for R&D activities – medium importance<br>Improving the international connections to the co-operation with foreign companies in R&D projects – medium importance |

| Area “2”: Renewable electricity generation | |
|---|---|
| Development and demonstration of integrated technologies for electricity production from renewables, suited to different regional conditions, in order to provide the means to raise substantially the share of renewable electricity production in the EU. Research should increase overall conversion efficiency, significantly drive down the cost of electricity, enhance process reliability and further reduce the environmental impact. Emphasis will be on photovoltaics, wind and biomass (including biodegradable fraction of waste). Furthermore, research will aim at realising the full potential of other renewable energy sources: geothermal, thermal solar, ocean and small hydropower. | |
| 1. Problems important for the Hungarian research community | Creating co-ordinated national R&D programme regarding the development of the renewable energy based power generation.<br>Focusing on the agricultural origin biomass, bioethanol and biogas technologies.<br>Optimization of the technology mix in the power generation. |
| 2. Problems important for the Hungarian economy and society | Creating technical and business conditions for the larger amount of wind power generation (connections to the grid, backup capacities etc.).<br>To meet the requirements of the international climate change agreements (Kyoto Protocol etc.) |
| 3. Problems important for the Hungarian SMEs<br>Select importance: (high, medium, low, zero)<br>**-high importance** | Harmonised development of the agriculture and the renewable energy sector – high importance<br>Clear role of the SME-s in the regional development programmes especially in the field of renewable energy – medium importance |

| Area "3": Renewable fuel production | |
|---|---|
| Development and demonstration of improved conversion technologies for the sustainable production and supply chains of solid, liquid and gaseous fuels from biomass (incl. biodegradable fraction of waste), in particular biofuels for transport. Emphasis should be on new types of biofuels as well as on new production and distribution routes for existing biofuels, including the integrated production of energy and other added-value products through biorefineries. Aiming to deliver 'source to user' carbon benefits, research will focus on improving energy efficiency, enhancing technology integration and use of feedstock. Issues such as feedstock logistics, pre-normative research and standardisation for safe and reliable use in transport and stationary applications will be included. To exploit the potential for renewable hydrogen production, biomass, renewable electricity and solar energy driven processes will be supported. | |
| 1. Problems important for the Hungarian research community | Development and demonstration of improved renewable fuel production and conversion technologies<br>New technologies and new types of renewable fuels.<br>Improving the efficiency and reliability of the existing technologies |
| 2. Problems important for the Hungarian economy and society | Creating complex and harmonized programme to the development of the agriculture, the renewable fuel production and the regional development.<br>Research on the evaluation of the production and utilisation of biofuels comparing the fossil fuels in the frame of the energy policy, and development of instruments for the biofuels promotion |
| 3. Problems important for the Hungarian SMEs<br><br>Select importance: (high, medium, low, zero) | Improving the conditions of the agricultural production for biofuel production – high importance<br>Local production and utilisation of biofuels for internal combustion engines – **medium importance** |

| Area "4": Renewables for heating and cooling | |
|---|---|
| Development and demonstration of a portfolio of technologies to increase the potential of heating and cooling from renewable energy sources to contribute to sustainable energy. The aim is to achieve substantial cost reductions, increase efficiencies, further reduce environmental impacts and optimise the use of technologies in different regional conditions. Research and demonstration should include new systems and components for industrial applications (incl. thermal seawater desalination), district and/or dedicated space heating and cooling, building integration and energy storage. | |
| 1. Problems important for the Hungarian research community | Introduction of passive solar systems in the building sector<br>Developing new technologies for the combined solar heating and cooling systems<br>New technologies for active solar thermal utilisation |
| 2. Problems important for the Hungarian economy and society | Developing cheep and easy technologies for the renewable energy based heating and cooling in the household sector<br>Education programmes for the solar energy utilisation<br>Awareness raising for the promotion of the dissemination of the solar thermal technologies |
| 3. Problems important for the Hungarian SMEs<br><br>Select importance: (high, medium, low, zero) | Development of small scale biomass boilers for heating and co-generation – medium importance<br>Development of gasification technologies – medium importance<br>Development of heat pumps and energy storage – low importance<br>Development of more efficient and cheaper solar thermal collectors – medium importance<br>Combining the different types of renewables in the heating and cooling systems **– medium importance** |

| Area "7": Smart energy networks | |
|---|---|
| To facilitate the transition to a more sustainable energy system, a wide-ranging R&D effort is required to increase the efficiency, flexibility, safety and reliability of the European electricity and gas systems and networks. For electricity networks, the goals of transforming the current electricity grids into a resilient and interactive (customers/operators) service network and removing the obstacles to the large-scale deployment and effective integration of renewable energy sources and distributed generation (e.g. fuel cells, microturbines, reciprocating engines), will also necessitate the development and demonstration of key enabling technologies (e.g. innovative ICT solutions, storage technologies for RES, power electronics and HTS devices). For gas networks, the objective is to demonstrate more intelligent and efficient processes and systems for gas transport and distribution, including the effective integration of renewable energy sources. | |
| 1. Problems important for the Hungarian research community | Integration of renewable energy technologies and distributed generation.<br>More intelligent and efficient processes and systems for gas transport and distribution. |
| 2. Problems important for the Hungarian economy and society | Integration of concentrated large-scale power generation and distributed power generation.<br>Improving the safety of power supply.<br>Integration of renewable energy sources into the gas transport and distribution systems. |
| 3. Problems important for the Hungarian SMEs Select importance: (high, medium, low, zero) | Improving the safety of power supply on local level – medium importance<br>Integration of renewable energy sources into the electricity and gas systems – **medium importance** |

<table>
<tr><th colspan="2">Area "8": Energy efficiency and savings</th></tr>
<tr><td colspan="2">The vast potential for energy savings and improvements in energy efficiency need to be harnessed through the optimisation, validation and demonstration of new concepts and technologies for buildings, services and industry. This incorporates the combination of sustainable strategies and technologies for increased energy efficiency, the use of renewable energy and poly-generation and the integration of demand management systems at large scale in cities and communities. These large-scale actions may be supported by innovative R&D addressing specific components or technologies, e.g. for poly-generation and ecobuildings. A key aim is the optimisation of the local community energy system, balancing a significant reduction in energy demand with the most affordable and sustainable supply solution, including the use of new fuels in dedicated fleets.</td></tr>
<tr><td>1. Problems important for the Hungarian research community</td><td>Optimisation of community energy systems<br>Innovative R&D actions addressing specific components or technologies for increasing energy savings</td></tr>
<tr><td>2. Problems important for the Hungarian economy and society</td><td>Combination of sustainable strategies and technologies for increased energy efficiency<br>Significant reduction of energy demand in the industry, transport and household sector<br>Improving energy efficiency of the industry<br>Development programmes for eco-cities and eco-communities</td></tr>
<tr><td>3. Problems important for the Hungarian SMEs<br><br>Select importance: (high, medium, low, zero)</td><td>Improving technical and economical conditions of an effective energy efficiency activity – high importance<br>Integration of energy saving and renewable energy technologies – medium importance</td></tr>
</table>

| Area “9”: Knowledge for energy policy making | |
|---|---|
| Development of tools, methods and models to assess the main economic and social issues related to energy technologies. Activities will include the building of databases and scenarios for an enlarged EU and the assessment of the impact of energy and energy-related policies on security of supply, environment, society and competitiveness of the energy industry. Of particular importance is the impact of technological progress on EU policies. | |
| 1. Problems important for the Hungarian research community | Comparative assessment of the of the different energy technologies incl. traditional and new and renewable energies.<br>Development of methods and models to assess the economic and social effects of the new energy technologies.<br>Complex methods to evaluate the economic, ecologic and technical conditions and consequences of the introduction of new energy technologies. |
| 2. Problems important for the Hungarian economy and society | Harmonisation of the energy and environmental policies concerning the dissemination of the renewable energy technologies.<br>Scientific support for the development long-term energy policy, with the participation of the relevant actors and followed by all political interest groups.<br>Introduction and implementation of the RES an EE related EU directives. |
| 3. Problems important for the Hungarian SMEs<br><br>Select importance: (high, medium, low, zero) | Improving market conditions for the wider utilisation of renewable energy technologies – high importance<br>Improving the background of the R&D and technology innovation activities of the SME-s<br>**– medium importance** |

## RESPONDEE ADMINISTRATIVE DETAILS

| Institution | | | |
|---|---|---|---|
| **Name** | **Kaunas University of Technology – KTU** | | |
| **Country** | LITHUANIA | | |
| **Postal address** | Donelaicio 73, LT-44029 Kaunas, Lithuania | | |
| **Type of organization**, *mark YES, where appropriate* | SME, | RTD,<br>Yes | Other (University),<br>Yes |
| **Contact person** | | | |
| **Name** | Vytautas | | |
| **First name** | Adomavicius | | |
| **Telephone** | +370 37 351181 | | |
| **Fax** | +370 37 351181 | | |
| **e-mail** | vytautas.adomavicius@ktu.lt; vytas@topolis.ktu.lt | | |

| | |
|---|---|
| **Consultation with (if was done also out of the host organisation):** | No |
| **Distribution agreement (Yes/No)** | Yes |

## *A) Energy and renewable energy technological RTD priorities in CEEC- Lithuania*

| **Energy technology** | **Priorities:** *Mark: high (H), medium (M), low (L), zero (Z)* |
|---|---|
| General power technology | M |
| Decentralised power generation | H |
| Electricity grid control system | M |
| Power distribution | M |
| Power transmission | L |
| Powerline communication system | M |
| Storage | M |
| Energy storage | M |
| Cold storage | Z |
| Electrochemical storage | L |
| Batteries | M |
| Battery active materials | M |
| Gas Storage | M |
| Heat Storage | M |
| Mechanical storage | L |
| Compressed air technology | L |
| Combustion | M |
| Fuel combustion | H |
| Combustion control systems | M |
| Combustion monitoring systems | M |
| Others | M |
| Gas cleaning | M |
| Natural resources exploration | M |
| Deep water exploitation | L |
| Offshore technology | M |
| Pipeline technology | M |
| Generation of electricity | M |
| Combined heat power systems | H |
| Generation of heat | M |
| Heat pumps | M |
| Hybrid energy systems | M |
| Rational use of energy | M |
| | |
| Renewable Energies | |
| Bioenergy | H |
| Biofuels | H |
| Gaseous biofuels | H |
| Liquid biofuels | H |
| Solid biofuels | H |
| Biomass | H |
| Anaerobic fermentation | H |
| Biofuels for transport | H |
| Biomass combustion | H |
| Biomass gasification | M |
| Biomass hydrolysis fermentation | M |
| Biomass pre-processing | M |
| Biomass pyrolysis | L |
| Bioresidues | H |

| | |
|---|---|
| Energy crops | H |
| Biogas production | H |
| Geothermal Energy Technology | M |
| Deep drilling | M |
| Deep geothermal resources | M |
| Direct geothermal heat use | H |
| Enhanced geothermal systems | L |
| Geothermal electricity generation | L |
| Hot fractured rock | Z |
| Reservoir management | M |
| Hydropower | M |
| Hydroturbine technology | M |
| Micro hydropower | H |
| Small hydropower | H |
| Ocean energy technology | Z |
| Photovoltaics | L |
| PV building applications | M |
| PV cells | L |
| PV components | Z |
| PV concentrators | Z |
| PV integration | M |
| PV mains grid connection | L |
| PV manufacturing processes | M |
| PV materials | M |
| PV modules | M |
| PV socio-economics | M |
| PV systems | M |
| Solar thermal technology | M |
| Solar concentrating technology | Z |
| Solar chemical reactors | L |
| Solar dish technology | Z |
| Solar tower technology | Z |
| Solar trough technology | M |
| Solar flate-plate collectors and systems | H |
| Wave Energy | L |
| Tidal current technology | Z |
| Wave energy technology | L |
| Offshore mooring | L |
| Offshore power transmission | Z |
| Submersible turbine technology | L |
| Wave hydrodynamics | L |
| Wells turbine technology | Z |
| Wind energy technology | H |
| Environmental technology | M |

## *B) How Seventh Framework Programme (Priority 5. ENERGY, renewable energy related areas only) fits to Lithuania and SMEs*

| **Area "1": Hydrogen and fuel cells** | |
|---|---|
| The integrated research and deployment strategy developed by the European Hydrogen and Fuel Cell Technology Platform provides the basis for a strategic, integrated programme for transport, stationary and portable applications, aimed at providing a strong technological foundation for building a competitive EU fuel cell and hydrogen supply and equipment industry. The programme will comprise: fundamental and applied research and technological development; large-scale demonstration ("lighthouse") projects to validate research results and provide feedback for further research; cross-cutting and socioeconomic research activities to underpin sound transition strategies and provide a rational basis for policy decisions and market framework development. The industrial applied research, demonstration and cross-cutting activities of the programme will preferably be implemented through the Joint Technology Initiative. This strategically managed, goal-oriented action will be complemented and closely co-ordinated with more upstream collaborative research effort aimed at achieving breakthrough on critical materials, processes and emerging technologies. | |
| 1. Area importance for Lithuania (high, medium, low, zero) | Low for the nearest 10 years |
| 2. Problems important for Lithuanian research community | Demonstration facility with different types of fuel cells, mainly: PEM and SOFC<br>Comparison of efficiency of various technologies of satisfying final demand for transport or electricity supply<br>Research on hydrogen production from biomass and from off pick wind energy generation |
| 3. Problems important for Lithuanian economy and society | Evaluation of possibilities for common hydrogen economy in Lithuania and hydrogen supply from domestic resources.<br>Application of hydrogen for mobile vehicles<br>Hydrogen production from off pick wind energy generation |
| 4. Problems important for Lithuanian SMEs. Select importance: (high, medium, low, zero)<br>**– low importance** | Fuel cells for stationary applications, based on biogas, bio-ethanol and bio-diesel<br>Hydrogen production from wind energy |

| Area “2”: Renewable electricity generation | |
|---|---|
| Development and demonstration of integrated technologies for electricity production from renewables, suited to different regional conditions, in order to provide the means to raise substantially the share of renewable electricity production in the EU. Research should increase overall conversion efficiency, significantly drive down the cost of electricity, enhance process reliability and further reduce the environmental impact. Emphasis will be on photovoltaics, wind and biomass (including biodegradable fraction of waste). Furthermore, research will aim at realising the full potential of other renewable energy sources: geothermal, thermal solar, ocean and small hydropower. | |
| 1. Problems important for Lithuanian research community | Biomass and waste co-firing for electricity and heat production in co-generation<br>Biomass and waste gasification for electricity and heat production in co-generation.<br>Use of lignocelluloses based ethanol and rape derived esters for electricity production in heat and power industry.<br>Choice of the optimal technology for biomass co-firing based on the economic and ecological evaluation (LCA analysis).<br>Environmental friendly utilisation of local hydro energy potential.<br>Cost-effective and environmental friendly (low noise) small-scale WT (up to 100 kW) for homesteads and farmsteads. |
| 2. Problems important for Lithuanian economy and society | Elaboration of methods of quick and efficient upgrading of electrical grid and local networks to survive the peak input (in short time) from wind parks.<br>Development of small-scale environmental friendly hydropower systems (up to 10 MW).<br>Development of small-scale cost-effective WT (up to 100 kW) for homesteads and farmsteads. |
| 3. Problems important for Lithuanian SMEs<br>Select importance: (high, medium, low, zero)<br>**-high importance** | Development of agricultural biogas (co-fermentation) technologies<br>Pre-treatment and preparation of biomass derived solid fuels (pellets, briquettes) for large (e.g. biomass esterification) and small-scale electricity generation.<br>Development of cost-effective and efficient electrical generators for small-scale WT. |

| Area "3": Renewable fuel production | |
|---|---|
| Development and demonstration of improved conversion technologies for the sustainable production and supply chains of solid, liquid and gaseous fuels from biomass (incl. biodegradable fraction of waste), in particular biofuels for transport. Emphasis should be on new types of biofuels as well as on new production and distribution routes for existing biofuels, including the integrated production of energy and other added-value products through biorefineries. Aiming to deliver 'source to user' carbon benefits, research will focus on improving energy efficiency, enhancing technology integration and use of feedstock. Issues such as feedstock logistics, pre-normative research and standardisation for safe and reliable use in transport and stationary applications will be included. To exploit the potential for renewable hydrogen production, biomass, renewable electricity and solar energy driven processes will be supported. | |
| 1. Problems important for Lithuanian research community | Development of technologies for hydrogen separation from gases generated by different conversion methods of biomass and wastes.<br>Integrated production of energy and other added-value products through biorefineries (so called agro-energy complexes).<br>New production and distribution routes for biofuels (existing and new ones). |
| 2. Problems important for Lithuanian economy and society | Rational exploitation of agricultural potential to cultivate biomass used for energy production.<br>Increasing of employment in agriculture sector through larger introduction of biomass plantation and biomass processing for energy purposes.<br>Lowering the level of biodegradable wastes landfilling.<br>Research on the evaluation of rational policy and instruments towards biofuels promotion. |
| 3. Problems important for Lithuanian SMEs Select importance: (high, medium, low, zero)<br>**- high importance** | Utilization (combustion) of liquid biofuels in engines and stationary boilers (due to the high price of heating oil).<br>Biomass pre-treatment in relation to EU standards development for solid biofuels.<br>Local/small scale production of liquid biofuels for transportation.<br>Cleaning, purification and utilization of biogas for transportation purposes. |

| Area "4": Renewables for heating and cooling | |
|---|---|
| Development and demonstration of a portfolio of technologies to increase the potential of heating and cooling from renewable energy sources to contribute to sustainable energy. The aim is to achieve substantial cost reductions, increase efficiencies, further reduce environmental impacts and optimise the use of technologies in different regional conditions. Research and demonstration should include new systems and components for industrial applications (incl. thermal seawater desalination), district and/or dedicated space heating and cooling, building integration and energy storage. | |
| 1. Problems important for Lithuanian research community | Solar passive systems – eco-buildings.<br>Solar energy storage: short and long term, including UTES – Underground Thermal Energy Storage and other technologies for heat storage (e.g. PCM – Phase change materials)<br>Development of Trigeneration and polygeneration concepts<br>New technologies for windows, reduction of solar energy input in summer (shading), increase of solar energy input in winter.<br>Heat and cool seasonal storage. |
| 2. Problems important for Lithuanian economy and society | District and/or dedicated space heating and cooling, building integration and energy storage.<br>Adequate balancing of centralized (district heating and cooling) and decentralized systems for heating and cooling<br>Competition over biomass resources for heating with its use for transportation fuels and electricity generation |
| 3. Problems important for Lithuanian SMEs<br>Select importance: (high, medium, low, zero)<br>**-medium importance** | Small scale biomass boilers for heating and cogeneration of heat and power based on renewables and especially biomass (gasification).<br>Combination of solar collectors with heat pumps and energy storage.<br>Development of more efficient and cheaper solar thermal collectors. |

| Area "7": Smart energy networks | |
|---|---|
| To facilitate the transition to a more sustainable energy system, a wide-ranging R&D effort is required to increase the efficiency, flexibility, safety and reliability of the European electricity and gas systems and networks. For electricity networks, the goals of transforming the current electricity grids into a resilient and interactive (customers/operators) service network and removing the obstacles to the large-scale deployment and effective integration of renewable energy sources and distributed generation (e.g. fuel cells, microturbines, reciprocating engines), will also necessitate the development and demonstration of key enabling technologies (e.g. innovative ICT solutions, storage technologies for RES, power electronics and HTS devices). For gas networks, the objective is to demonstrate more intelligent and efficient processes and systems for gas transport and distribution, including the effective integration of renewable energy sources. | |
| 1. Problems important for Lithuanian research community | Demonstration of effective integration of renewable energy sources and distributed generation (e.g. fuel cells, microturbines, reciprocating engines)<br>Development and demonstration of key enabling technologies (storage technologies for RES, power electronics, storage devices (supercapcitors, redox batteries).<br>Development of converters permitting bidirectional power flow.<br>Development of sufficient (hundreds of MW) smoothly adjustable electricity generating powers operating in the Lithuanian Power System and necessary for the balancing of power received from the RES (mostly from WTs). |
| 2. Problems important for Lithuanian economy and society | Integration of large-scale deployment of distributed power generation based on renewable energy sources, both at national and regional (distribution and low voltage systems).<br>Integration of the development of distributed generation with refurbishment and development of low voltage grid.<br>Development and integration into the Lithuanian Power System of two additional smoothly adjustable hydroelectric generating sets (2 x 200 MW) in Kruonis Pumped Storage Power Plant (current capacity of Kruonis PSPP is 800 MW, the designed capacity – 1600 MW). |
| 3. Problems important for Lithuanian SMEs<br>Select importance: (high, medium, low, zero)<br>**- high to medium importance** | Creation of local electricity balancing areas based on renewable energy generation.<br>Integration of small-scale renewable energy electricity generation technologies.<br>Development of supporting schemes for introduction of net metering and development of own on site electricity generation. |

| Area "8": Energy efficiency and savings | |
|---|---|
| The vast potential for energy savings and improvements in energy efficiency need to be harnessed through the optimisation, validation and demonstration of new concepts and technologies for buildings, services and industry. This incorporates the combination of sustainable strategies and technologies for increased energy efficiency, the use of renewable energy and poly-generation and the integration of demand management systems at large scale in cities and communities. These large-scale actions may be supported by innovative R&D addressing specific components or technologies, e.g. for poly-generation and ecobuildings. A key aim is the optimisation of the local community energy system, balancing a significant reduction in energy demand with the most affordable and sustainable supply solution, including the use of new fuels in dedicated fleets. | |
| 1. Problems important for Lithuanian research community | Development of methodologies for EM (energy management) and DSM (demand site management).<br>Optimization, validation and demonstration of new concepts and technologies for residential and tertiary buildings.<br>Development of intelligent buildings.<br>Demonstration of eco-cities and eco-communities.<br>LCA – Life Cycle Assessment of energy systems. |
| 2. Problems important for Lithuanian economy and society | Revitalization of districts, cities and communities (building sector consumes the main part of final energy consumption).<br>Thermal modernization of buildings with implementation of solar architecture and renewables.<br>Refurbishment and optimization of local community district heating energy systems. |
| 3. Problems important for Lithuanian SMEs<br>Select importance: (high, medium, low, zero)<br>- **medium importance** | Introduction of better methods on line energy consumption measurement (buildings and industrial processes) and its on line visualisation.<br>Implementation of efficient and proved method of energy auditing in housing sector and in industry.<br>Integration of solar and other renewable energy with traditional energy conservation schemes. |

<table>
<tr><th colspan="2">Area “9”: Knowledge for energy policy making</th></tr>
<tr><td colspan="2">Development of tools, methods and models to assess the main economic and social issues related to energy technologies. Activities will include the building of databases and scenarios for an enlarged EU and the assessment of the impact of energy and energy-related policies on security of supply, environment, society and competitiveness of the energy industry. Of particular importance is the impact of technological progress on EU policies.</td></tr>
<tr><td>1. Problems important for Lithuanian research community</td><td>Assessment of energy External Costs.<br>Techno-economic optimization of thermal processes and energy management.<br>Grid integration of renewable energy sources – policy issues and legislation.<br>Implementation of presently used tools and models for energy policy appraisal as well as participation in their development.<br>Exergy analysis, studies of cumulative energy and exergy consumption.<br>Thermodynamic and economic problems of environmental protection.<br>Mathematical modeling of market support mechanisms for renewable and CHP electricity – modeling technical, economic and policy measures of RES-E support.</td></tr>
<tr><td>2. Problems important for Lithuanian economy and society</td><td>Scientific support for the development long-term energy policy, especially with regard to energy security and role of domestic resources including especially RES, which would be followed by all political groups.<br>Harmonization and coordination of support policies devoted for the implementation of the EU RES directives and programs.<br>Efficient support for distributed generation in relation to RES-E and CHP.<br>Sustainable biomass availability for various energy and non-energy purposes.</td></tr>
<tr><td>3. Problems important for Lithuanian SMEs<br>Select importance: (high, medium, low, zero)<br>- medium importance</td><td>Market studies and longer term competitiveness of small-scale technologies (standing alone and grid connected).<br>Barriers removal and competitiveness of distributed generation.<br>Introduction of technology innovation model with public support into business model of SMEs active on renewable energy market.</td></tr>
</table>

## RESPONDEE ADMINISTRATIVE DETAILS

<table>
<tr><th colspan="4">Institution</th></tr>
<tr><td>Name</td><td colspan="3">Latvian Technological Center</td></tr>
<tr><td>Country</td><td colspan="3">LV</td></tr>
<tr><td>Postal address</td><td colspan="3">Str.Aizkraukles 21, Riga, LV-1006</td></tr>
<tr><td>Type of organization, mark YES, where appropriate</td><td>SME,</td><td>RTD,</td><td>Other – Yes (Foundation)</td></tr>
<tr><th colspan="4">Contact person</th></tr>
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</table>

| | |
|---|---|
| **Consultation with (if was done also out of the host organisation):** | Institute of Physical Energetics, Latvian Academy of Sciences |
| **Distribution agreement (Yes/No)** | Yes |

## *A) Energy and renewable energy technological RTD priorities in CEEC- Latvia*

| **Energy technology** | **Priorities:** *Mark: high (H), medium(M), low(L), zero(Z)* |
|---|---|
| General power technology | M |
| Decentralised power generation | H |
| Electricity grid control system | M |
| Power distribution | H |
| Power transmission | M |
| Powerline communication system | L |
| Storage | M |
| Energy storage | M |
| Cold storage | Z |
| Electrochemical storage | L |
| Batteries | L |
| Battery active materials | L |
| Gas Storage | M |
| Heat Storage | H |
| Mechanical storage | L |
| Compressed air technology | L |
| Combustion | M |
| Fuel combustion | H |
| Combustion control systems | M |
| Combustion monitoring systems | M |
| Others | M |
| Gas cleaning | M |
| Natural resources exploration | M |
| Deep water exploitation | Z |
| Offshore technology | L |
| Pipeline technology | M |
| Generation of electricity | H |
| Combined heat power systems | H |
| Generation of heat | H |
| Heat pumps | L |
| Hybrid energy systems | M |
| Rational use of energy | H |
| | |
| Renewable Energies | |
| Bioenergy | H |
| Biofuels | H |
| Gaseous biofuels | H |
| Liquid biofuels | H |
| Solid biofuels | H |
| Biomass | H |
| Anaerobic fermentation | H |
| Biofuels for transport | H |
| Biomass combustion | H |
| Biomass gasification | M |
| Biomass hydrolysis fermentation | M |
| Biomass pre-processing | M |
| Biomass pyrolysis | L |
| Bioresidues | M |

| | |
|---|---|
| Energy crops | M |
| Biogas production | H |
| Geothermal Energy Technology | L |
| Deep drilling | L |
| Deep geothermal resources | L |
| Direct geothermal heat use | Z |
| Enhanced geothermal systems | Z |
| Geothermal electricity generation | Z |
| Hot fractured rock | Z |
| Reservoir management | L |
| Hydropower | H |
| Hydroturbine technology | H |
| Micro hydropower | H |
| Small hydropower | H |
| Ocean energy technology | Z |
| Photovoltaics | M |
| PV building applications | M |
| PV cells | H |
| PV components | H |
| PV concentrators | M |
| PV integration | M |
| PV mains grid connection | M |
| PV manufacturing processes | M |
| PV materials | H |
| PV modules | M |
| PV socio-economics | M |
| PV systems | M |
| Solar thermal technology | M |
| Solar concentrating technology | M |
| Solar chemical reactors | L |
| Solar dish technology | M |
| Solar tower technology | M |
| Solar trough technology | M |
| Solar flate-plate collectors and systems | M |
| Wave Energy | Z |
| Tidal current technology | Z |
| Wave energy technology | Z |
| Offshore mooring | Z |
| Offshore power transmission | Z |
| Submersible turbine technology | Z |
| Wave hydrodynamics | Z |
| Wells turbine technology | Z |
| Wind energy technology | H |
| Environmental technology | H |

## *B) How Seventh Framework Programme (Priority 5. ENERGY, renewable energy related areas only) fits* ***to Latvia and SMEs***

| **Area "1": Hydrogen and fuel cells** | |
|---|---|
| The integrated research and deployment strategy developed by the European Hydrogen and Fuel Cell Technology Platform provides the basis for a strategic, integrated programme for transport, stationary and portable applications, aimed at providing a strong technological foundation for building a competitive EU fuel cell and hydrogen supply and equipment industry. The programme will comprise: fundamental and applied research and technological development; large-scale demonstration ("lighthouse") projects to validate research results and provide feedback for further research; cross-cutting and socioeconomic research activities to underpin sound transition strategies and provide a rational basis for policy decisions and market framework development. The industrial applied research, demonstration and cross-cutting activities of the programme will preferably be implemented through the Joint Technology Initiative. This strategically managed, goal-oriented action will be complemented and closely co-ordinated with more upstream collaborative research effort aimed at achieving breakthrough on critical materials, processes and emerging technologies. | |
| 1. Area importance for Latvia (high, medium, low, zero) | At the moment - **low**, but with higher perspective in next 5 years. |
| 2. Problems important for Latvian research community | Research of equipment and energetic materials of hydrogen that would promote development of hydrogen as alternative energy source in Latvia. Very important issue is accumulation, storage and transportation of hydrogen (infrastructure of hydrogen). Similarly actual question is usage of hydrogen - procuring of hydrogen as fuel, using cells of fuels. But for increase of their efficiency and work safety, researches on electrodes and membrane materials, production of devices, testing as well as adjustment of electric parameters to existing distribution and transmission networks and consumers of electricity. Researches and testing are necessary in order to ensure that hydrogen energetic devices are used for production of heat and electricity simultaneously.<br>In this field of research in Latvia operates Institute of Physical Energetics and Institute of Solid State Physics, University of Latvia. |
| 3. Problems important for Latvia economy and society | It is necessary to carry out researches in order to be possible to start practical introduction of hydrogen energetics in economics – in supply of national and local institutions, as well as households with electricity and heat.<br>Evaluation of possibilities for common hydrogen economy in Latvia and hydrogen supply from domestic resources is important too, as well application of hydrogen for mobile vehicles.<br>It is necessary to build awareness of society by informing it on possibilities of use of hydrogen, in order to promote development of hydrogen as one of the alternative energy sources in Latvia – information in mass media, testing, demonstration measures etc. |
| 4. Problems important for Latvian SMEs. Select importance: (high, medium, low, zero) | **Low**<br>Only few enterprises are operating in this field, most active – middle sized enterprise "Hydro Energo" Ltd., small sized – "Energi-R" Ltd.<br>Most important problems for Latvian SMEs – fuel cells for stationary applications, electric and heat supply of households.<br>Technologies for industrial recovery of hydrogen from biomass for grid-connected fuel cells |

| Area "2": Renewable electricity generation | |
|---|---|
| Development and demonstration of integrated technologies for electricity production from renewables, suited to different regional conditions, in order to provide the means to raise substantially the share of renewable electricity production in the EU. Research should increase overall conversion efficiency, significantly drive down the cost of electricity, enhance process reliability and further reduce the environmental impact. Emphasis will be on photovoltaics, wind and biomass (including biodegradable fraction of waste). Furthermore, research will aim at realising the full potential of other renewable energy sources: geothermal, thermal solar, ocean and small hydropower. | |
| 1. Area importance for Latvia (high, medium, low, zero) | **High** |
| 2. Problems important for Latvian research community | 1) Organic waste as source of bio energy, evaluation of its usage technical, economical and environmental responsibility factors;<br>2) Scientific basis for load studies of Latvia electricity supply system;<br>3) Ecological and economical evaluation of energy recovery from organic waste thermal treatment using mathematical modeling methods;<br>4) Development of theoretical foundations for multipole (low-turn) asynchronous machines with moveless windings;<br>5) Elaboration of system for evaluation and optimal selection of organic waste treatment technologies on the bases of mathematical modeling methods;<br>6) Biodegradable composites from renewable resources;<br>7) Guidelines for the analysis of potential optimal locations for wind off-shore technologies - demonstration projects;<br>8) River electric power plants taking into consideration transients inside the plant;<br>9) To proceed the development of production of solar energy equipment;<br>10) Development capacity and quality of electricity by wind generators;<br>11) Assessing technical potential for generated electricity by biogas. |
| 3. Problems important for Latvian economy and society | 1) In 1995 fixed tariffs was created for electricity from renewable energy sources produced by small HEPP and wind plants in order to promote the development of RES in Latvia. In 2005 Law "On Energy" was amended and paragraphs that regulate the support for produced from renewable energy sources were excluded. Law "On electricity market" was adopted, but without fixed tariffs. Therefore support in form of fixed tariffs is not applied anymore, but meantime there are producers who continue to receive support according to previous signed agreements. Now regulations issued by the Cabinet of Ministers are under preparation in order to regulate procedure of pricing for electric energy produced by RES.<br>2) Quotation system for renewable energy capacity;<br>3) Bureaucracy and administrative barriers in issuing quotas;<br>4) Development of new small HEPP is limited due very strict Rule of Building new and reconstructing old small HEPP weirs on rivers issued by the Cabinet of Ministers;<br>5) Development of methods and means for optimal control of hydro units of the Daugava;<br>6) The amount of produced energy depends on water flow in river Daugava, therefore the share of renewable energy sources in electricity consumption fluctuates widely;<br>7) Revision of the existing norms for water level fluctuations and enhanced supervision of the compliance of the small HEPP to the laws and regulations controlling their activities;<br>8) The use of wind energy is determined by the fact that the velocity of the wind is the constant. This factor defies the operation of wind power plant installations, because energy deficit in grid has to be compensated from other resources during low energy yield;<br>9) More utilization of biomass in production of electric energy in co- |

| | |
|---|---|
| | generation stations;<br>10) More utilization the sources of obtaining biogas: biodegradable municipal waste, active slime, processed pig and cattle dung, animal waste, organic waste of food industry, green mass;<br>11) Now – no solar energy use for production of electricity, but with potential of producing 1kWe/per year in the future. |
| 4. Problems important for Latvian SMEs Select importance: (high, medium, low, zero) | **High**<br>1) The implementation of new environmentally friendly technologies in small hydroelectric power plants (HEPP) in order to increase their effectivity;<br>2) Development of new models of hydraulic turbines;<br>3) Development of fear pump technologies;<br>4) Decreasing negative impact of small HEPP on the environmental;<br>5) Development of equipment for wind speed measurement;<br>6) Composing of wind cadastre in Latvia<br>7) Development of small capacity (till 500kW) steam engines for electricity production ;<br>8) State Joint Stock Corporation LATVENERGO is monopoly company engaged in the production and sale of electricity and heating energy , also provides transmission and distribution services. Monopoly situation is the barrier for development of small producers of electricity;<br>9) High investment costs and long pay-back period of projects related with implementation of modern technologies in renewable electricity generation;<br>10) Too restrictive quotas and decreasing feed-in tariffs for newcomers in the market;<br>11) The costs of production of solar energy equipment are high;<br>12) The costs for setting up the installations of wind generators are high;<br>13) Technical and economical justifications of installations of wind turbines;<br>14) Production of biogas by fermentation of semi dry and liquid biomass and waste;<br>15) Biomass purification and concentrating. |

| **Area “3”: Renewable fuel production** | |
|---|---|
| Development and demonstration of improved conversion technologies for the sustainable production and supply chains of solid, liquid and gaseous fuels from biomass (incl. biodegradable fraction of waste), in particular biofuels for transport. Emphasis should be on new types of biofuels as well as on new production and distribution routes for existing biofuels, including the integrated production of energy and other added-value products through biorefineries. Aiming to deliver ‘source to user’ carbon benefits, research will focus on improving energy efficiency, enhancing technology integration and use of feedstock. Issues such as feedstock logistics, pre-normative research and standardisation for safe and reliable use in transport and stationary applications will be included. To exploit the potential for renewable hydrogen production, biomass, renewable electricity and solar energy driven processes will be supported. | |
| 1. Area importance for Latvia (high, medium, low, zero) | **High** |
| 2. Problems important for Latvian research community | 1) Environment – compatible fuels in the energy balance of Latvia: possibilities of production and use;<br>2) Determine the potential of biofuels, technical and non-technical barriers faced by the wider introduction of biofuels in the transport sector and related market issues in Latvia;<br>3) Simulation methods for the evaluation of the energetic, economic and environmental factors in the development of the Latvian fuel and energy complex;<br>4) Development of method of producing bio diesel fuel from used sustenance oils;<br>5) Development of new optimal content of used oils and fat composition to use for utilization of bio diesel fuel production.<br>6) Utilization of glycerol;<br>7) Additives to improve storage stability and low temperature characteristics of biodiesel;<br>8) Quality control of mixed fuels;<br>9) Further development of fuel cells fuelled by hydrogen from renewables;<br>10) Development of efficient technologies for timber and wood felling residues |
| 3. Problems important for Latvian economy and society | 1) The Law “On Biofuel” (2005) stipulates the use of bio-fuel in Latvia - determines to reach the target of biofuel share in proportion to total power intensity of transport fuel 2 % in 2005 and 5,75 % in 2010;<br>2) Stipulate the production of rapeseed and rapeseed oil to meet the demand for bio diesel;<br>3) Requires governmental support for producers of bio diesel and bio ethanol to reach the defined objectives in the Law “On Biofuel” and The National Program for production and use of bio-fuel ;<br>4) Fuel stocks optimisation in energy market’s liberalisation conditions;<br>5) More attention has to be paid to complete, effective and rational utilization of wood and wood waste to utilize the firewood for processing value-added wood products |
| 4. Problems important for Latvian SMEs Select importance: (high, medium, low, zero) | **High**<br>1) Qualitative bio diesel fuel production for diesel engine application;<br>2) The main drawback of wood co-generation is the high capital and operational costs;<br>3) Wood fuel could be used more economically if it were generating both thermal energy and electricity;<br>4) Transportation and harvesting/handling costs are very high compare with the real price of the forest residues at the user facility;<br>5) Technologies of biomass burning and storage system;<br>6) Development of new technology for bio diesel fuel production from used oils and fat. |

| Area "4": Renewables for heating and cooling | |
|---|---|
| Development and demonstration of a portfolio of technologies to increase the potential of heating and cooling from renewable energy sources to contribute to sustainable energy. The aim is to achieve substantial cost reductions, increase efficiencies, further reduce environmental impacts and optimise the use of technologies in different regional conditions. Research and demonstration should include new systems and components for industrial applications (incl. thermal seawater desalination), district and/or dedicated space heating and cooling, building integration and energy storage. | |
| 1. Area importance for Latvia (high, medium, low, zero) | **Heating – high, cooling - zero** |
| 2. Problems important for Latvian research community | 1) Investigations into the potential of energy accumulation and conversion for power supply;<br>2) Integrating solar collectors to district heating by 2 means: a) decentralised collectors, mounted on the roofs of individual buildings and b) centralised solar collector fields situated close to the heating plant;<br>3) Working out of more efficient and ecologically cleaner heat energy production technology;<br>4) Due to the luck of finances available for experiments of already developed technology, by the way of financial support of European funds to make an experimental models, carry out the necessary laboratory and field experiments in order to demonstrate the new type of collector where into collector's box only an absorber is fixed and both sides of collector's box are covered by glass or plastic pane. For this the collector is provided with special device tracking the collector to the sun.;<br>5) Several studies of the assessment of the potential of wood resources have been made, but data differ significantly. |
| 3. Problems important for Latvian economy and society | 1) Investigation of adaptation of cogeneration (up to 4MW) in district heating systems;<br>2) Increase of share of cogeneration in DH production;<br>3) Improving the average efficiencies of CHP plants from 75-80% in 1994 to 84-86% in 2020;<br>4) Increase use of biomass for DH production<br>5) Sophisticate the heating main (heat isolation and heat resistance);<br>6) Reduction of heat losses in DH network from 20-25% to about 8% in 2020 and power transmission losses; |
| 4. Problems important for Latvian SMEs Select importance: (high, medium, low, zero) | **Heating – high, cooling - zero**<br>1) Find the technology and equipment for processing of hay and wood chips into high added value products (e.g. briquettes, pellets etc.);<br>2) Required most advanced technology to produce charcoal and wooden briquettes for heating and energy production from nearly any kind of biomass. The specific production volume for charcoal production output per annum is estimated 150.000 metric tons in the 1st year. The specific production volume for wooden briquette production output per annum is estimated 200.000 metric tons in the 1st year. The both products should be produced by one technology;<br>3) Reconstruction of boiler houses has to be performed in several cities in order too keep energo efficiency;<br>4) Production of solar collectors for water heating;<br>5) Improving the efficiency of regional (small and medium) DH plants by 3-9% |

| Are “5”: CO2 capture and storage technologies for zero emission power generation | |
|---|---|
| Fossil fuels will inevitably continue to contribute a significant share of the energy mix for decades to come. To make this option compatible with the environment, particularly as regards climate change, drastic reductions in the adverse environmental impacts of fossil fuel use are needed, aiming at highly efficient power generation with near zero emissions. The development and demonstration of efficient and reliable CO2 capture and storage technologies are crucial, aiming at decreasing the cost of CO2 capture and storage to less than 20€/tonne, with capture rates above 90%, as well as proving the long-term stability, safety and reliability of CO2 storage. | |
| 1. Area importance for Latvia (high, medium, low, zero) | **Medium** |
| 2. Problems important for Latvian research community | n/a |
| 3. Problems important for Latvian economy and society | No important problems as the main part of boiler houses in Latvia have installed modern technologies. During the last few years use of firewood and wood waste was increasing significantly in district heating systems. This fuel is used more and more by introducing modern conversion technologies for production district heat and partially electricity.<br>Latvia has already met the obligations provided for by the Kyoto Protocol, since the amount of greenhouse gas emissions in the country is less than 92 % from the volume of emissions in 1992 (e.g., in 2003 the total volume of GHG emissions was 41.5 % from the level of 1990). That is why the use of renewable energy sources in generating electricity does not contribute directly to meeting the nationalcommitments. Latvian economy developing rapidly, the total volume of GHG emissions gradually increases, and increased utilization of renewable energy sources would help to keep a low level of emissions also in the future.<br>The total quantity of allocated emission allowances of carbon dioxide for the period 2005 – 2007 at the moment is estimated at about 13,7million.<br>The main sectors generating the greatest amount of pollution are the energy sector (in 2000 it generated around 50% of total emissions), the transport sector (in 2000 generated 20% of total emissions) and fianlly the agriculture (15%) and waste management sectors.<br>If the building of new coal electroc power station in Ventspils will be implemented in the future, then the question of CO2 capture will become actual for Latvia. |
| 4. Problems important for SMEs | **Low**<br>1) High costs for decreasing GHG emission to permissible level.<br>2) The national allocation plan contains totally 86 sources: 69 energy production plants or industrial installations and 17 opt-ins’ volunteer plants. The opt-ins that have been incorporated into the allocation plan on the basis of the Article 24 of the EC Emissions Trading Directive include district heating plants under 20 MW. |

| Are “6”: Clean coal technologies | |
|---|---|
| Coal fuelled power plants remain the workhorse of electricity generation worldwide, but have considerable potential for further efficiency gains and emissions reductions, particularly concerning CO2. To maintain competitiveness and contribute to the management of CO2 emissions, the development and demonstration of clean coal conversion technologies will be supported to significantly increase plant efficiency and reliability, minimise pollutant emissions and reduce overall costs, under various operating conditions. Looking towards future zero emission power generation, these activities should prepare for, complement and be linked with developments on CO2 capture and storage technologies. | |
| 1. Area importance for Latvia (high, medium, low, zero) | **Zero** |
| 2. Problems important for Latvian research community | **-** |
| 3. Problems important for Latvian economy and society | **-** |
| 4. Problems important for SMEs | **-** |

| Area “7”: Smart energy networks | |
|---|---|
| To facilitate the transition to a more sustainable energy system, a wide-ranging R&D effort is required to increase the efficiency, flexibility, safety and reliability of the European electricity and gas systems and networks. For electricity networks, the goals of transforming the current electricity grids into a resilient and interactive (customers/operators) service network and removing the obstacles to the large-scale deployment and effective integration of renewable energy sources and distributed generation (e.g. fuel cells, microturbines, reciprocating engines), will also necessitate the development and demonstration of key enabling technologies (e.g. innovative ICT solutions, storage technologies for RES, power electronics and HTS devices). For gas networks, the objective is to demonstrate more intelligent and efficient processes and systems for gas transport and distribution, including the effective integration of renewable energy sources. | |
| 1. Area importance for Latvia (high, medium, low, zero) | **Medium** |
| 2. Problems important for Latvian research community | 1) The approach for electrical network optimization under liberalized electricity market;<br>2) The network reliability optimization under liberalized electricity market;<br>3) Theoretical principles and practical recommendations for automation and modernization of industry and transport based on the latest technology developments of power semiconductors, new materials and information processing;<br>4) Elaboration of the development dynamic model for system „Distribution Networks and Distribution Generation” in order to connect to the interconnected system of European state’s power system association (UCPTE) as a competitive subset;<br>5) Analysis of energy supply options and security of supply;<br>6) Scientific basis for efficiency analysis of investments in electrical networks;<br>7) Development of the electrical energy parameters conversion theory for the application in automatic electrical drive and electrical energy supply;<br>8) Autonomous energy supply of waste water treatment units using biogas;<br>9) Development of microprocessor-based arrangements for raising of electric network condition effectiveness;<br>10) Development of multi-agents systems for energy distribution;<br>11) Independent producer’s power stations impact on reactive power balance in electric grid;<br>12) Investigation and elaboration of operative electrical power converter systems;<br>13) Synthesis and testing of electric power system's protective relaying and automation network architecture, elements and software;<br>14) Development of specialized microprocessor-based arrangements for raising the effectiveness of electric network's condition;<br>15) Analysis and optimization of neutral treatment for 10...20 kV distribution network;<br>16) Simulation of electric insulation ageing;<br>17) Integration of RES-fuel cells to low and medium voltage grids; esp. research of economical and technical opportunities;<br>18) Investigation of problems and thresholds for integration of fuel cells driven by hydrogen from biomass into low and medium voltage grids. |
| 3. Problems important for Latvian economy and society | 1) Integration of small independent producers – small HPP, wind power plants and biogas stations into electricity supply grid in order to increase the contribution of independent producers into electricity production;<br>2) Barrier to choosing wind generators is the necessity to integrate them into the electricity supply grid and technical demands.<br>3) Grid connection problems;<br>4) Connection problems of wind generators to high voltage networks; |

| | |
|---|---|
| | 5) Clear out and correct technical specifications for connection of independent electric power plants during operation and maintenance period. |
| 4. Problems important for Latvian SMEs Select importance: (high, medium, low, zero) | **Medium**<br>1) State Joint Stock Corporation Latvenergo is monopol company engaged either in electricity transmission and distribution services in Latvia;<br>2) Integration of small renewable energy electricity generation technologies;<br>3) High investment costs of implementation of modern technologies. |

| Area "8": Energy efficiency and savings | |
|---|---|
| The vast potential for energy savings and improvements in energy efficiency need to be harnessed through the optimisation, validation and demonstration of new concepts and technologies for buildings, services and industry. This incorporates the combination of sustainable strategies and technologies for increased energy efficiency, the use of renewable energy and poly-generation and the integration of demand management systems at large scale in cities and communities. These large-scale actions may be supported by innovative R&D addressing specific components or technologies, e.g. for poly-generation and ecobuildings. A key aim is the optimisation of the local community energy system, balancing a significant reduction in energy demand with the most affordable and sustainable supply solution, including the use of new fuels in dedicated fleets. | |
| 1. Area importance for Latvia (high, medium, low, zero) | **High** |
| 2. Problems important for Latvian research community | 1) Strategy of energy efficiency and saving for the development of the Latvian fuel and energy complex;<br>2) Complex diagnostics of heat losses and more accurate estimation of heat consumption in buildings – use of automated measuring- and hierarchically connected systems of mathematical models;<br>3) Investigation and optimisation of regional GHG emission reduction by implementation of energy efficiency measures in buildings;<br>4) Economic justification methods of building energy efficiency evaluation;<br>5) Energo saving power electronic converters and control systems with neutral networks and fuzzy logic controllers;<br>6) Heat and air exchange through building constructions |
| 3. Problems important for Latvia economy and society | 1) Promoting energy efficiency and renewable resources as the basis for secure power and fuel supply and sustainable development of the Latvian Energy Sector, 2006–2009;<br>2) Methodological aspects and technical, economical and ecological challenges development of renewable energy resources utilization;<br>3) Investigation and optimization of energy efficiency of energy supply systems of hospital buildings;<br>4) Necessity to improve the energetic efficiency of existing buildings and the aspects of the economy of energy must be followed in renovation of buildings and in construction of new ones. |
| 4. Problems important for Latvian SMEs Select importance: (high, medium, low, zero) | **High**<br>1) Implementation of efficient method of energy auditing in housing and industry sectors;<br>2) There are mainly monopol players : Latvenergo, Latvijas Gaze (Gass company) and Rīgas Siltums in provision of energy efficiency and savings.<br>3) SMEs can participate as the technology developer and supplier for them;<br>4) Development of methods for energy efficiency of buildings. |

| Area "9": Knowledge for energy policy making | |
|---|---|
| Development of tools, methods and models to assess the main economic and social issues related to energy technologies. Activities will include the building of databases and scenarios for an enlarged EU and the assessment of the impact of energy and energy-related policies on security of supply, environment, society and competitiveness of the energy industry. Of particular importance is the impact of technological progress on EU policies. | |
| 1. Area importance for Latvia (high, medium, low, zero) | **High** |
| 2. Problems important for Latvian research community | 1) Regulation of energy prices and tariffs in liberalised energy market to ensure implementation of the sustainable energy policy;<br>2) Latvian Energy sector development strategy and its management process research by using simulation and optimisation methods;<br>3) Investigations into the potential of energy accumulation and conversion for power supply<br>4) Challenges of Kyoto commitments for Baltic States' energy sectors;<br>5) Suitable methodology for setting up fuel prices and energy tariffs to ensure sustainable development of the energy sector;<br>6) Practical scientific researches supporting transfer of new technologies and adaptation to Latvia, as well as support for researches on innovative use of RES;<br>7) Assessment of energy external costs; |
| 3. Problems important for Latvian economy and society | 1) To establish such institutional and normative environment that would promote ever wider use of RES;<br>2) Administrative and market barriers for wider use of RES has to be eliminated;<br>3) System of supportive measures and normative documents for renewable sources has to be established - transparent and understandable for all groups of society interested in use of renewable energy sources, and giving base for investors and financial institutions to consider investments in use of RES and in reduction of greenhouse emissions to be secure.<br>4) To increase production of thermal energy and electric energy from renewable energy sources and enlarge production of biofuel in regions.<br>5) The development of renewable energy sources and in particular of bio-energy is important in order to reduce dependence on the Russian natural gas monopoly and its impact on the national economies of the Baltic States. |
| 4. Problems important for Latvian SMEs Select importance: (high, medium, low, zero) | **High**<br>1) Implementation of new technologies for use of renewable energy sources by pilot projects in order to demonstrate possibilities of these technologies and to test their consistency in Latvian conditions;<br>2) Implementation of market solutions and creation of advantageous conditions for those technologies of energy production that allow to increase competitiveness of renewable energy sources comparing with fossil energy sources;<br>3) Removal of barriers and increase competitiveness of distributed generation;<br>4) Ensurance of fair accessibility to electricity net for every electricity producer;<br>5) Improvement of infrastructure of electricity network by net operator;<br>6) High investment costs and long pay-back period of projects related with implementation of modern technologies, insufficient internal financial resources necessary to implement governmental policies and comparatively fast increase of prices for this fuel. |

## RESPONDEE ADMINISTRATIVE DETAILS

| Institution | | | |
|---|---|---|---|
| **Name** | **ENERO-Centre for Promotion of Clean and Efficient Energy in Romania** | | |
| **Country** | RO | | |
| **Postal address** | Str. Feroviarilor nr. 51, Apt 13, Bucuresti, 012206, Romania | | |
| **Type of organization**, *mark YES, where appropriate* | SME, | RTD,<br>Yes | Other,<br>ONG |
| **Contact person** | | | |
| **Name** | Tantareanu | | |
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|---|---|
| **Consultation with (if was done also out of the host organisation):** | |
| **Distribution agreement (Yes/No)** | Yes |

## *A) Energy and renewable energy technological RTD priorities in Romania*

| **Energy technology** | **Priorities:** *Mark: high (H), medium(M), low(L), zero(Z)* |
|---|---|
| General power technology | M |
| Decentralised power generation | H |
| Electricity grid control system | M |
| Power distribution | L |
| Power transmission | L |
| Powerline communication system | M |
| Storage | L |
| Energy storage | M |
| Cold storage | Z |
| Electrochemical storage | L |
| Batteries | M |
| Battery active materials | L |
| Gas Storage | M |
| Heat Storage | M |
| Mechanical storage | L |
| Compressed air technology | L |
| Combustion | M |
| Fuel combustion | H |
| Combustion control systems | M |
| Combustion monitoring systems | M |
| Others | M |
| Gas cleaning | L |
| Natural resources exploration | M |
| Deep water exploitation | L |
| Offshore technology | L |
| Pipeline technology | M |
| Generation of electricity | M |
| Combined heat power systems | H |
| Generation of heat | H |
| Heat pumps | M |
| Hybrid energy systems | L |
| Rational use of energy | H |
| | |
| Renewable Energies | |
| Bioenergy | H |
| Biofuels | H |
| Gaseous biofuels | H |
| Liquid biofuels | H |
| Solid biofuels | H |
| Biomass | H |
| Anaerobic fermentation | M |
| Biofuels for transport | H |
| Biomass combustion | H |
| Biomass gasification | M |
| Biomass hydrolysis fermentation | L |
| Biomass pre-processing | H |
| Biomass pyrolysis | L |

| | |
|---|---|
| Bioresidues | M |
| Energy crops | H |
| Biogas production | M |
| Geothermal Energy Technology | M |
| Deep drilling | M |
| Deep geothermal resources | M |
| Direct geothermal heat use | H |
| Enhanced geothermal systems | L |
| Geothermal electricity generation | M |
| Hot fractured rock | Z |
| Reservoir management | L |
| Hydropower | M |
| Hydroturbine technology | M |
| Micro hydropower | H |
| Small hydropower | H |
| Ocean energy technology | Z |
| Photovoltaics | M |
| PV building applications | H |
| PV cells | L |
| PV components | Z |
| PV concentrators | Z |
| PV integration | M |
| PV mains grid connection | L |
| PV manufacturing processes | L |
| PV materials | L |
| PV modules | M |
| PV socio-economics | M |
| PV systems | M |
| Solar thermal technology | M |
| Solar concentrating technology | Z |
| Solar chemical reactors | L |
| Solar dish technology | Z |
| Solar tower technology | Z |
| Solar trough technology | M |
| Solar flate-plate collectors and systems | H |
| Wave Energy | L |
| Tidal current technology | Z |
| Wave energy technology | L |
| Offshore mooring | Z |
| Offshore power transmission | Z |
| Submersible turbine technology | L |
| Wave hydrodynamics | L |
| Wells turbine technology | Z |
| Wind energy technology | H |
| Environmental technology | M |

## *B) How Seventh Framework Programme (Priority 5. ENERGY, renewable energy related areas only) fits to Romania and SMEs*

| **Area "1": Hydrogen and fuel cells** | |
|---|---|
| The integrated research and deployment strategy developed by the European Hydrogen and Fuel Cell Technology Platform provides the basis for a strategic, integrated programme for transport, stationary and portable applications, aimed at providing a strong technological foundation for building a competitive EU fuel cell and hydrogen supply and equipment industry. The programme will comprise: fundamental and applied research and technological development; large-scale demonstration ("lighthouse") projects to validate research results and provide feedback for further research; cross-cutting and socioeconomic research activities to underpin sound transition strategies and provide a rational basis for policy decisions and market framework development. The industrial applied research, demonstration and cross-cutting activities of the programme will preferably be implemented through the Joint Technology Initiative. This strategically managed, goal-oriented action will be complemented and closely co-ordinated with more upstream collaborative research effort aimed at achieving breakthrough on critical materials, processes and emerging technologies. | |
| 1. Area importance for Romania (high, medium, low, zero) | Medium. |
| 2. Problems important for Romanian research community | Demonstration facility with different types of fuel cells mainly SOFC.<br>Materials for SOFC.<br>Technological and economic Integration of fuel cells systems in distributed generation and cogeneration systems, including buildings |
| 3. Problems important for Romanian economy and society | Evaluation of possibilities for common hydrogen economy in Romania and hydrogen supply from domestic resources.<br>Increasing of the efficiency of "coal to hydrogen" technologies and the assessment of their role in hydrogen generation.<br>Application of hydrogen for mobile vehicles<br>Fuel cells and hydrogen for remote locations electricity and heat supply |
| 4. Problems important for Romanian SMEs. Select importance: (high, medium, low, zero)<br>**– low importance** | Fuel cells for independent power and heat supply.<br>Cogeneration technologies and micro-CHP |

| Area “2”: Renewable electricity generation | |
|---|---|
| Development and demonstration of integrated technologies for electricity production from renewables, suited to different regional conditions, in order to provide the means to raise substantially the share of renewable electricity production in the EU. Research should increase overall conversion efficiency, significantly drive down the cost of electricity, enhance process reliability and further reduce the environmental impact. Emphasis will be on photovoltaics, wind and biomass (including biodegradable fraction of waste). Furthermore, research will aim at realising the full potential of other renewable energy sources: geothermal, thermal solar, ocean and small hydropower. | |
| 1. Problems important for Romania research community | Biomass and waste co-firing for electricity and heat production in co-generation, mainly form forestry and agricultural waste<br>Biomass and waste gasification for electricity and heat production in co-generation<br>Use of lignocelluloses, and sugar crops (sugar beet, sweet sorghum etc) based ethanol and rape derived esters for decentralised production of heat and power<br>Large PV systems and grid interface |
| 2. Problems important for Romanian economy and society | Sustainability of co-firing of biomass with coal in large scale power units<br>Integration of renewable electricity from wind and small hydro into the electrical grid: perturbations, harmonics, output prediction etc<br>Environmental impact of large wind farms on the Black Sea littoral area.<br>Integration of GHG emissions trade in the European and international mechanisms (LCP Directive and Kyoto Protocol). |
| 3. Problems important for Romanian SMEs<br>Select importance: (high, medium, low, zero)<br>**-high importance** | Use of agricultural and forestry waste for power and heat generation (biogas, pellets, briquetts) in large (Duistrict Heating) or local power systems.<br><br>Integration of of wind electricity in local networks<br>Efficient PV panels integrated in buildings |

| Area “3”: Renewable fuel production | |
|---|---|
| Development and demonstration of improved conversion technologies for the sustainable production and supply chains of solid, liquid and gaseous fuels from biomass (incl. biodegradable fraction of waste), in particular biofuels for transport. Emphasis should be on new types of biofuels as well as on new production and distribution routes for existing biofuels, including the integrated production of energy and other added-value products through biorefineries. Aiming to deliver ‘source to user’ carbon benefits, research will focus on improving energy efficiency, enhancing technology integration and use of feedstock. Issues such as feedstock logistics, pre-normative research and standardisation for safe and reliable use in transport and stationary applications will be included. To exploit the potential for renewable hydrogen production, biomass, renewable electricity and solar energy driven processes will be supported. | |
| 1. Problems important for Romanian research community | Development of technologies for hydrogen separation from gases generated by different conversion methods of biomass and wastes<br>Integrated production of biofuels for transport and other added-value products through biorefineries<br>Technologies to produce land fill gases. |
| 2. Problems important for Romanian economy and society | Conversion of agricultural land form traditional crops to biomas and biofuel production.<br><br>Research on the evaluation of biofuels production and trade. |
| 3. Problems important for Romanian SMEs<br>Select importance: (high, medium, low, zero)<br>**- high importance** | Utilization (combustion) of liquid biofuels in engines and stationary boilers<br>Biofuels production certification (standards, test) in view of European trade.<br>Local/small scale production of liquid biofuels for transportation |

| Area "4": Renewables for heating and cooling | |
|---|---|
| Development and demonstration of a portfolio of technologies to increase the potential of heating and cooling from renewable energy sources to contribute to sustainable energy. The aim is to achieve substantial cost reductions, increase efficiencies, further reduce environmental impacts and optimise the use of technologies in different regional conditions. Research and demonstration should include new systems and components for industrial applications (incl. thermal seawater desalination), district and/or dedicated space heating and cooling, building integration and energy storage. | |
| 1. Problems important for Romanian research community | Solar passive systems – eco-buildings<br>Solar energy storage: short and long term, including UTES – Underground Thermal Energy Storage and other technologies for heat storage (e.g. PCM – Phase change materials)<br>Development od Trigeneration and polygeneration concepts<br>Technologies to valorise geothermal potential |
| 2. Problems important for Romanian economy and society | District and/or dedicated space heating and cooling, building integration and energy storage.<br>Adequate balancing of centralized (district heating and cooling) and decentralized systems for heating and cooling<br>Use of geothermal resources for district heating purposes |
| 3. Problems important for Romanian SMEs<br>Select importance: (high, medium, low, zero)<br>**-high importance** | Small scale biomass boilers for heating and cogeneration of heat and power based on renewables and especially biomass (gasification)<br>Integration of solar thermal systems in existing District Heating grids<br>Development of more efficient and cheaper solar thermal collectors for integration in buildings |

| Area “7”: Smart energy networks | |
|---|---|
| To facilitate the transition to a more sustainable energy system, a wide-ranging R&D effort is required to increase the efficiency, flexibility, safety and reliability of the European electricity and gas systems and networks. For electricity networks, the goals of transforming the current electricity grids into a resilient and interactive (customers/operators) service network and removing the obstacles to the large-scale deployment and effective integration of renewable energy sources and distributed generation (e.g. fuel cells, microturbines, reciprocating engines), will also necessitate the development and demonstration of key enabling technologies (e.g. innovative ICT solutions, storage technologies for RES, power electronics and HTS devices). For gas networks, the objective is to demonstrate more intelligent and efficient processes and systems for gas transport and distribution, including the effective integration of renewable energy sources. | |
| 1. Problems important for Romanian research community | Demonstration of effective integration of renewable energy sources and distributed generation in the existing grid<br>Stability of large wind farms.<br>Development of local DC grid for distributed generation and their integration in the existing AC grid<br>Development of converters permitting bidirectional power flow<br>Technologies for islanding microgrids with RES generators |
| 2. Problems important for Romanian economy and society | Integration of large-scale deployment of distributed power generation<br>based renewable energy sources, both at national and regional (distribution and low voltage systems)<br>Integration of the development of distributed generation with refurbishment and development of low voltage grid<br>DG impact on the demand elasticity |
| 3. Problems important for Romanian SMEs<br>Select importance: (high, medium, low, zero)<br>**- high importance** | Creation of local electricity balancing areas based on renewable energy generation<br>Development of supporting schemes for introduction of net metering and development of own on site electricity generation |

| Area "8": Energy efficiency and savings | |
|---|---|
| The vast potential for energy savings and improvements in energy efficiency need to be harnessed through the optimisation, validation and demonstration of new concepts and technologies for buildings, services and industry. This incorporates the combination of sustainable strategies and technologies for increased energy efficiency, the use of renewable energy and poly-generation and the integration of demand management systems at large scale in cities and communities. These large-scale actions may be supported by innovative R&D addressing specific components or technologies, e.g. for poly-generation and ecobuildings. A key aim is the optimisation of the local community energy system, balancing a significant reduction in energy demand with the most affordable and sustainable supply solution, including the use of new fuels in dedicated fleets. | |
| 1. Problems important for Romanian research community | Development of methodologies for EM (energy management) and DSM (demand site management)<br>Optimization, validation and demonstration of new concepts and technologies for residential and tertiary buildings<br>Development of intelligent buildings |
| 2. Problems important for Romanian economy and society | Retrofitting of multi apartments blocks to lower their heat consumption and improve life consitions.<br>Thermal modernization of buildings with implementation of solar architecture and renewables<br>Refurbishment and optimization of local community district heating energy systems |
| 3. Problems important for Romanian SMEs<br>Select importance: (high, medium, low, zero)<br>**- highmportance** | Integrated energy consumption management in industry and buildings.<br><br>Implementation of efficient and proved method of energy auditing in housing sector and in industry |

| Area "9": Knowledge for energy policy making | |
|---|---|
| Development of tools, methods and models to assess the main economic and social issues related to energy technologies. Activities will include the building of databases and scenarios for an enlarged EU and the assessment of the impact of energy and energy-related policies on security of supply, environment, society and competitiveness of the energy industry. Of particular importance is the impact of technological progress on EU policies. | |
| 1. Problems important for Romanian research community | Assessment of energy External Costs<br>Techno-economic optimization of thermal processes and energy management.<br>Grid integration of renewable energy sources – policy issues and legislation<br>New tools for energy management and energy strategy development.<br>Exergy analysis, studies of cumulative energy and exergy consumption.<br>Thermodynamic and economic problems of environmental protection.<br>Mathematical modeling of market support mechanisms for renewable and CHP electricity – modeling technical, economic and policy measures of RES-E support |
| 2. Problems important for Romanian economy and society | Scientific analyses of the RES role and contribution to the country energy independency and to electricity trade.<br>Harmonization and coordination of support policies devoted for the implementation of the EU RES directives and programs<br>Efficient support for distributed generation in relation to RES-E and CHP |
| 3. Problems important for Romanian SMEs<br>Select importance: (high, medium, low, zero)<br>**-high importance** | Market studies of small scale technologies (standing alone and grid connected)<br>Barriers removal and competitiveness of distributed generation |

## RESPONDEE ADMINISTRATIVE DETAILS

| Institution | | | |
|---|---|---|---|
| **Name** | **Business & Innovation Centre Bratislava – BIC Bratislava** | | |
| **Country** | SK | | |
| **Postal address** | Zochova 5, 811 03 Bratislava, Slovakia | | |
| **Type of organization,** *mark YES, where appropriate* | SME,<br>Yes | RTD, | Other, |
| **Contact person** | | | |
| **Name** | Vratny | | |
| **First name** | Stefan | | |
| **Telephone** | +421 2 5441 7515 | | |
| **Fax** | +421 2 5441 7522 | | |
| **e-mail** | vratny@bic.sk | | |

| | |
|---|---|
| **Consultation with (if was done also out of the host organisation):** | Energy Centre Bratislava<br>Slovak energy agency |
| **Distribution agreement (Yes/No)** | Yes |

# *A) Energy and renewable energy technological RTD priorities in CEEC- Slovakia*

| **Energy technology** | **Priorities:**<br>*Mark: high (H), medium(M), low(L), zero(Z)* |
|---|---|
| General power technology | M |
| Decentralised power generation | H |
| Electricity grid control system | M |
| Power distribution | M |
| Power transmission | M |
| Powerline communication system | M |
| Storage | |
| Energy storage | M |
| Cold storage | L |
| Electrochemical storage | M |
| Batteries | M |
| Battery active materials | H |
| Gas Storage | H |
| Heat Storage | M |
| Mechanical storage | L |
| Compressed air technology | M |
| Combustion | |
| Fuel combustion | H |
| Combustion control systems | H |
| Combustion monitoring systems | M |
| Others | |
| Gas cleaning | M |
| Natural resources exploration | L |
| Deep water exploitation | L |
| Offshore technology | L |
| Pipeline technology | M |
| Generation of electricity | H |
| Combined heat power systems | M |
| Generation of heat | H |
| Heat pumps | M |
| Hybrid energy systems | M |
| Rational use of energy | L |
| | |
| Renewable Energies | |
| Bioenergy | |
| Biofuels | H |
| Gaseous biofuels | H |
| Liquid biofuels | H |
| Solid biofuels | H |
| Biomass | M |
| Anaerobic fermentation | H |
| Biofuels for transport | H |
| Biomass combustion | M |
| Biomass gasification | M |
| Biomass hydrolysis fermentation | H |
| Biomass pre-processing | M |
| Biomass pyrolysis | M |
| Bioresidues | M |

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|---|---|
| Energy crops | H |
| Biogas production | H |
| Geothermal Energy Technology | |
| Deep drilling | M |
| Deep geothermal resources | M |
| Direct geothermal heat use | M |
| Enhanced geothermal systems | M |
| Geothermal electricity generation | M |
| Hot fractured rock | L |
| Reservoir management | L |
| Hydropower | |
| Hydroturbine technology | M |
| Micro hydropower | L |
| Small hydropower | M |
| Ocean energy technology | Z |
| Photovoltaics | |
| PV building applications | H |
| PV cells | M |
| PV components | H |
| PV concentrators | L |
| PV integration | M |
| PV mains grid connection | M |
| PV manufacturing processes | M |
| PV materials | M |
| PV modules | M |
| PV socio-economics | L |
| PV systems | L |
| Solar thermal technology | |
| Solar concentrating technology | L |
| Solar chemical reactors | M |
| Solar dish technology | L |
| Solar tower technology | L |
| Solar trough technology | L |
| Solar flate-plate collectors and systems | M |
| Wave Energy | |
| Tidal current technology | Z |
| Wave energy technology | Z |
| Offshore mooring | Z |
| Offshore power transmission | Z |
| Submersible turbine technology | Z |
| Wave hydrodynamics | Z |
| Wells turbine technology | Z |
| Wind energy technology | M |
| Environmental technology | M |

## *B) How Seventh Framework Programme (Priority 5. ENERGY, renewable energy related areas only) fits* **to Slovakia and SMEs**

| **Area "1": Hydrogen and fuel cells** | |
|---|---|
| The integrated research and deployment strategy developed by the European Hydrogen and Fuel Cell Technology Platform provides the basis for a strategic, integrated programme for transport, stationary and portable applications, aimed at providing a strong technological foundation for building a competitive EU fuel cell and hydrogen supply and equipment industry. The programme will comprise: fundamental and applied research and technological development; large-scale demonstration ("lighthouse") projects to validate research results and provide feedback for further research; cross-cutting and socioeconomic research activities to underpin sound transition strategies and provide a rational basis for policy decisions and market framework development. The industrial applied research, demonstration and cross-cutting activities of the programme will preferably be implemented through the Joint Technology Initiative. This strategically managed, goal-oriented action will be complemented and closely co-ordinated with more upstream collaborative research effort aimed at achieving breakthrough on critical materials, processes and emerging technologies. | |
| 1. Problems important for Slovak research community | Most prominent barrier to spreading of fuel cells is its high cost. Whole hydrogen technology is in state of experimental research and first practical applications at present. We look forward up to ten-fold decrease of investment costs of fuel cells as current piece production shifts to industrial assembly line production.<br>Slovakia has reliable and widespread power distribution network. There is no need for traditional distributed power generation supplying electricity to remote places. Cheap and reliable power supply from conventional sources spares little place for fuel cells and alternative sources, as they seem to be less economical. Alternatives can win through applications, where their inherent strengths become apparent. |
| 2. Problems important for Slovak economy and society | Lack of financial support, insufficient state support given to the project aimed at the renewable energy sources including fuel cells and hydrogen energy<br>Due to an insufficiency of the state energy policy there is a lack of an appropriate efficient financial support to an active national renewable energy sources policy. Despite the various sources of public financial support, the overall amount of funding available is very limited.<br>Taxation in favour of conventional energy sources<br>A comprehensive taxation system should be devised to make renewable energy sources and to them relevant equipments more competitive.<br>Different criteria used to provide grants by various institutions responsible for the subsidiary programmes<br>Unstable business environment<br>Disinterest of commercial banks to finance projects aimed at the use of the alternative energy sources<br>Lack of integration of energy in public procurement laws<br>Procurement criteria do not usually take a life-cycle cost analysis into account, thus discouraging the purchase of energy efficient equipment that while requiring a higher investment would involve lower operating costs in comparison with conventional solutions.<br>Incompatibility between budget guarantee and contract duration terms<br>Investors and contracting companies need mid- and long-term security of payment flow in order to refinance their investments. Public bodies in particular meet some difficulties in assuring such financial flows beyond the current budget period, which is usually one year only (with a maximum period of 4 years). Even when realising savings, an energy efficiency project requiring more than one year of operation is not guaranteed to secure the necessary |

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|---|---|
| | budget for the subsequent years. In these conditions, very few investors are ready to commit themselves over several years, when guarantee of repayment of their investment is not ensured. |
| 3. Problems important for Slovak SMEs. Select importance: (high, medium, low, zero) **– medium importance** | Lack of domestic technical, machine and technological facilities<br><br>High investment requirements of the imported facilities<br><br>Difficult import procedures for certain energy technologies<br>Additional problems to the above-mentioned lack of legislative regulation on relevant technologies arise when efficient technologies need to be imported, as the procedure is lengthy and requires complicated administrative steps.<br><br>Low level of utilisation of the existing tax exemption systems The present tax relief systems for efficient purchasing energy and renewable energy equipment and technologies are considered by analysts to be under-utilised because they are too restrictive and because of a lack of information on the opportunities on offer.<br>Absence of a systematic domestic research in the field of the renewable energy sources and hydrogen energy. |

| Area "2": Renewable electricity generation | |
|---|---|
| Development and demonstration of integrated technologies for electricity production from renewables, suited to different regional conditions, in order to provide the means to raise substantially the share of renewable electricity production in the EU. Research should increase overall conversion efficiency, significantly drive down the cost of electricity, enhance process reliability and further reduce the environmental impact. Emphasis will be on photovoltaics, wind and biomass (including biodegradable fraction of waste). Furthermore, research will aim at realising the full potential of other renewable energy sources: geothermal, thermal solar, ocean and small hydropower. | |
| 1. Problems important for Slovak research community | Wind power is not utilized in Slovakia yet. First larger wind mills are in planning stage. This technology, which is already cost competitive in some EU countries, is delayed in Slovakia mainly due to the low feed in tariffs. In case that governmental policy will change we can estimate the wind potential. In Slovakia, there are not very suitable localities with consistent winds with sufficient intensity. |
| 2. Problems important for Slovak economy and society | At present, 85 per cent of households is supplied of heat from public power engineering. The development of power engineering in Slovakia will be oriented on usage of RES emphasis on biomass and geothermal energy. It is important to build new technology equipments and to use solar collectors, which are used only a little.<br>Biomass can be utilized in different ways. According the domestic experience the heat production seems to be the most cost effective at present. |
| 3. Problems important for Slovak SMEs Select importance: (high, medium, low, zero) **-medium to high importance** | Lack of a country wide wind-atlas, respectively state of art measurements makes it difficult to estimate the actual resource potential of the country. As far as the legal framework is concerned, the gradual full liberalization of te market is planned only following privatization, although no firm time table for this has been agreed.<br>The investment costs of wind motors are high, the return on investment is long, these equipment are loud and it is important to ensure the safety of them.<br>In Slovakia, there are a lot of geothermal sources, but the usage of this energetic potential is low. The barriers are: high investment costs, problems with incrustation and environmental problems.<br>In Slovakia, the domestic production of solar collectors is not very developed and the import of these equipments is not economically effective.<br>There are also barriers in the usage of small hydropower: high investment costs, lack of finance sources, long return on investment, negative influence on environment… |

| Area “3”: Renewable fuel production | |
|---|---|
| Development and demonstration of improved conversion technologies for the sustainable production and supply chains of solid, liquid and gaseous fuels from biomass (incl. biodegradable fraction of waste), in particular biofuels for transport. Emphasis should be on new types of biofuels as well as on new production and distribution routes for existing biofuels, including the integrated production of energy and other added-value products through biorefineries. Aiming to deliver ‘source to user’ carbon benefits, research will focus on improving energy efficiency, enhancing technology integration and use of feedstock. Issues such as feedstock logistics, pre-normative research and standardisation for safe and reliable use in transport and stationary applications will be included. To exploit the potential for renewable hydrogen production, biomass, renewable electricity and solar energy driven processes will be supported. | |
| 1. Problems important for Slovak research community | In Slovakia, there are only few examples of usage of biogas and few equipments for biogas production. |
| 2. Problems important for Slovak economy and society | Although, the usage of biogas is ecologically and economically favourable, the development of this technology is inhibited in Slovak conditions in spite of the lack of finance sources in agricultural enterprises and uncertainties in the future development of animal production. The irregular consumption of heat and warm water during the year by constant production of biogas decreases the economic of the equipment. |
| 3. Problems important for Slovak SMEs Select importance: (high, medium, low, zero) **- medium importance** | The equipments for biogas production in Slovakia don´t achieve the technical and economic effectivity. Some equipments are imported from other countries (Austria). |

| Area “4”: Renewables for heating and cooling | |
|---|---|
| Development and demonstration of a portfolio of technologies to increase the potential of heating and cooling from renewable energy sources to contribute to sustainable energy. The aim is to achieve substantial cost reductions, increase efficiencies, further reduce environmental impacts and optimise the use of technologies in different regional conditions. Research and demonstration should include new systems and components for industrial applications (incl. thermal seawater desalination), district and/or dedicated space heating and cooling, building integration and energy storage. | |
| 1. Problems important for Slovak research community | It is clear that a strong energy policy is needed to counterbalance the expected increase in energy consumption in all sectors, with emphasis on measures in the building sector (both residential and tertiary) and in the transport sector. Furthermore improvements in the district heating sector are also essential to prevent further disconnection from district heating and a shift to other means of heating. |
| 2. Problems important for Slovak economy and society | Although the usage of RES enables decreasing of consumption of fossil fuels and production of gas emission solids, it is not very developed in Slovakia.<br>RES are timely variable (solar energy), the investment cost are high, in some cases RES cause the negative influence on environment (wind and water power station), and the most important factor for usage of RES are the costs of energy production (the production of energy from RES is more expensive than from fossil fuels).<br>Energy prices and cross subsidies, unprofitable purchase price of the energy into the grid<br>Electricity tariffs are still under finalisation and electricity and heat prices are still set by decree. Their levels are still much lower than international energy prices, which are usually considered too low and a barrier for the improvement of energy efficiency. But what is more important any determination of feed-in tariffs for energy generated by renewable sources or co-generation is not yet on the agenda to prepare an efficient price calculation for energy generated by CHP or renewable sources to support these alternative energy sources. |
| 3. Problems important for Slovak SMEs<br>Select importance: (high, medium, low, zero)<br>**-medium importance** | The costs for energy production from RES for heating are high, it is caused by high investment costs and low usage of output during the year. |

<table>
<tr><th colspan="2">Area “7”: Smart energy networks</th></tr>
<tr><td colspan="2">To facilitate the transition to a more sustainable energy system, a wide-ranging R&D effort is required to increase the efficiency, flexibility, safety and reliability of the European electricity and gas systems and networks. For electricity networks, the goals of transforming the current electricity grids into a resilient and interactive (customers/operators) service network and removing the obstacles to the large-scale deployment and effective integration of renewable energy sources and distributed generation (e.g. fuel cells, microturbines, reciprocating engines), will also necessitate the development and demonstration of key enabling technologies (e.g. innovative ICT solutions, storage technologies for RES, power electronics and HTS devices). For gas networks, the objective is to demonstrate more intelligent and efficient processes and systems for gas transport and distribution, including the effective integration of renewable energy sources.</td></tr>
<tr><td>1. Problems important for Slovak research community</td><td>Requirement of effective integration of RES and equipment for their transport<br>- new technologies of changes, transport and energy accumulation<br>- systemic and regional power engineering<br>- micro-regional systems of RES<br>- economizing and environmentalizing of power engineering<br>- coordination of consumption<br>- responsibility and safety electric system<br>- knowledge power engineering</td></tr>
<tr><td>2. Problems important for Slovak economy and society</td><td>Integration of the technology for transport of RES</td></tr>
<tr><td>3. Problems important for Slovak SMEs<br>Select importance: (high, medium, low, zero)<br>- medium importance</td><td>Development of supporting schemes for development of own RES transport technologies.</td></tr>
</table>

| Area "8": Energy efficiency and savings | |
|---|---|
| The vast potential for energy savings and improvements in energy efficiency need to be harnessed through the optimisation, validation and demonstration of new concepts and technologies for buildings, services and industry. This incorporates the combination of sustainable strategies and technologies for increased energy efficiency, the use of renewable energy and poly-generation and the integration of demand management systems at large scale in cities and communities. These large-scale actions may be supported by innovative R&D addressing specific components or technologies, e.g. for poly-generation and ecobuildings. A key aim is the optimisation of the local community energy system, balancing a significant reduction in energy demand with the most affordable and sustainable supply solution, including the use of new fuels in dedicated fleets. | |
| 1. Problems important for Slovak research community | A review of the main barriers to energy efficiency leads to the conclusion that while significant changes are needed in the regulatory framework, the lack of access to finance and the general lack of awareness about existing technologies and best practice represent the greatest barriers. |
| 2. Problems important for Slovak economy and society | Inappropriate institutional framework. Various administrations are involved, either directly or indirectly, in energy policy. The lack of co-ordination between the different public authorities results in an overlap between programmes offering assistance to stakeholders in some cases, while in other cases some areas are not covered at all by public support. The criteria for allocating funds or for granting permits or licenses vary according to the institution in charge of the programme. Monitoring and evaluation of programmes and policy are not sufficiently developed. This in turn limits the scope for reviewing the effectiveness of policy instruments.<br>Lack of finance or access to finance. In addition to the lack of in-house capital in all sectors of the economy, investments in renewable energy are limited by the difficulty of access to external finance. Efficient energy technologies are often viewed as insufficiently mature, making loans for such projects difficult to obtain and increasing the level of guarantees requested by commercial banks.<br>Lack of incentives - Low energy prices and heterogeneous levels of taxation tend to favour a conventional use of energy and neglect of renewable energy.<br>Lack of awareness and information. The lack of awareness about energy conservation in general is related to the general public's perception that the related technologies can affect their level of comfort, and lack both efficiency and reliability. |
| 3. Problems important for Slovak SMEs Select importance: (high, medium, low, zero) **- medium importance** | A series of barriers prevent market actors from realising more potential for energy-savings. These barriers need to be. The principal barriers to energy conservation are listed below:<br>Foreign operators also perceive high risks in investing in Slovakia, because of legal and administrative barriers. Some progress has however been made in the last few years, for example in the field of energy contracting, due to the regulatory framework and access to loans from banks for the ESCOs themselves. |

| Area "9": Knowledge for energy policy making | |
|---|---|
| Development of tools, methods and models to assess the main economic and social issues related to energy technologies. Activities will include the building of databases and scenarios for an enlarged EU and the assessment of the impact of energy and energy-related policies on security of supply, environment, society and competitiveness of the energy industry. Of particular importance is the impact of technological progress on EU policies. | |
| 1. Problems important for Slovak research community | Policy instruments have been identified which can turn energy efficiency into one of the driving forces of the overall economic and development strategy of the country. Some of these instruments deal with general issues such as general policy issues, regulatory and legal aspects, the institutional framework and fiscal, taxation and pricing policy. They are designed to improve the present conditions and would use only a limited part of the available public budget. The state budget dedicated to energy issues will need to be increased significantly if the proposed targets are to be realised. This increase in budget allocation would enable the implementation of programmes to significantly reduce energy imports and therefore lead to an improvement in the balance of payments. The adoption of these instruments will be beneficial for the entire economy. The most obvious impact is related to the level of energy imports, and therefore the balance of payments. |
| 2. Problems important for Slovak economy and society | Inadequate legal framework. Slovakia has successfully negotiated its Energy Chapter and has harmonised most of the energy legislation with the *acquis communautaire*. Despite this progress the legal framework still needs to be improved mainly by adopting laws which specify the conditions for the production, distribution and conversion of energy and the role of the different stakeholders. |
| 3. Problems important for Slovak SMEs Select importance: (high, medium, low, zero) **- medium importance** | Slovakia already has a general framework for energy policy focusing mainly on the supply side: security of supply and market liberalisation to meet the requirements of accession to the European Union. This policy lacks emphasis on energy efficiency and renewable energy. Although quantitative targets have been set, the lack of an energy efficiency strategy prevents market actors from developing a clear understanding of the policy objectives. |

# ANEX II: National innovation and renewable energy case studies – RESCUE partners

## Annex II.1 Polish case study

### II.1.1 General information and national energy RTD context

The main criterion to describe Polish non nuclear energy (NNE) research actors is the energy sector they are connected with. The coal sector is by far the most important, the wealthiest and the most influential of all: even the governmental responsible for renewable energies come from the coal sector.

There exist a significant number of research groups dedicated to coal energy throughout Poland, especially in Silesia. Some of them work on the environmental friendliness of coal-based processes: coal gasification, hydrogen from coal.

As far as RTD performing is concerned, and due to the still marginal role of renewable energies in Poland, there is not any publicly-funded research programme devoted to renewable energies RTD. What one will find is a limited number of small-scale, rather scattered projects performed by various university research teams. Then, so far, it would make no sense to call "sectors" the various communities of researchers who work on the commonly quoted technological fields: biomass, wind energy, solar energy.

There is neither any clear set of priorities for the overall NNE RTD nor any clear priority-setting process in Poland. This is a "huge need" for Poland: the presence of the implied national bodies (the Ministry, the Academy, the Parliament…) does not seem to boil down to any clearly defined process. Therefore, it appears as very important that the EU has clear priorities in this field (for instance to promote renewable energies and environment protection) since these are influencing the government's decisions.

Energy RTD only consists in separated projects and is not supported by any specific program, even though there is a proper structure inside the national Scientific Council (elected body, supporting the ministry of science and high education) for conventional energy systems.

However, there were some governmental initiatives, influenced somehow by the EU energy policy. First of all, after the Commission had issued a "white paper" in 1997 calling for the development of a renewable energy policy, Poland decided to tackle to this challenge although it was not a member state at that time. Some conferences and contacts were then organised with the EU. In 2000, the Polish government accepted the EC BREC's draft renewable energy policy, which was approved by the Parliament in 2001. This document gives references and "soft obligations" for the development and implementation of mid-term programmes (7,5 % of energy production coming from renewable sources by 2010). RTD should be a part of these sectoral programmes.

Co-operation with the Commission and the EU is seen as very important, from both (RES and conventional) sectors.

RTD projects in the field of renewable energies only, receive so far a very thin support from polish government. The EU action (both priority-setting and project funding) is therefore very much influential. Secondly, the coal industry is well aware of the environmental challenges it will soon have to tackle to. But, on the other hand, it is confronted to great economic and social problems today. The conversion from a "traditional" to a "cleaner" coal industry can succeed but with the massive support from the EU only (see below).

A great emphasis should be put on the need for technological transfer. This is mostly what is expected from RTD partnerships. Poland and the other accession countries, since they are less advanced in technological terms, tend to be imitators rather than technology producers. They seem not to be eager to compete with US and Japan on fuel cells for instance. There is the risk that polish decision-makers wish to follow the EU in some ambitious projects, driven by the objective of world competitiveness. There is not clear if Poland can afford to do so for the moment: it would lack money and would get no results. So, underlined above, technological transfer sounds more pragmatic if there are no clear priorities and lack of money.

One of the biggest challenges in energy sector in Poland is electricity production. A lot of coal is currently fired into power and directives for environmental quality are thus very hard to follow. Most likely, big generators will work on coal for the next 20 to 50 years. On the other hand, the local heat production systems could be changed from now on. Still, such a conversion requires investments and will be very expensive and Poland may needs the Commission's support on this crucial point. The coal sector is a very complex issue, which has strong social and political aspects. For the moment, Poland is trying to close some mines, which are not competitive. Still, since this country does not have any oil source and only limited gas sources (covering less than 40% of natural gas demand), coal will remain the main fuel for long. So far the EU, as far as it is concerned, did not seem to plan to invest much of its NNE RTD efforts on coal, but following the raising energy security problems, al least "clean coal" is becoming again the RTD priority under the FP7.

Still existing divergence between polish RTD potential and the EU RTD priorities leads to the following paradoxical situation: all realistic analyses agree to say that coal is and will be the key energy source in Poland for the next decades but, since it is not an upper priority in EU RTD agenda and since coal polish industries can, in some extend afford to perform research without any massive support from EU, it is by far the energy sector where intra-European synergies are the weakest. On the contrary, EU RTD programmes' influence has by far become the strongest in the renewable energy sectors, which will remain unaffordable to Poland for a very long time and which seem very unlikely to play a significant role in the future national energy policy.

In terms of the "research programmes", several EU programmes are mentioned as for NNE RTD: the RTD framework programmes and ALTENER are the most frequently cited framework for RES RTD&D as well as such programmes as PHARE, INTERREG and SAVE. There is a lack of large national RTD programmes helping in structuring of national RTD research. Bureaucracy and especially financial requirements seem to be another obstacle for small research groups and innovative SMEs. Polish partners of the EU funded RTD projects perfectly understand that all participants in a co-operative project have to pay some part of their activity but some stress that it is a critical problem for them. Because of a lack of financial resources, they cannot afford to participate in all the projects they would be interested in.

### II.1.2 The role of industrial research and innovation in Polish SMEs

***The structure and spending in Polish RTD&D sector and the role of SMEs***

Polish R&D public actors can be divided into 3 categories:

- around 20 institutes linked to the Polish Academy of Sciences and covering a wide range of fields
- universities and technical universities, under the umbrellas of the ministry of higher education and f research

- public institutes linked to other ministries such as the ministry of economy. They are called “branch RTD units” and they are supposed to work for the industry.
- non-public independent, and usually private research and development centres established by research groups evolving from above institutes or from industrial groups (following the approval of the national act on promotion of innovation activities, ‘2005). Experimental development (innovation activities) usually dominating in their activities

A ministry responsible for research was created in 2002, encapsulating the Sate Committee for Scientific Research. The Committee has been setting up a foresight exercise, which will prepare the ground for some sound top-down policy. The ministry is considered to be more powerful than before. The second ministry responsible for innovation (programming and financing) is the ministry of economy.

The main changes in the institutional structure are related to the decreasing of the number of state own so called branch RTD units as well as the units of the Polish Academy of Science while the number of industrial RTD unites has been increasing (including medium size enterprises) over decade and they contributed both, to R&D and innovations. As far as human resources are concerned, it is very frequent that researchers work parallel in several offices or several universities due to their difficult financial situation.

Table 1 Units performing RTD 1995-2003, Central Statistical Office: “Main Science and Technology Indicators 1995-2013” ‘2005.

| Specification | 1995 | 2000 | 2002 | 2003 |
|---|---|---|---|---|
| **Total** | **738** | **860** | **838** | **925** |
| **Scientific and research-development units** (NACE Rev.1, division 73) | **334** | **321** | **338** | **314** |
| Scientific units of the Polish Academy of Sciences | 81 | 81 | 81 | 80 |
| scientific institutes | 54 | 58 | 57 | 58 |
| independent research departments | 27 | 23 | 24 | 22 |
| Branch research-development units | 218 | 222 | 211 | 201 |
| research institutes | 128 | 137 | 139 | 135 |
| central laboratories | 10 | 11 | 10 | 8 |
| research-development centres | 80 | 74 | 62 | 58 |
| Others | 35 | 18 | 46 | 33 |
| **Science support units** | **4** | **18** | **29** | **31** |
| **Business enterprises** | **296** | **402** | **345** | **446** |
| **Higher education institutions** | **104** | **114** | **119** | **128** |
| **Other units** | **—** | **5** | **7** | **6** |

A new system structure of financing research (units and projects) constitutes one of the crucial factors of strategy development for Poland. It came into force on 5th February 2005 by the Act on Principles for Financing Science. It allows for financing programmes or other activities defined by the Ministry for Scientific Research and Higher Education. Almost all government support for separately budgeted research is channeled entirely through this ministry. There are six ways of financing:

1. Core funding for statutory R & D activities, i.e. institutional finance provided selectively to designated research establishments, units and university departments for covering the costs of their own research activities. Schools at the university level cannot use those funds to finance their educational or training activities.
2. Investments in R & D infrastructure, such as buildings and equipment.
3. Peer-reviewed research grants based on research proposals, presented by small research teams or individual researchers, no matter where they are employed or what scientific degrees they hold. Applications are evaluated by an appropriate group of the Committee twice a year. Research projects should deal with new scientific problems and must not be financed from the state budget in any other for m.
4. Subsidies for R & D programmes of national importance commissioned by enterprises, state administrative bodies or local authorities. The financial means are allocated for the implementation of projects and the utilization of research findings.
5. Subsidies for international scientific and technological cooperation resulting from intergovernmental agreements.
6. Subsidies for selected R & D support activities (e.g. information services).

Figure1 presents the breakdown of the national R&D budged per type of the support (instruments). Major part of the budged is absorbed by state own R&D institutions for their statutory activities (the co-operation in between SMEs and such institutions benefiting from this large part of the national RTD budged is rather not stimulating). It seems, there is to low budged for market oriented projects might create a kind of structural barrier for involvement of SMEs in RTD & Innovation.

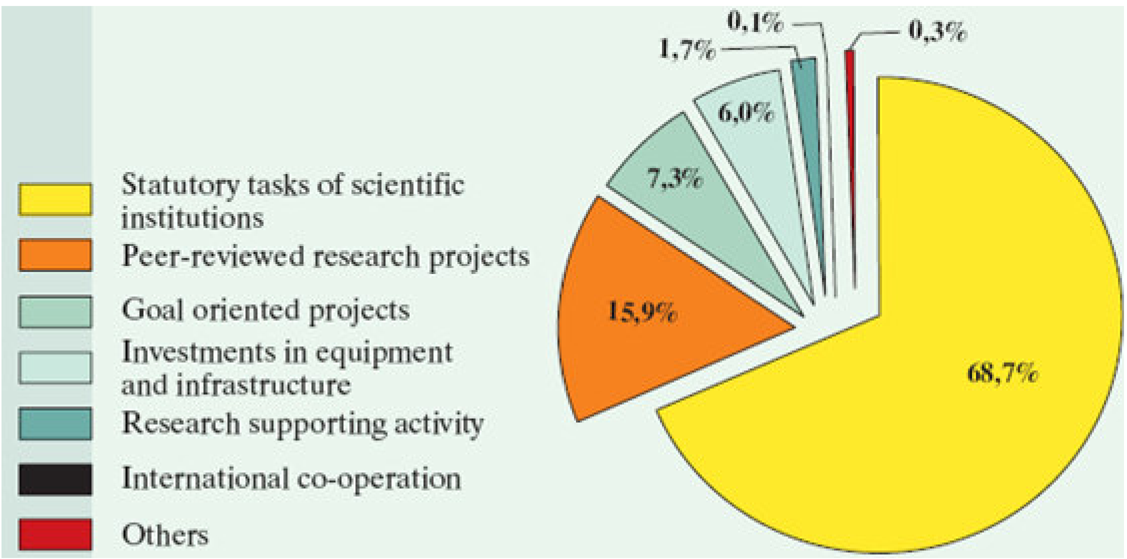



*Fig 1. Governmental budged allocated to R&D and related activities (budged sector science) by channel of financing '2003. Source: Central Statistical Office - "Main Science and Technology Indicators 1995-2013" '2005.*

Taking into account very low national RTD budged per capita (0,6%) the industrial and privet spending for research and innovations seems to be crucial. However business and enterprise contribution for national research and for supporting (co-financing) of research establishment is very low (under 30%). On the other hand, the national statistics (Fig 2) shows hat business does own RTDD activities (total RTD budged was app. Euro 140 mln in '2003) but such activity is low and even decreasing state budged (15% only).

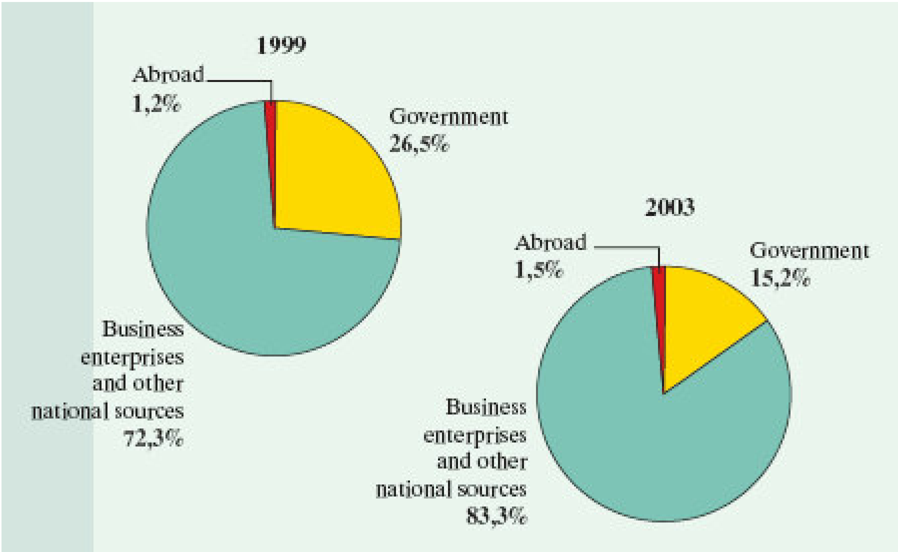



*Fig 2 Business and enterprises sources of funds for RTD (540 mln zl'2003)*

Despite of so far a little only support from the sate for RTD, the companies budged for industrial innovation is grooving and in 2003 it reached almost PLZ 1,5 bln (Euro 400 mln) see fig. 3.


*Fig 3 Expenditure (in PLZ) for innovation activities in business and enterprises (more than 49 employees), Source: Polish Statistical Office '2005.*

The percentage of the innovative enterprise has been grooving from 16% in 1997 to 22% in 2003 – fig 4.

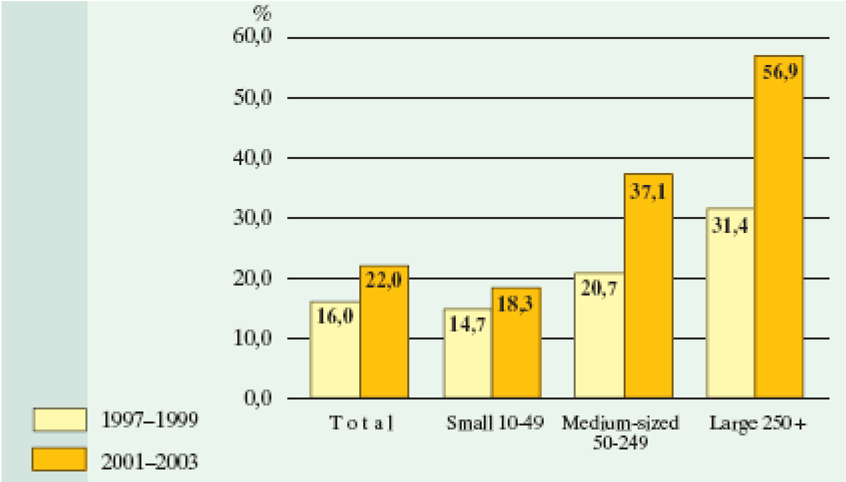


*Fig. 4 Percentage of the innovative enterprise in the service sector by size*

Since the beginning of '2006 new public co-financing is assigned for companies' innovative activity development via support for projects of enterprises and private research groups with "R & D Centers" status or applying for this status. These units and their activities will be supported by tax incentives and low interest, partly not paid back credits and supplemented by support for dissemination of knowledge in the field of industrial property rights, copyrights and related rights protection as well as by co-financing protection of industrial property rights abroad. The formal requirements (e.g. turnover more than Euro 800 000/year) cause that this mechanism seems attractive mostly industrial research at lager scale companies.

***RES related RTD programmes and investment support for innovation***

In Poland, *bottom up* approach (based on researchers initiatives and project proposals), for the stimulation of innovative and emerging energy research, is more common than *top down* approach, based on politically determined priorities, covered by several centrally developed national research programmes. However in area of innovative energy technologies and processes, there are examples of separate research projects as well as national programmes related both, to fundamental and applied research.

In the late 80-thies and 90-thies there were implemented in Poland two parallel and supplemental national research programmes (so called *Central Governmental Programmes on Fundamental and on Basic Research: CPBR and CPBP*), dedicated for non-conventional energy and emerging technologies, including renewable energy (e.g. solar, wind, biomass) and energy end use efficiency (e.g. energy efficient houses). The total budged of the two programmes was app. Euro 2,5 mln. The results of the programmes (with demonstration component and involvement of SMEs) created solid foundation for further national research (late 90-thies and early '00-thies).

Since Poland's accession to the European Union on 1 May 2004, the country's research policy has taken into account the participation in creation and implementation of scientific activity on a pan-European level and research itself has become a crucial element of the country's development strategy and its membership in the European Union.

The bottom up approach for defining and initiation of research programmes has been again used in shaping up of the *National Development Programme for the years 2004-2006,* with the total budged (for all type of activities) of app. Euro 14 billions and strong emphasises of modern energy technologies implementation, especially renewable energy. Modern renewable energy issues are particularly important in technological innovations dedicated sub-programme *Innovation and competitiveness increase,* with the budged of Euro 140 millions, managed by the *Ministry of Scientific Research and High Education* (MNiSW). Not strictly defined, app. Euro 5-10 mln (considerable part dedicated for research infrastructure and innovation, including energy infrastructure (e.g. solar energy laboratory, bioenergy laboratory). MNiSW is also responsible for national foresight study, focused also on sustainable technologies.

The new system of energy related research programmes are under development now. In the new "National energy policy up to 2025" approved the Council of Ministries on Jan 5th, 2005, in the part concerning direction of research there are stated the assumptions for research programmes, including: "the use of biomass in heat and electricity production, wind power and fuel cells are among the most promising new technologies. R&D activities of enterprises should be to a larger degree supported with legal measures (act on financing of science, national Foresight program)…". There are the following research programmes planned for realization until 2008: a) determination of research and development for the support of energy policy, as an element of the domestic framework program – realized under the leadership of the minister responsible for science in cooperation with the minister responsible for economy, b) support for acquiring EU funding for research and development in energy – realized under the leadership of the minister responsible for science in cooperation with the minister responsible for economy. However there are no specific many reallocated for each of this programmes yet as well as there is no detailed information how the programmes will be implemented.

In September '2005 the former Minister of Science and Information Technology (now MNISW) approved the National Framework Research Programme for the coming years This national programme (updated in the future on regular basis) has set up already 9 strategic research areas, among them "Energy and energy resources strategic research programme", consisting of 4 priorities, including: a) new energy technologies (FC, hydrogen, PV), b) clean and efficient call (gasification and supercritical vapour parameters), c) national energy security (including electricity grid balancing and grid flexibility), d) renewable energy sources and biofuels. There is no yet programme related specific call for proposals, however the National Framework Research Programme will be implemented through multi-annual interdisciplinary integrated projects, starting from '2006.

For energy RTD and innovations the complementarily between national research programmes, Structural Funds and FP7 within the next round of financial perspective 2007-2013 seems to be crucial in Poland.

On the 1st of Oct. 2006 the Council of Ministry approved two (prepared by the Ministry of Economy) relevant operational programmes related to RES and innovations, within the new ***National Development Programme for the years 2007-2013***. The programmes will absorb 47,4% of the total financial sources for the Polish cohesion policy and they seem to be the major supporting financial mechanism for innovations in RES field. Both programme are described briefly below.

Operational Programme "Environment and Infrastructure" (Euro 26 bln, including Euro 21 bln from the EU: ERDF and FS) encompasses some innovative priorities, including the most innovative part – "activity 12.2): Development of renewable and alternative energy sources, including biomass" with the total indicative budged of Euro 613 mln (including Euro 334 mln from ERDF). The programme will focus on the investment support for investment in innovative energy technologies. ***The beneficiaries of the programme will be energy industry (biofuels, biogas, wind and hydro energy and geothermal) and, as well as, SMEs starting production of renewable energy technologies equipment (all renewable energy technologies).*** The programme required projects with the budged higher than Euro 5 mln. It is excepted that smaller projects would be financed from 16 Regional Operational Programmes (total "horizontal budged – Euro 16 mln). The programme will be managed by the Ministry of Economy.

Ministry of Economy (in cooperation with the Ministry of Science and Higher Education) is also responsible for the Operational Programme "Innovative Economy" (Euro 8,2 mln, including Euro 7 bln form ERDF). This is horizontal programme, without dedicated budged for RES, however RES related technological research, innovation and implementation activities might be easily financed within the framework of this programme, especially if such projects are developed by or for innovative SMEs. Among 7 specific priorities ***the most relevant for SMEs is the priority 4 "Investment in innovative enterprises" with the total budged of Euro 894 mln. The support will be given for SMEs both, for new products development - industrial research (80% for small companies and 65% for large companies) and for new investment in modern technologies (70% for small companies and 50% for large companies)***. SMEs can also be beneficiaries in others priorities, especially in co-operation with RTD units: priority 1- technological research and development; priority 2 – research infrastructure (i.e. industrial and private research abd development centres), 3-capital for innovations (incubators and spin offs); priority 5 innovation diffusion (i.e. enterprises grouped in clusters) as well as priority 6- Polish economy at international market (export promotion).

# Annex II.2: Bulgarian case study

## II.2.1 General overview

Bulgarian energy sector is dominated by nuclear power and imported fossil fuels, which represent approximately 96% of its primary energy supply. It imports more than 70% of its primary energy sources, mainly from Russia: oil, natural gas, high quality coal and nuclear fuel. The only significant domestic energy source is low-quality lignite coal with high content of sulphur. Coal has a significant share in the Bulgarian fuel mix and is widely used for electricity generation - at about 40% of total electricity generation. Bulgaria's nuclear plant accounts at about 41% of all electricity supplies, depending upon the availability of hydropower. At present Bulgaria exports electricity.

This structure of the energy balance causes concern in term of the security of energy supply. Despite of its scarce domestic energy potential, Bulgaria's economy differs from other economies /both developed and Central and Eastern European economies in transition/ in what can be called energy extravagance. Bulgarian economy is highly energy-intensive due to the high energy intensity of the industry - the national GDP energy intensity is 2-5 times higher than the average in the EU member states. Another feature is that the consumption of fuels and energy for the households is relatively low in comparison with the other EU countries – by 2 to 4 times.

Due to the geographic location and geologic conditions, Bulgaria has a number of potential sources for renewable energy, i.e. solar, hydro, biomass, geothermal and wind energy. That is why the key strategic objective of the economy and, more specifically, of the energy sector should be rational use of energy sources as well as the RES ones: Bulgaria has an area of 11.1 million hectares / 7.8 mln. population 2005/. Forests covers over 35% of this area and further 55% is available for agriculture. The assessments show there is tremendous scope to utilize wood, wood waste, wood energy crops and agricultural waste not only for heating in small, inefficient household and industrial units, as it occurring today, but in modern, highly efficient systems.

The usage of different types of RES in Bulgaria – 2004 is shown in the Table:

| No | Renewable Energy Sources | Installed Capacity – MW | Energy produced |
|---|---|---|---|
| 1. | Wind stations | 0 | Electric |
| 2. | Small and Medium Hydro PSs | 63 | Electric |
| 3. | Solar PV systems | 0 | Electric |
| 4. | Tidal & Wave generators | 0 | Electric |
| 5. | Geothermal installations | 100 | Heat |
| 6. | Installations for generation energy from crops/ethanol, biodiesel | 0 | Electric & Heat |
| 7. | Solar hot water systems | 20 | Heat |
| 8. | Installations for generation energy from wood leavings | 963 | Electric & Heat |
| 9. | Installations for generation energy from agriculture waste products / solid and liquid/ | 0 | Electric & Heat |
| 10. | Installations for generation energy from industrial waste products | 0 | Electric & Heat |
| 11. | Installations for generation energy from landfill gas | 0 | Electric & Heat |
| 12. | Overall RES installed capacity in Bulgaria and its % from the total | 1146 MW 0.4% | Electric & Heat |

The EBRD study for Bulgaria concluded that, except for solar, Bulgaria has very promising renewable energy resources development opportunities across all technologies", being one of the countries with highest wind potential / 3,400 MWe in 2020/. Additionally, taking into account that 90% of Bulgaria's territory is arable, the potential of biomass is considered to be very promising.

Its is that the generation of energy from RES could reach in general 8 GW / medium theoretical potential in 2012/. The installed energy powers in 2002 in Bulgaria were 12 GW.

The use of biomass in Bulgaria is presently confined to heat production from residues and officially this contributes 3.7% / 409 thousand toe/ of the final energy supply, but there is no DH plant on biomass operating currently for the domestic sector in Bulgaria. Biomass has the immediate potential to contribute up to 5% of the current national total energy requirement. But, nowadays there is no significant experience on biomass electricity technologies

Also Bulgaria is characterized by the presence of important proven geothermal potential of low enthalpy. Utilization of geothermal resources has been going on slowly until now, mainly due to the specialized technology knowledge needed at the geothermal exploitation installations.

Forecast for the capital cost of renewable energy technology in Bulgaria - heating 2020

- residues / forest, agr./ - 0.007
- wastes - 0.01
- electricity 2020:
- residues / forest, agr./ - 0.003
- wastes - 0.02

The RES theoretical potential in Bulgaria according the Phare BG 9307-03-01 Project Final Report data is evaluated to 14 387 TJ/year- Geothermal energy; 77 156.6 TJ/year-solid agricultural waste; 478. 47 TJ/year – biomass from paper waste; 9 605.2 TJ/year – biomass from wood for heating; 79.8 TJ/year – biomass from natural fibers; 11 381.83 TJ/year – liquid agricultural waste; 25 766 GWh/year – big and small HPSs; 1500 kWh/m$^2$year – solar radiation.

### II.2.2 General information and national energy RTD context

In compliance with the country economy recovery and forthcoming accession to the EU, in 1999 started the creation of the necessary legislation basis in order to implement effective policy on energy efficiency and to encourage the usage of RES. Up to now there has been significant progress in putting in place the greatly needed legal and financial mechanisms to achieve sustainable energy development:

- National legislation and initiatives related with the RTD activities incl. the RES field:
- Law on Energy 2003 includes provisions on the obligatory connection of small renewable and co-generation units to the electricity grid with up to 10 MW installed capacity.
- Energy efficiency law 2004 stimulates the investments for energy efficiency – the aim is to decrease the energy intensity of the GDP, created in the industry by 25% till 2014 and the RES share in the Bulgarian energy mix to 7%.

- National short term program for energy efficiency till 2007 with main aim to reach 11% of the gross internal energy consumption by RES.
- National long term program for promoting the use of RES' 2004-2014 with a list of 104 RES investments projects with higher readiness for implementation, using; solar energy / solar heat water collectors, solar heat and hot water installations, solar thermo installations, hybrid heating systems, MHPS's erection, geothermal heating systems, production of briquettes from biomass, wood boilers, biomass systems for heating, biomass systems for generation of biogas etc./. The execution of the program will result in the installation of 393 MWe capacity and 1,488 MWth capacity with total investment needs of USD 1,647 million.
- Operational program for the development of the Bulgarian economy 2007-2013 with, priorities: Development and application of innovation technologies in the SMEs incl. increase of the innovation potential of the SMEs and - Diversification of the usage of energy sources.
- Establishment of Energy Efficiency Agency /2004/ and a National Fund for energy efficiency /2005/ for law interest energy efficiency investments for the SMEs;
- National strategy on regional development: with the aim to decrease the energy intensity of the Bulgarian economy and increase the energy efficiency of the SMEs.

<u>RES RTD players in Bulgaria:</u>

In general the RTD activity in the RES field is hardly limited. The main direction of the National Strategy is to establish incubators, technological centers, scientific-technological parks in order to ameliorate the coordination between the RTD Institutes and the SMEs, to guarantee the building up of efficient innovation potential and to relate the search and the offer at the innovation market.

In 2005 the number of the Bulgarian SMEs was 202 000= 99.7% of the total number of enterprises in Bulgaria i.e 54% of the hired working people, producing 48% of the national income. In the sectorial structure the number of the SMEs with high tech and innovation fields is law.

The innovation index of Bulgaria for 2004 – SII-2 / European Innovation Scoreboard/ for 2004 is at about 0.30 / i.e. is trying to reach the European medium level. The number of the SMES with RTD for 2003 is 96.

Last year Bulgaria marks a progress regarding the innovations – up to the European innovation index SII-2 passing from the forth to the third group. Nevertheless the relative share of the costs for RTD from the GDP is decreasing and remains law compared to the European one:

Bulgaria – 0.51 % to 0.84 of EU-10 / 2001/

Bulgaria – 0.49 % to 1.99 of EU-15 / 2002/.

The low level of innovations in Bulgaria and the trend to keep this low level will have a negative impact of the fulfilment of the Lisbon objectives for Bulgaria. Unfortunately the costs for RTD and innovation are decreasing gradually in Bulgaria and the business show also a lack of interest for investing in.

RTD Institutions active in the RES field:

- The Bulgarian Academy of Science and around of 12 Institutes under its umbrella.
- The Technical University- Sofia
- The Chemical – technological University
- A couple of NGOs mainly active in the awareness raising and education on the RES problems.

- Very limited number of SMEs.

Human potential: The percentage of the active people with higher education is equal to the level of the EU-15 / 2003/ = 21%, and higher that the one of the 10 new member countries. But, the number of the people engaged in creating and using scientific knowledge is decreasing. Bulgaria gradually changes its orientation from a human potential creating scientific achievements to one only applying it. The RTD personnel decreased by 43.1 % in 2003 compared with 1995. The number of the RTD enterprises also - by 20% in the last 5 years.

Financial instruments for fulfilment of the policy on energy efficiency, RES and innovations:

- Energy efficiency Fund
- Innovation Fund
    - Grant Scheme / launched 2003/ for enhancement of the innovation in SMEs in Bulgaria - 49 applications approved for funding for 1 522 976 Euro from which EU funding 1 142 232 Euro from EU funds – 6 % related with energy efficiency.
    - The grant beneficiaries, re: RTD activities:
        - 79% had RTD projects;
        - 82% launched new or significantly improved products;
        - 64% indicated that they regularly implement RTD.
    - RE; size:
        - 27% employed up to 10 employees;
        - 42% - 10-50 employees;
        - 12% - 51-100 employees and
        - 18% more than 100 employees.
- Phare – with priorities for hi-tech business incubators, R& D, SME technology grant scheme;
- FP5 – 12 projects with BG partners, 1 - in the energy field – in the PV sector.
- FP6 – in Research and Innovation - 258 submitted projects proposals with BG entities participation, 43 – retained for funding.

  In the energy field, Bulgarian BG participation projects – 15, 2 projects with BG participation approved in:
    - Cooperative research : Development of integrated solar system for buildings;
    - Collective research: Sustainable heat and energy research for heat pumps applications.

  The Bulgarian Academy of Science and the universities have 36% of the approved projects, the SMEs – also 36%.

  Participation of Bulgarian entities in horizontal research activities involving SMEs:
    - 959 submitted projects;
    - 75 – BG entities participations retained for funding;
- Program SAVE – an Energy agency established being the first energy management one in Bulgaria which priority is the RES promotion.
- Banks credits - The European Bank for development and reconstruction opened, with the collaboration of the Bulgarian government, a credit line for loans aimed to SMEs' projects for energy efficiency and RES. The Bulgarian banks have no appropriate approach to funding the projects for technologies involving the use of renewable resources as they are evaluated as high-risk projects.

Problems for RTD in the Bulgarian SMEs:

- absence of clear strategy on RES development;
- “die hard” prejudices;
- weak national RTD funding;
- strong fossil fuels lobby;
- lack of information;
- language barriers;
- lack of human and financial resources.

Barriers:

- low percentage innovation/GDP per capita;
- downsizing of research programs;
- week structures for technology transfer;
- insufficient financing for innovations;
- only 3.43 of the total number of SMEs have RTD.
- bad market orientation of the RTD.

Challenges:

- obligations arising from White paper /12 % RES/ and Directive 2001/77/EC / 22.1 % E-RES/ in 2010;
- enlargement of EU;
- improvement of the coherence of new members and EU RTD activities in RES field.

Potential for success:

- high intellectual potential;
- international networking;
- increasing number of off-grid systems.

Recommendations to the Bulgarian government by foreign institutions:

- to put great priority on the technological RES transfer;
- to set clear targets and adopt a comprehensive strategy and action plan for the development of RE generation, and implement them;
- feed-in tariffs to be adopted for all renewables / not only for wind and hydro/ and clear standards for connection to the grid should be set. Preferential tariffs for the heat produced from renewables should also be established;
- to involve all stakeholders in project development so that local experience and the knowledge of experts can be considered;
- tax exemption for renewable energy generation equipment could be implemented;
- to develop education campaign targeted at different stakeholders and to establish information centers where information for projects development would be provided;
- to develop a centralized information division in order to support project developers and RTD makers and facilitate dissemination of the information regarding energy efficiency and renewable energy potentials.

# Annex II.3. Hungarian case study

## II.3.1 General information and national energy RTD context

The main components of the Hungarian national RTD system at institutional level are governmental organisations, the Hungarian Academy of Sciences and non-budgetary research organizations. Further key energy RTD players are universities and private companies (SMEs, large enterprises) and NGOs.

The Science and Technology Policy College (TTPK) is the highest governmental level consulting body of science and technology policy. TTPK and its advisory body composed of eleven highly distinguished representatives of the national scientific community and industry (Science and Technology Advisory Committee, TTTT) was established in April 2003. Prior to that between 2000 and 2003, on the Government level, the Ministry of Education (MoE) had been responsible for planning and implementing the Hungarian S&T policy, for R&D programmes and for promoting the international (including EU) science and technology co-operation. On 1st January 2004 a new government office, the National Office of Research and Technology (NKTH) has been set up as a legal successor of R&D Division of the MoE.
The NKTH has the following responsibilities and missions:

- elaborating the governmental strategy in the field of innovation,
- forming the means and tools for the R&D and innovation policy at governmental level,
- preparing documents concerning the national S&T policy, running technology foresight programmes, preparing reports and reviews for promoting the acquisition and dissemination of new knowledge and information in co-operation with social partners, NGOs, industrial and professional associations,
- representing the government in the international field, organising and co-ordinating the Hungarian participation in such programmes,
- co-ordinating the activity of the Research and Technology Innovation Fund (RTIF) and the National R&D Programmes, and supervising the Agency for Research Fund Management and Research Exploitation (this Agency is responsible for managing different R&D support programmes financed from the RTIF),
- raising innovation awareness in the society.

From August 1, 2003 a new agency called Agency for Research Fund Management and Research Exploitation (KPI) has been set up for managing the R&D budgets of the RTIF and the EU Structural Funds.
The main tasks of the agency are:

- Financing R&D and innovation projects through open calls using the sources of the RTIF,
- Accredited implementing organisation (intermediary body) of the Research, Development and Innovation priority within the Economic Competitiveness Operational Programme (GVOP), using the EU Structural Funds and national cofinancing,
- Promoting public-private partnerships,
- Advisory services for S&T stakeholders at national and regional level.

Another important institution is The Hungarian Academy of Sciences (HAS) (www.mta.hu) It is an autonomous public body based on the principle of self-government, financed by state budget. It is constituted by the members of the Academy and by those active representatives of science who hold a scientific degree (Ph.D. or D.Sc.). It has the right and duty to support the development of sciences, scientific research, and the publication of scientific books and journals; to regularly evaluate scientific research results as well as encourage and assist publication, dissemination and utilisation of them; and to represent the Hungarian science in the national public and at international scientific lives. The Academy's share in the Hungarian research capacity in terms of the total number of other Hungarian R&D organisations is about 10%, within this that of R&D institutions is slightly more than 60%. The Academy's share in the number of total R&D personnel is almost 20%. According to the different fields of sciences, this share is the highest in natural sciences (based on the share in R&D expenditures of all R&D units, it is almost 60%), and by phases of research its share is decisive in the field of basic research (also based on the share in R&D expenditures of all R&D units, it is more than 40%). The HAS has 37 research institutes, about one fourth of them do research related to renewable energy systems.

*Research institutes of the HAS associated with RES*

| Natural Sciences and Mathematics | Life Sciences |
|---|---|
| Chemical Research Centre (www.chemres.hu)<br>KFKI Research Institute of KFKI Research Institute for Technical Physics and Material Science (www.mfa.kfki.hu)<br>RCES (Research Centre for Earth Sciences) (www.core.hu/fkk/fkk_eng.html)<br>RCES Geodetical and Geophysical Research Institute (www.ggki.hu)<br>RCES Geographical Research Institute (www.mtafki.hu)<br>RCES Laboratory for Geochemical Research (www.core.hu/gkl/gkl_eng.html) | Agricultural Research Institute (www.mgki.hu)<br>Institute of Ecology and Botany (www.botanika.hu)<br>Research Institute for Soil Science and Agricultural Chemistry (www.taki.iif.hu)<br>Biological Research Centre (www.szbk.uszeged.hu) |

The Bay Zoltán Foundation (BZF) www.bzaka.hu and the Collegium of Budapest www.colbud.hu are the most important among the non-budgetary research organizations. The BZF is the largest research foundation in Hungary, founded in 1993, comprising of three research units: Institute for Biotechnology, Institute for Material Science and Technology and Institute of Logistics and Production Engineering. The Collegium Budapest (CB) is the first IAS-type institute in Central and Eastern Europe. As an adaptation of the Princeton Model, the CB represents a new type of institute, different from both universities and specialised research institutes. Its main attraction is offering its research fellows temporary liberation from their administrative and teaching obligations, allowing them to concentrate fully on their chosen research agenda.

Further crucial players of RTD are the universities: there are about 1613 research units in the higher education sector.

*List of the Hungarian state universities that have energy related RTD orientation:*

- Budapest University of Technology and Economics (www.bme.hu)
- University of Debrecen (www.klte.hu)
- Eötvös Loránd University, Budapest (www.elte.hu)
- University of Miskolc (www.uni-miskolc.hu)
- University of Western Hungary, Sopron (www.nyme.hu)
- University of Pécs (www.pte.hu)
- University of Szeged (www.u-szeged.hu)
- University of Veszprém (www.vein.hu)
- Szent István University, Gödöllő (www.szie.hu)

*Private companies*

As a result of the mapping of the national competencies in the field of RES it was found that there are only a few large enterprises active in the field. These companies are mainly involved in research and development of the utilization of biomass, primarily energy crops, innovative technologies of waste incineration, the production of bioethanol, biohydrogen production and the development of cogeneration facilities based on renewable energy sources.

The number of small and medium sized enterprises active in the RES-related field is relatively high, about 160 Hungarian SMEs include RES in their company profiles. Most of these companies are very small, fitting into the category of micro-enterprises. About 20% of the SMEs put emphasis on R&D activities. The majority are open to get involved into R&D projects as partners and a few SMEs have their own initiatives and project ideas or are willing to be project coordinators.

NGOs

*NGOs*

The Energy Club (www.energiaklub.hu) is one of the most important NGOs active in the field of renewables having activities that are related to environment and energy since 1990. They are in favour of an energy sector which is based on environmental-friendly technology and which assures sustainability, i.e. decentralised, diversified energy system where the Least Cost Principle is taken into account.

<u>Hungarian energy RTD priorities</u>

Increasing the share of RES is quite important for Hungary in order to lower its dependence on fossil fuel imports. The country is poor in energy, its domestic energy production namely from oil, gas, nuclear power, low calorific coal and lignite only meet barely half of its energy requirements. At present the share of renewable energy sources in Hungary in the total energy production is 3,6%. The aim is to almost double this share, to reach 7% by 2010.

For the moment there is no existing national renewable energy strategy. However, the Hungarian Energy Policy for the period of 2006-2030 is under preparation and the draft version is available where chapter 12 includes a programme for the enhanced use of renewable energy sources, while chapter 15 is dedicated to the role of energy R&D. According to the programme Hungary can count mainly on biofuels, on powerplants based on biomass (until 2010 it means the yearly yield of firewood, afterwards the yield of future energy crops), on wind- and geothermal energy and solar thermal energy. Bioenergy is considered as one of the six key technology areas of the national innovation policy. The programme is not dealing with RESs that will not be part of the national energy policy by 2025 because of economic or other barriers. Therefore, photovoltaics and the use of hydrogen as an energy carrier are not in the official focus.

Strategical importance is devoted to the following:

- The utilization of agricultural lands for biofuel production and the constrained introduction of the use of biofuels
- Biomass powerplants – new energy plantations
- The issue of wind power plants and its infrastructure (network building, system controlling, etc.)
- The utilization of the national geothermal reserves, establisment of geothermal electric power plants
- Support of the use of solar thermal systems for decentralized heating in residential buildings, public and agricultural facilities
- Utilization of heat gained from waste incineration and sewage sludge

- Providing renewable energy to autonomous systems

The study also assumes that by 2010 Hungary will be able to fulfill its commitments towards the EU. After 2010 the gradual increase of electricity generation from renewables is proposed in the document, but the target is to reach a maximum share of 7%. The preferred sources for that will be biomass and wind energy, however, in the case of wind energy there are existing barriers (i.e. technology of system-controlling) that have to be eliminated.

RES needs a complex approach of research and education (economical, organizational environmental, legal, technological concerns where the externalities are also considered) especially regarding biomass deriving from energy crops. Research of externalities is crucial in order to have an economically feasible and effective base of references. By fulfilling the above objectives the share of RES in energy use in Hungary can reach 9% by 2025.

### II.3.2 Hungarian energy RTD programmes

Presently, there is no such existing funding programme that would be entirely dedicated to renewable energy RTD.

A S&T Act was approved in 2003 to create the Research and Technology Innovation Fund. The two most important revenue sources of the Fund are the central budget of current Technological Development Program and National Research and Development Programmes expenditures (70%), and the contribution paid by a defined range of companies (30%). The planned amount of the Fund was about 26 billion HUF (about 100 million EUR) in 2004, and a dynamic growth was expected for years 2005 and 2006. The official objective is to change the above ratio by increasing the ratio of funding contribution of the business sector.

Two Operational Programmes (OP) of the National Development Plan (2002-2006) covered energy innovation to some extent. These are the Environment and Infrastructure OP (KIOP) and the Agriculture and Regional Development OP (AVOP). The EIOP has one measure that deals with the innovation of the environmentally friendly energy management. It has two themes that are the increase of the use of renewables and the energy efficiency. The AVOP deals only with the efficient energy supply of agricultural enterprises. A third OP called the Economic Competitiveness OP (GVOP) has to be mentioned since it is dealing with R&D and innovation along with further important topics like investment incentives and SME promotion. All existing and planned R&D and innovation actions of the GVOP are organised in three measures:

- Support of application-oriented co-operative RTD activities
- Improvement of the conditions of research, technology transfer and co-operation at publicly financed and non-profit research facilities
- Reinforcement of corporate R&D capacities and innovation skills

Further publicly funded programmes started in 2004 that support innovation and investment developments. SMART 2004-5 was initiated by the Ministry of Economy and Transport with the focus on the switch to environmentaly friendly technologies, NEP 2004-10 is dedicated to the national energy efficiency and KÖVICE started by the Ministry of Environment and Water aims to support the sustainable energy management. Unfortunately all of these programmes are suspended since 2005.

National R&D challenges in Hungary

- High-tech entrepreneurship is very reluctant in the country
- Lack of products and services that are competitive on the global market
- The structure of the national innovation system is not proportionated in the right way
- Low level of corporate R&D activity and investment

- The interest of people working in the field of natural sciences and engineering is not in line with market needs and expectations (this is also partially true for the 1/3 of people working in Old member states)
- The national industrial background for the important interdisciplinary scientific field is weak or does not exist
- Strategic cooperation between companies itselves and between researchers is missing
- Low activity regarding patents
- Fragmentized research

***Sources of information:***

Research and Development in Hungary 2003-2004
http://www.nkth.gov.hu/main.php?folderID=808

Hungarian Research Themes in the field of Life Sciences, Materials, Environment and Energy – CERA project brochure - http://docs.tetalap.hu/eng/cera_brochure.pdf

Az új magyar energiapolitika tézisei a 2006-2030-as időszakra, 12. fejezet A megújuló energiaforrások szerepe az energiaellátásban 2005 szept. tervezet

15. fejezet Az energetikai kutatás-fejlesztés szerepe 2006 január- tervezet

Renewable energy sources in Hungary: regional potential and environmental impact – EPCEM Study Report 2004

Magyarország innovációs stratégiája, a nemzeti stratégiák szerepe Győr 2006. április 7. Dr. Imre József előadása

WIP/ETA, REPROMO – Who is who in Bioenergy and Solar Energy in CEEC, 02/2005

Environment and Energy Operative Programme 2007-2013, draft 29th September 2006

# Annex II.4.Lithuanian case study

## II.4.1 General information and national energy RTD context

RTD activities in energy sphere are being carried out in the following institutions of Lithuania:

- Lithuanian State's research institutes,
- Universities,
- NGO,
- Some small-scale private companies.

The main researching capacities are concentrated in state's research institutes, which are subordinated to the Lithuanian Ministry of Education and Science. They have the most significant number of professional researchers in the country and the largest share of financial support, which is very low to compare with OMS of EU.

The universities are the second main researching force in Lithuania. The RTD work is being carried here mostly in research institutes and centers established at the universities. Some researches are being performed in the departments of universities as well by academic personnel including researches under the Ph.D. students' programmes. The financial support for RTD activities in the institutes and centres at Lithuanian universities is very low too, especially for researches in RES sphere (close to zero). Therefore they try to win various possible national and international grants for researches, studies, projects and scientific programs in order to enhance their knowledge, know-how and readiness to solve the problems important for Lithuania in spheres of providing themselves by clean energy resources and protection of environment from pollutions.

Besides the state's research institutes and universities, there are some non-governmental organizations (NGO) in Lithuania active in energy sector, mostly in RES. One of them is the Lithuanian Academy of Applied Sciences established by scientists from all over Lithuania in 2001. Researches and other activities in energy and especially in RES sector are one of the priorities of the Academy.

Another NGO active in RES sector is Alternative Energy Information Fund (ALTEI Fund) "The Green Farmstead". The ALTEI Fund was established in 1996 and carried out some projects, organized a number of seminars, conferences, expositions in local and international exhibitions in sphere of RES. Both mentioned NGO are small-scale institutions working without financial support from government.

There are many various SMEs in Lithuania, however currently only less than 30 of them are active in RES sphere and only 3 or 4 of them are involved in RTD work. The most promising of them are UAB "Saules energija" (PV), UAB "Slengiai"(biomass combustion, solar villages) UAB "Technogama" (WT). High scientific potential has SME "Moksliniu paslaugu firma GTV" (Firm of scientific services GTV), which in future would like to work in RES field as well. According to the draft project of General National Strategy for Usage of EU Structural Funds in 2007-2013 (Vilnius, September 1, 2006), innovative activeness in the Lithuanian enterprises is very low. Even 72 % of country's industrial enterprises do not implement any innovative activity and only 4 % of them are just modifying their technologies without doing researches. Rate of innovativeness of Lithuanian enterprises is one of lowest in EU and makes up only 0.27, meanwhile the EU-15 has the rate 0.46, EU-25 – 0.42.

The most promising Lithuanian SMEs active RES sector are UAB "Saules energija" (PV), UAB "Slengiai"(biomass combustion, solar villages) UAB "Technogama" (WT). High scientific potential has SME "Moksliniu paslaugu firma GTV" (Firm of scientific services

GTV), however recently they refused from intentions to work in RES field because of the multiple engagements in other projects and orders.

The most important Lithuanian institutions active in RE field are presented in the table below.

Lithuanian universities and research institutions active in RES field

| Nr. | Name of institution | Activities in RES sphere | Web site |
|---|---|---|---|
| 1 | Lithuanian Energy Institute (LEI) | Biofuels, Biogas, Landfill gas, Solar thermal technology, Wind energy technology | http://www.lei.lt |
| 2 | Institute of Lithuanian Scientific Society | Photovoltaics | http://msi.lms.lt |
| 3 | Kaunas University of Technology (KTU) | Biogas, Biomass, Hydropower, Solar thermal technology, Wind energy technology | http://www.ktu.lt |
| 4 | The Centre for Renewable Energy Technologies at KTU | PV, Electrochemical storage, Hydropower, Wind energy technology | www.aet.eaf.ktu.lt |
| 5 | Lithuanian Agricultural University (LAU) | Biofuels, Biogas, Hydropower | http://www.lzuu.lt |
| 6 | Lithuanian Institute of Agricultural Engineering at LAU | Biofuels, Biomass, Solar thermal technology, Wind energy technology | http://www.mei.lt |
| 7 | Klaipėda University | Environmental technology, Biofuels | http://www.ku.lt |
| 8 | Institute of Geology and Gegraphy | Geothermal Energy | http://www.geo.lt |
| 9 | Lithuanian Institute of Agriculture | Energy crops | http://www.lzi.lt |
| 10 | Lithuanian Forest Research Institute | Biomass | http://www.mi.lt |
| 11 | The Lithuanian Academy of Applied Sciences (NGO) | Biomass combustion, Hydropower, PV, Solar thermal technology, Wind energy technology | http://www.ltma.ten.lt |

Co-ordination and financial support of RTD activities in general here are far from acceptable level. The main players of the state's financial support distribution among the researching organizations in Lithuania are the following institutions:

- Lithuanian Ministry of Science and Education (www.smm.lt),
- Lithuanian State Science and Studies Foundation (www.vmsfondas.lt).

Lithuanian Ministry of Science and Education is responsible for the financial support allocation for every year and every research institute and university depending on their magnitude and last year's achievements in RTD activities counted according to the established rules. This support is rather insignificant.

Another possibility to receive a financial support in this country is to submit a project proposal to the Lithuanian State Science and Studies Foundation in order to win a grant for RTD activities. This way is considered as rather complicated and hardly available because the number of potential appliers is high and capacity of the Foundation is limited at the low level, so the chance to win a grant is not favourable.

RTD in the national energy sector less or more is left for itself without co-ordination and sufficient financial support as well, especially in sphere of RES. Power and heat production mainly are based on nuclear and traditional fossil fuels. Prevailing of RTD themes related with this traditional energy over themes related with RES is much more evident than ratio of produced energy from fossil fuels and RES. Currently renewable energy sector and particularly RTD of this sector in Lithuania is in its initial stage of development apart from the wood usage mostly for heat production.

The wood is being used in centralized heat plants (total capacity is about 420 MW, 34 % of wood and its residues consumption) as well as in CHP plants for heat and power production and for house heating mostly in farmsteads and small towns (66 %). Presently installation of CHP plants is in progress in Lithuania. Total production of electricity in CHP plants running on biomass in 2004 made up 7.4 GWh when official target for this year was only 1.5 GWh. Total capacity of installations for heat production running on straw now is about 7 MW. The official target for electricity production from biomass for the year 2009 is 180 GWh. So, implementation of technologies for heat and power from solid biofuels is going rather smoothly without considerable problems.

Domination of the biomass technologies development in Lithuania is foresighted in the nearest future as well: according to the mentioned above draft project of General National Strategy for Usage of EU Structural Funds in 2007-2013, financial support under priority Renewable Energy Sources is allotted only for the biomass energy (113,7359 millions of LTL or 32,94 millions of Euro).

Unfortunately, fulfillment of the rest official targets for power production from other renewable energy sources is lagging behind. The gap between target and reality for power production from wind energy is especially significant. The actual electricity production from the wind in 2004 was only 1.2 GWh when the target was 28 GWh. Approximately the same quantity of produced electricity is expected in 2005 because only the same three wind turbines presently are operating: in Vydmantai (600 kW), in Telšiai (150 kW) and Juragiai (55 kW). The target of electricity production from WT for 2005 is 84.2 GWh and for 2009 – 278 GWh. The Government will support installation of total wind turbine capacity 200 MW. Meanwhile Ministry of Economy already has applications for about 900 MW.

The main problem and the reason of poor start of wind energy technologies development in Lithuania is lack of the generated power amount control flexibility in the power system. The power system currently has no enough means to balance hardly predictable and quickly changing power received from the WT. In order to solve this problem Kruonis Pumped Storage Power Plant presently having capacity 800 MW (the designed capacity is 1 600 MW) could be used for the balancing of power received from the WTs country's parks of wind turbines. However, the power of Kruonis Pumped Storage Power Plant presently is not smoothly adjustable because hydroelectric generators having capacity 200 MW (4 x 200 MW) are not adjustable. Installing of two additional smoothly adjustable hydroelectric generating sets having the same capacity 200 MW could help to solve the problem. So, total adjustable power of Kruonis PSPP could be increased up to1200 MW, when any amount of power generated in the plant could be received by means of combinations of number of switched on hydroelectric generating sets including the existing ones. RTD regarding the implementation of two additional unique smoothly adjustable hydroelectric generating sets in Kruonis PSPP would be necessary.

Electricity production in small-scale hydroelectric power plants currently has no good prospects for development because almost all old ponds are being used already and installation of new plants is hardly possible because of the strict environmental requirements. However, efforts of researchers working in various countries including Lithuania in order to make the HPP according to the environmental requirements in future could mitigate the existing problems and share of electricity from hydro energy could increase. The researches of new innovative environment-friendly hydropower systems are necessary in Lithuania.

As it seems, Lithuania does not intend to develop PV systems in appreciable scale as well as geothermal power systems. The merged target of both systems for the year 2009 makes up only 6 GWh and most probably it will not be achieved because any PV or geothermal power generating system of appreciable scale is not intended to install in the nearest future.

In general, the role of renewable energy, its resources, possibilities of their efficient utilisation and researches in this sphere in Lithuania are underestimated. The country's official targets of heat and power productions, state's support to this sector and legal basis for the renewable technologies development actually does not correspond to the scale of serious problems deriving from the skyrocketing oil prices, risky dependence on fuel import, pollution of environment caused by unlimited exploiting of fossil fuels and troubles because of their rapid coming to end. Education of local decision makers, creation of adequate legal basis for the renewable energy and sufficient support of this sector could help to solve this problem.

### II.4.2 Lithuanian energy research programmes

One of the main spheres of researches in energy sector is related with Ignalina Nuclear Power Plant. The researches are being carried out in various aspects: environmental issues, safety and reliability of Ignalina NPP operation, competitiveness of of the INPP in the national and international markets, decommissioning issues of the INPP before 2009 and other.

Other group of the themes of power engineering being researched in Lithuania is economic strategies of power system. It includes researches on forecast of electricity demands and power balance in Lithuania, forecast of electricity consumption, long term power supply in Baltic countries taking into account security and reliability, risk management expanding Lithuanian electricity to Scandinavian markets, environmental issues of power engineering and other.

Traditional and long lasting theme of researches in electrical and power engineering in Lithuania is electromagnetic disturbances in electronic or electrical devices and power systems. E.g., the following researches recently were carried out in Lithuania: peculiarities of the selection of protecting devices against overvoltages for 110-330 kV network, experimental registration and research of overvoltages in electric power networks, analysis of registrations data of overvoltage impact duration and etc. The last - XVI International Conference on Electromagnetic Disturbances EMD' 2006 was held in Kaunas University of Technology. Protection of electronic and electric devices or systems from malfunction, failure or permanent degradation is critical, especially from the point of view of economics.

There were some programs and projects carried out in Lithuania in sphere of RES. One of the first programmes in the sphere of renewables was "Solar and other renewable sources of energy for agriculture", 1996-1999 supported by the Lithuanian State Fund for Science and Studies and its continuation "Solar energy conversion and utilization", 2001-2004. A consortium of the programme was formed mainly of state's research institutes and universities.

The project "Partial alteration of nuclear energy by renewable and alternative energy in Utena region after the decommissioning the Ignalina Nuclear Power Plant", 2001-2003 was supported by German funds.

The PHARE Programme supported two small-scale projects:

- “The cycle of training and consultations in area of thrift and renewable energy in micro-region Ladruva” under the PHARE PARTNERSHIP PROGRAMME, 1999-2000,
- “Teaching, propagation and training of renewable energy technologies” under the PHARE PROGRAMME, 2002-2003.
- Currently project partners from Lithuania are carrying out three projects of FP6 related with RES and three projects related with hydrogen technologies.

# Annex II.5. Latvian case study.

## II.5.1 General information and national RTD context

One of Latvia's main energy policy is to reduce dependence on imported energy resources, especially to reduce dependence on the Russian natural gas monopoly and its impact on the national economies of Latvia.

The conditions of the production and use of energy sources, in particular of bio-energy, has been defined by a number of energy policy documents. The most considerable energy policy documents are: the National Energy Program, the Law on Energy, the National Program for Production and Use of Bio-fuel in Latvia, Law on Biofuel, Strategy of Energy development 2006-2016 and the Latvian Renewable Energy Strategy 2006-2010. The last 2 documents were approved recently (June 2006) by the Cabinet of Ministers and the main goals of both strategies are definition of essential principles of policy planning of Latvian government, objectives and course of actions of renewable energy resources usage in Latvia.

Renewable energy resources (RES) hold important position in the balance of Latvian primary energy resources.

The main targets of RES policy in Latvia are determined in several legal documents, and the aims are:

- Electric energy obtained from renewable energy sources – 49,3% of electric energy consumption in 2010;
- Biofuel – 5,75% from power-intensity of transport fuel commercialized in 2010;
- Share of renewable energy sources in national balance of energy resources – at least 33%.

**In order to achieve planned and stable increase of the use of RES, it is necessary to act both in the field of energy production and in the field of testing of new technologies and practical research.**

***Therefore four priorities of action are defined in the Latvian Renewable Energy Strategy 2006-2010 :***

1. Implementation of market solutions and creation of advantageous conditions for those technologies of energy production that allow to increase competitiveness of renewable energy sources comparing with fossil energy sources;
2. Use of biomass in production of heat and electric energy;
3. Implementation of new technologies for use of renewable energy sources by pilot projects in order to demonstrate possibilities of these technologies and to test their consistency in Latvian conditions;
4. Practical scientific researches supporting transfer of new technologies and adaptation to Latvia, as well as support for researches on innovative use of RES.

**<u>The brief information of RES potential in Latvia.</u>**

When Latvia became the New EU Member State, she undertook the obligation to have 49 percent of its total electricity consumption come from renewable energy sources by the year 2010. ***Hydropower*** contributes to approximately 72% of Latvia's energy supply. Electric power generation in Latvia hydropower plants is an important resource for all Baltic States, however given the high fluctuation – yearly, seasonal and sometimes monthly, of the Daugava basin (the main Latvian river basin) it is impossible to forecast hydroelectricity generation and to base a energy policy on this resource only. Latvia has three major hydropower plants and 150 small-scale local facilities. There is still unused potential for

electricity production on the Daugava River. Currently three large-scale hydropower plants on the Daugava River are being discussed as well as two large scale HPPs Jekabpils (30 MW) and Daugavpils (100 MW).
Latvia has a very good potential for ***wind energy development***. At present Latvia has wind generators having the total capacity of 26.9 MW. Their most rapid growth was observed in 2002 and currently there are seven enterprises using wind energy which have installed 41 wind generators.
***Solar energy*** can be used to generate thermal energy (solar collectors) and electricity (photo voltaic elements). In Latvia the sun rays have comparatively low intensity. The total amount of solar energy is 1109 kWh/m2 a year, which is a little more than in the Scandinavian countries. At present within the framework of pilot projects solar collectors have been installed in Aizkraukle20 — on the roofs of the secondary school and the boiler house (absorber area 208 m2) and in Ulbroka21 at the mechanical workshop of the SC „Grauds PI" Ltd. (absorber area 4 m2). Potential purposes for utilizing solar energy in Latvia could be hot water supply in summer months, especially at summer houses, hotels, grain drying-kilns or for haymaking.
The ***existing geothermal resources*** in Latvia are not used, although there may be geothermal brines with temperatures up to 55°C. With rising heat prices, geothermal heat supply systems with heat pumps could become feasible and there could be plants up to 16MWth. The most promising reservoirs are located in the Riga region and in southwestern Latvia. However, at the moment, the low heat prices for district heating, and the little experience in the field are serious barriers to the development of this resource. Latvia does not have sufficient geothermal resources for electricity generation.
The Biofuel Law and Energy Law of Latvia define ***biomass*** as the biodegradable fraction of products, waste, and residues from agriculture (including vegetal and animal substances), forestry and related industries, as well as the biodegradable fraction of industrial and municipal waste. The type of biomass most often used for energy generation in Latvia is wood, a small amount of straw is also used, as well as biogas obtained from anaerobic decomposition of biodegradable materials. It is possible to use biomass as basic fuel or blend it with other fuels in installations that use fossil energy sources, e.g., coal co-generation plants.
***Wood*** is the major local fuel in Latvia. In 2004, the share of wood in the total amount of primary energy sources was 24.4%2 from the total electricity consumption. Wood is used in centralized, local and individual heating systems, and its share in energy supply (heating and electricity production) was 45 % in 2004. In 2004 74 % of wood used for energy generation was firewood, 20 % were woodchips and 6 % were wood residues. The great potential of wood in Latvia can be explained by the fact that forests cover 45 % of the territory of the country, their total area is 2923.2 thousand ha. The average forest area per head in Latvia is 1.25 ha, which is 4.5 times more than the average figure in Europe. Wood is mainly utilized to generate thermal energy, yet woodfuel could be used much more economically if it were generating both thermal energy and electricity.

**Straw**, which could be used for energy production in Latvia, equals to about 0.57 million ton. Currently there is only one installation using this fuel for heat production. Straw has a local potential in Latvia mainly for heat production.
At present there is one boiler house using straw as fuel in Latvia. It is financially assisted by the Energy Agency of Denmark. It produces 20 TJ of thermal energy a year, utilizing 1300 t of straw10. Straw obtained from agricultural activities in Latvia has not been considered a significant source of potential fuel.

***Biogas*** is combustible-gas obtained in the process of anaerobic fermentation of biomass. It contains on the average 60-75 % of methane (natural gas) and 25-40 % of CO2 (carbon dioxide). There are biogas co-generation installations in Latvia the joint capacity of which is 7.5 MW. The total amount of electricity generated by biogas is 1 % from the amount of electricity produced by renewable energy sources.

### II.5.2 Latvian energy RTD programmes

The Research and Development Policy implemented in Latvia during the past years has been to a great extent determined by the conditions of the transition period of the state. Radical changes in politics, economy and culture have taken place in Latvia during this period, creating a totally new environment for the development of science and research. The new role of the state in market economy has resulted in the need to make changes and adjustments to the science and research policy. As a result, many research institutions and especially universities have become autonomous administrative structures. The great number of independently operating institutions has however raised the problem of co-ordination of activities in meeting the state's policy with regard to research and development.

In the context of joining EU the national science and technology development policy is aimed at reorienting Latvian research potential towards European and national priorities, and to stimulate active involvement of researchers in solving the actual economic, cultural and social problems.

A National Concept of Research and Development, worked out in 1998, presenting itself a summary of action-focused statements for the period up to the year 2010, and takes into account the growing role of research in society as well as its impact on the economy. The national concept consists of:

- Description of the state of science and research in Latvia;
- The main principles for the development of science and research, including the setting of priorities in principal research areas; the renewal and strengthening of research staff; financing; the development of international collaboration, e.g. participation in the EU research programmes;
- Working programme for year 2002 - 2010.

**The Law "On Research Activity"** (2005) regulates the administrative, financial and institutional features in the area of research and development, and determines the competence of the Ministry of Education and Science, the Latvian Council of Science and other bodies. It prescribes the research and development financing priorities through the state budget and determines the rights and duties of organizations and individual (legal and physical entities) engaged in research. The law states that the Cabinet of Minister provides annual increase of funding from the state budget for Research and Development no less than 0.15% of GDP until the state budget allocation for Research and Development amounts to 1% of GDP.

In the year 2000 the Parliament accepted amendments to law "On Scientific Activity" and obligated the Cabinet of Ministers *to set national research priorities for basic and applied research for years 2002-2005.* The objective of prioritisation was to promote the more active involvement of researchers in finding solutions to current industrial, economic, cultural, and social problems as well rational exploitation of Latvian scientific values. The identified priority areas for applied research for years 2002-2005 were: 1) information technology; 2) organic chemistry and bio-medicine; 3) material sciences; 4) forestry and wood sciences and 5) *Lettonica*.

**And just in 2006, the Cabinet of Ministers defined Power Industry – environmental friendly forms of renewable energy, safe energy supply and effective utilization of energy as the national research priority. In 2005 five National Research Programmes were launched in conformity with five stated priorities. The National Research Programmes are supposed to be the main tool for implementing these research priorities.** As Power Industry as the national research priority for basic and applied research is recently defined, the results from the support of state side will be seen in next few years.

The Latvian Council of Science takes very important role in Latvian science and Research. The fundamental and applied research projects (also renewable energy projects) are financed through in the form of grants by the instrumentality of Latvian Council of Science. The Council is a collegial body of researchers that deals with science and research problems within the country.

After the renewal of independence research staff in Latvia underwent great changes. The number of persons involved in research has decreased 6-7 times (30,500 FTE in 1989 and 4,800 in 2003). State allowances for research and prestige of science in society have sharply diminished. Young and middle age researchers were forced to quit due to lack of resources, therefore research groups have diminished to 1-3 persons per group. This has resulted the aging of research staff and problems with recruiting academic staff for the universities. At present the average Latvian researcher is more than 56 years of age and this generation is not sufficient in number to train a new generation of highly skilled scientists. This requires a special attention to the development of a systematic programme that will address the need of specialists in the areas defined as state priorities and those with a market demand. Starting from 2004 the activities for rejuvenation of academic and scientific staff in universities and scientific institutions are implemented. They are co-financed by EU Structural funds.

Latvian Universities and Scientific Institutes have long and successful traditions in training high qualified professionals in several scientific disciplines, incl. energy. In Latvia significant potential of scientific research in the field of energy is located in Institutes and Universities: Institute of Physical Energetics, Latvian Academy of Science; Riga Technical University, Latvia University of Agriculture, Latvian State Institute of Wood Chemistry, Agriculture Energetic Institute (at Latvia University of Agriculture), Agency of Latvia University of Agriculture "Research institute of Agricultural Machinery", Institute for Environmental Science and Management (at University of Latvia), Institute of Microbiology and Biotechnology etc.

More then 200 scientists are involved in different research projects in the field of energy. In 2005 there were 33 projects of fundamental and applied research and joint research projects in the field of energy supported by Latvian Council of Science. Scientists of Latvia participate actively in different research programmes and other programmes for energy and regional development financed by the EU (FP5, FP6, Intelligent Energy Europe, PHARE, SYNERGY, LIFE, INTERREG etc.). Institute of Physical Energetics Latvian Academy of Sciences is the leading institution in the field of research in these projects.

Many directions of research in the field of renewable energy are related to priorities given by the Governmental of Latvia. For example, several research projects are carried out in relation with the National Program for Production and Use of Bio-fuel in Latvia. For each of three blocks – bio diesel, ethanol and biogas production – are necessary to make research activities. For example, in implementation of the National Program there are used results from joint research program Biotechnological Conversion of Renewable Resources and Use of its Production (2002-2006). This joint research project carried out by Institute of Microbiology and Biotechnology, University of Latvia and Institute of Physical Energetics, Latvian Academy of Sciences. There are other research programmes in Latvia that support development and uses of renewable energy. There is a program for scientific research of rapeseed as source for biofuel as well as other scientific research projects.

Research and technology development of Energy sector in Latvia is implemented through 3 different types of projects:

1) Fundamental & Applied Research projects (grant by the Council of Science);
2) Market-oriented Research Programme Projects;
3) Projects financed by the Ministry of Environment.

**Sources of Finance for R&D in Latvia (total in 2003 – 24.1 million Ls)**

| | |
|---|---|
| Government Funds | 11.2 million Ls (46.5 %) |
| Business Enterprise Funds | 8.0 million Ls (33.2 %) |
| Foreign Funds | 4.9 million Ls (20.3 %) |

**The Structure of State Science Budget, 2004**

| | |
|---|---|
| Fundamental & Applied Research Projects | 65 % |
| Participation in the EU Framework programmes | 28 % |
| Market-oriented Research Projects | 7 % |

The total domestic expenditure for Research and Development in 2004 was 24.1 million Lats, representing 0.42% of the GDP. Government expenditure for Research and Development in 2003 was 11.2 million Lats, only 0.18% of the GDP. And Power Industry (including renewable energy sector) received just 2,46% from Government expenditure for Research and Development. The comparatively higher expenditure from the private sector is presently such due to the high level of financial support from abroad. The relatively high level of financial support from abroad (20.3%) is a result of successful applications by Latvian scientists to a variety of international scientific foundations.

Since 1998, significant part of the direct research funding is allocated to state research programmes and projects in the areas of national research priorities determined by the Cabinet of Ministers. Again – Power Industry (including renewable energy sector) received just small financial support from the State side as Power Industry is defined as the national research priority in 2006.

The Latvian Council of Science plays an important role as a semi-governmental decision-making body, controlling approximately 65% of the science budget. The main part of the funds is allocated to particular projects via the grant system.

About 65% of the state science budget (governmental funds) is *allocated as grants for basic and applied research.* Those pre-reviewed projects are proposed on a project-to-project basis. Grants given to winners of the National project proposal competition are administered in a manner similar to that used by the European Commission. Annually the Council of Science, basing its decision on the conclusions of the expert commissions, distributes this portion of science budget among ~700 grant applicants. In evaluating each project application, the experts look at the scientific quality, as well as its feasibility; the qualifications of the applicants are reviewed as indicated by publications, patents and other indicators. The significance of these proposals and their potential contribution to the country's economy, culture and education system is also taken into account. About 20 - 30% of projects are rejected.

Around 29 national projects of fundamental and applied research in Power industry (including renewable energy sector) were supported through grants by the Council of Science during the period of 2004-2006. Also 2 joint projects in renewable energy were supported through grants by the Council of Science in 2006.

Since 1993 the Ministry of Education and Science is realising and coordinating a special program for applied research - the so called "Market-oriented Research Programme" (MORP). This program is created with the goal to promote researchers from universities, research institutes and SMEs to develop new competitive products and encourage the development of new start-ups.

7% of the governmental R&D expenditure is being spent for MORP. The total amount in this fund is about 0.8 million Ls per year. Every year the Ministry of Education and Science is financing 70-90 MORP projects. These projects are mainly carried out in state research institutes and universities, partly in innovative SMEs.

Every researcher or entrepreneur can submit his project proposal all year round. Projects are funded if they have a positive scientific evaluation and if an essential part (~50%) of the total project costs is covered by an industrial or other partner. This approach intends to stimulate researchers to prepare project applications which are vital to the industry.

During the past 4 years more than 350 such projects have been completed, ~90 are currently in progress.

Approximately 60% of the whole program budget is given to technology (engineering sciences) projects. Besides the technology branch, projects in natural sciences, biotechnology, forestry and agricultural sciences also have been funded and attracted reasonable amounts of the resources involved.

Several scientific labs have realized MORP projects in order to become test and certification labs, which would eventually be able to gain income from providing testing and certification services. The profile and the field of activity of these labs include the problems of food products, construction materials, environment pollution etc.

Participation in international cooperation activities in the field of science is very important to such a small country as Latvia. Such cooperation activities contribute to the development and help to obtain extra resources. International collaboration with the European Union is coordinated and supervised by the Ministry of Education and Science.

Scientific research, both basic and applied constitutes the core of the Research and Development system and the basis for modern high-tech industries. Being an integral part of higher education, it is regarded as one of the national priorities in co-operation with the EU and other Member States. The main tasks of Latvian Research and Development during the pre-accession period to the EU were the restructuring of research and higher education institutions, the integration of various research institutes into universities, competitive selection and turnover of personnel, tight contacts with industry, agriculture and the social sphere, a re-orientation of research potential focusing on national priorities and strengthening its competitiveness. Participation in joint international projects serves as an assessment indicator of country's international competitiveness in the field of RTD. Therefore one of the aims of Latvian science policy at present is strengthening cooperation with the EU through integration in the European Research Area, as well as with all neighbouring countries and with other strategically important countries throughout the world, and becoming a full member of the most important international science and technology programmes and organizations, particularly those of the EU.

Regular co-operation with the European Community started in 1992, when the 3$^{rd}$ Framework Programme (1990-1994) was in effect. Since the 1$^{st}$ of August, 1999 Latvia became fully associated to both the 5$^{th}$ Framework Program for RTD and the Euratom Programme. For the Latvian research society and entrepreneurs this meant participation on equal terms with those of the EU Member States. The results show that Latvian researchers have participated in most of FP5 thematic programmes and horizontal activities. More than 660 project applications with Latvian involvement were submitted in the different calls for project proposals with one or more Latvian participants involved.

Latvian Innovation Relay Centre (IRC Latvia, http://www.innovation.lv) was established in year 2000 to promote and support the integration of Latvian small and medium size companies, and the national technological and research potential into the European Community in order to facilitate technology transfer. IRC Latvia is a member of the European Network of Innovation Relay Centres (IRC Network). IRC Latvia is a technology advisory centre that provides trans-national technology co-operation services. The activities are mainly **oriented on SMEs, who are technology producers. But there are just few SMEs in renewable energy field in Latvia, who are able to develop a new product or technology.**

Implementation of modern technologies is related with high investment costs and long pay-back period of projects. Financial risk hinder investments into renewable energy and investors often consider that renewable energy sources projects are more risky than conventional energy sources due to rather long pay-back period. Nevertheless some special policy instruments are needed to overcome the initial high costs especially in a case of new technologies.

Mainly research institutes and universities of energy sector are developing new technologies for further adoption and practical use in energy sector in Latvia, because a very small amount of SMEs have research potential. During past 10 years research institutes and universities of energy sector have established a good relationship with European research community and quit often Latvian scientists are doing scientific studies for them. There are very limited numbers of renewable energy technologies, which are developed by Latvian scientists. Major share of technologies for use of renewable energy sources is imported from European countries and local engineers have to assemble locally.

***Development of small and medium enterprises***

Development of electric energy production in diversified places largely depends on amount and type of RES available in concrete region, as well as on available financial and informative support. Small and medium enterprises that produce energy from RES contribute to regional development – by developing power supply infrastructure and local acquisition system of energy sources, and by creating new jobs. Formation of small and medium enterprises in the field of RES allows attracting finances from both private sector and from various assistance funds, as well as lays foundations for actual energy (especially electric energy) market liberalization.

Currently program “Development of small and medium size enterprises in Latvia” for 2004-2006 that is approved in Cabinet of Ministers on 25 May 2004 is implemented in Latvia. Efforts made within the framework of the program promote realization of RES strategy.

In planning of development of small and medium enterprises that work with RES it is important to foresee possibility to get support not only for energy transferred to public heat and electric energy networks, but also for energy enterprise is using for its own needs.

In order to promote increase of energy market participant number and growth of competitiveness that use RES, adequate and stable support is necessary both in facility establishment and exploitation phase. Circle of support recipients should be widened, including not only public sector of power supply, but also enterprises that produce energy for their own needs. ***Following tools are defined for support of renewable energy sources in the Latvian Renewable Energy Strategy 2006-2010:***

1) Support for investment that implements effective and environmentally friendly RES technologies, including replacement of outmoded RES technologies to innovative.
2) Setting of tariffs depending on type of RES and according to methodology that would stimulate producer to reduce actual cost and to enlarge competitiveness in energy market.
3) Diversion of fossil energy tax by special purpose payments to support RES.
4) Subsidies for use of biofuel in enterprise's transport (communal, cargo, passenger traffic and institutional transport) or subsidies for adjustment of enterprise's transport for use of biofuel (for example, modification of engines).

**Available supportive instruments to RES SMEs and RTDs for development in Latvia**

Main groups of supportive instruments are support for investment, fiscal measures, fixed tariffs and subsidies.

***Support for investment:***

*1. Latvian Environmental Investment Fund*

Founded in 1997 as limited liability company under the Ministry of Environment of the Republic of Latvia.

The Fund supports renewable energy sources in following fields:

1) Alternative energy (small hydropower plants (HPP), wind power plants (WPP)
2) Air pollution (reconstruction of heating systems – heat efficiency, fuel replacement – including biomass).

Totally until the 2004 the Fund has invested 2 047 000 LVL in different projects of renewable energy sources. It has financed 6 projects of small HPPs, 1 project for wind generator, and 17 projects of biomass combustion systems.

*2.Administration of Latvian Environmental Protection Fund*

The capital of the Fund is acquired from the income in national budget from the tax of natural resources (distribution – 40% to national budget, 60% to local authority budget). In 2004 income from the national resources' tax managed by the Fund was 9,64 million LVL. Financial resources of the Fund are used by several programs, including:

1) Research and renewal of natural resources (includes renewable energy resources)
2) Air protection and climate changes (includes use of renewable energy resources)

Aid is offered in a form of subsidy and covers up to 100% of costs of the project.

Projects may be submitted by private persons, local authorities and governmental environment protection institutions. Concerning renewable energy sources projects are mostly connected with planning and research of resources.

*3. National program of the Republic of Latvia "On improvement of heating systems, decreasing the consistence of sulphur in fuel"*

The aim of the program is to use the financial support from European Union structural funds, European Regional Development Fund (ERDF). The program supports replacement of residuel (heavy) fuel oil with different fuels, including renewable energy sources (wood and straw). The supports cover up to 75% of project eligible costs.

***Fiscal measures:***

*1. The tax of natural resources*:

The law „On the Natural Resources Tax" envisages that HPPs are exempted from paying this tax. Using surface water for manufacturing needs, the tax rate is 0,002 LVL/$m^3$.

*2. Excise tax:*

- lowered for petrol (182 LVL / $10^3$ liters), if 4,5-5% of ethyl alcohol from agricultural raw material is added, if 10-12% if bio-ETBE (ethyl-tertiary butyl ether) added;
- lowered for diesel (155 LVL / $10^3$ liters), if diesel contains 5-30% of bio diesel made from rapeseed oil;
- lowered for diesel (115 LVL / $10^3$ liters), if bio diesel added 30% or more;
- fuel is tax-exempted if it is produced purely from rapeseed oil.

*3. $CO_2$ tax*:

Is not collected from those combustion systems that use renewable energy sources (wood, straw) and local peat as a fuel. For other systems tax is 0,1LVL/t (after 2008 – 0,3LVL/t) $CO_2$ equivalent.

***Fixed tariffs:***

Support in the form of fixed tariffs in Latvia has been given for energy production from renewable energy sources. Conditions for getting support have changed very often. Because of this reason in Latvia currently work energy producers that use one kind of renewable energy sources, but sell produced energy under different conditions – double tariff, average sales tariff, tariff set by the Regulator and contract price. In 2005 Law "On energy" was amended and paragraphs that regulate support for energy produced from renewable energy sources were excluded. Law "On electricity market" was adopted, that does not set fixed tariffs. Therefore support in form of fixed tariffs is not applied anymore; in the same time there are producers that continue to receive support according to previously signed agreements.

***Subsidies for producers:***

Since 2005 government assigns support for producers of biofuel according to rules Nr. 712 of the Cabinet of Ministers "The procedure in which governmental support is provided for the production of annually minimal necessary amount of biofuel and gives the amount of financial support for quotas for bio diesel and bioethanol". Every year quotas that get financial support are set for bio diesel and bioethanol. In 2005 amount of the quota was: 11 392 000 liter of bioethanol and 12 500 000 liter of bio diesel. Within the framework of this quota direct support was 170 LVL for 1000 liter of produced bio diesel and 140 LVL for 1000 liter of produced bioethanol in 2005.

Latvia is regarded as separate NUTS II region, and its whole territory is eligible for Objective 1 Structural Funds support. In 2004 the Single Programming Document (SPD) was designed for EU Structural Funds intervention in Latvia for the period of 2004-2006. One of the priorities of SPD is promotion of enterprises and innovation.

Development of scientific potential and applied research capacity is one of the preconditions for raising the competitiveness of enterprises and ensuring the future growth of the economy. It has been recognised that Latvia has a globally competitive science potential that can give an important impact in restructuring its economy towards knowledge economy. At present the scale and scope of state investment in Latvian research is limited. As a result, the applied research activities in public research institutions and RTD capabilities in terms of human resources, infrastructure and equipment are weak.

During the programming period of 2004-2006 SPD foresees the co-funding of EU Structural Funds (ERDF) for two activities which aims at the development of public research:

- The first activity is aimed at promoting targeted applied research projects (open call for projects) in the state's research institutions with the objective to initiate development of new products and technologies. The support for projects is tailored to applied research activities, performed in accordance with the research priorities set up for the time period of 2001-2005. The results of the activities carried out should be available on equal basis for all economic operators.
- The second activity is supporting provision of modern equipment and infrastructure to the state's research institutions which perform strategic and applied research. The Ministry of Education and Science has outlined a national programme for the implementation of this activity. Improvement of the infrastructure and introduction of modern equipment aims at raising the quality of research. Investments in public RTD infrastructure are focused on interventions where a solid research potential for cooperation with the private sector, is observed, which could lead to general benefits in terms of innovation.

The total funding for the realisation of both activities amounts to 25,022,720 Euro.

**Supporting Financial Mechanisms in Renewable Energy Field:**

1. *EU Structural Funds 2004-2006:*
    - ~7,8 mill EUR – modernisation of heat supply systems according the environmental and energy efficiency demands (supply and demand side)
    - ~3,8 mill EUR – modernisation of heat supply systems by reducing of sulphur content in fuel
2. *Public Investment Programme – 2005:*
    - ~0,808 mill EUR – renovation of district heating systems
3. *Public Investment Programme – 2006:*
    - ~10,0 mill EUR – implementation of energy efficiency measures and renovation of district heating systems.

The below listed means are defined in ***the Latvian Renewable Energy Strategy 2006-2010 in order to improve the competitiveness of renewable energy sources***:

1) ***In order to attract European Union funding***, following measures should be realized:
- Supporting measures and activities for development of renewable energy sources should be introduced in strategic frame document for period 2007-2013 and in operational programs.
- In the framework of projects financed by European Community Competitiveness and innovation framework program institutional system for preparation of competitive projects on usage of RES should be established.
- Supporting measures for obtaining biogas in the framework of agricultural production to rural development from European Agriculture Fond.
- Supporting measure for biomass production and utilization for heating to rural development from European Agriculture Fond.

2) ***In order to attract National funding,*** following measures should be realized***:***
- State supports producers of renewable energy sources with mandatory purchase appointing purchase price depending from type of used resources.

- Support for investment directed to effective and environmentally friendly use of RES.
- In order to establish pilot projects on renewable energy sources government co-financing is offered for development and implementation of new products and innovative technologies.
- Currently state subsidies are available to producers of biofuel, as well as for farmers that cultivate rapeseed. In future possibility to support producers of seed oil, usable as transport fuel.

**On the 3rd of October, 2006 the Council of Ministry approved amendments in document of the National Strategic Reference Framework 2007-20013 and 3 Operational Programmes: 1) Infrastructure and Services, 2) Entrepreneurship and Innovation and 3) Human resources and Employment, which will be the essential support mechanisms to renewable energy sector SMEs and researchers in Latvia.**

**Operational Programme "Infrastructure and Services"** (Totally - 2,8 bln EUR financed by EC). There are 2 priorities relevant to the players of RES in Latvia:

1) Priority 4 – "Provision of qualitative environment life and economic activities" – Action 4.4 – "Energy efficiency in dwellings". The scheduled financing are ~ 358,4 mill EUR from ERDF and 63,2 mill EUR Latvian co-financing. The activities will focus on investment in the actions for energy efficiency – isolation and renovation of heat supply systems, reconstructed energy resources and heat supply grids.

2) Priority 5 – "Facilitation of environment infrastructure and environmentally friendly energetics" – Action 5.2 dedicated to "Energy". The scheduled financing are ~ 606,4 mill EUR from KF and 107,2 mill EUR Latvian co-financing. The activities will focus on investment in modernising heat supply systems to increase energy efficiency, investment in development of renewable and alternative energy technologies and traditional energy networks, investment for the use of biomass in the energy sector, investment in the production of electric power in co-generation facilities.

**Operational Programme "Entrepreneurship and innovation"** (Totally – 743 mill EUR financed by EC). There are 2 priorities relevant to the players of RES in Latvia:

1) Priority 1 – "Science and Innovation" – Action 1.1 – "Science, research and development" and Action 1.2 – "Innovation". The scheduled financing are ~ 447,2 mill EUR from ERDF and 78,9 mill EUR Latvian co-financing. The activities will focus on support for research and science implementation, facilitation of international cooperation projects in science and technology (FP7, EUREKA etc), investment in research and science infrastructure, investment of establishment of a coordinated establishment of a coordinated technological transfer system, increasing access to funding and granting funding for the creation of new knowledge-based enterprises, support for the formation of clusters and centres of excellence, establishment and modernisation of scientific laboratories, support for purchasing facilities and equipment to launch the manufacturing process of new and innovative products, the promotion of R&D in the private sector by implementing awareness campaigns and granting access to funding, recruitment of high qualified labour force.

2) Priority 2 – "Promotion of Entrepreneurship" – Action 2.1 – "Raising of entrepreneurship activities and competitiveness". The scheduled financing are ~ 270,9 mill EUR from ERDF

and 47,8 mill EUR Latvian co-financing. The activities will focus on facilitation the development of innovative products and technology by elaborating and implementing a programme of technology incubators, developing and implementing a support programme for the establishment of business incubators, industrial (scientific and technological) parks, as well as attracting investments to regions.

**Operational Programme "Human resources and employment".** (Totally – 457 mill EUR financed by EC). There is just one priority s relevant to the players of RES in Latvia:

1) Priority 1 – "Improvement of quality in education and science development" – Action 1.1 – "Development of science and research potential". The scheduled financing are ~ 255,9 mill EUR from ESF and 45 mill EUR Latvian co-financing. The activities will focus on Support of international cooperation and relationship in science, attraction of human resources to the science, foster motivation of society to take part in science activities.

# Annex II.6 Romania case study

## II.6.1 General information and national RTD context

National Authority for Scientific Research – NASR, represents the specialised Government body with the mission to elaborate, implement, monitor and evaluate the RTD policies. It is under the coordination of the Education and Research Ministry. It's main objective it is to harmonise national RTD policies with the European ones.

The main implementing tools of RTD policies are represented by the programmes financed from public funds.

- National RTD & Innovation programmes, coordinated by NASR:
  - Excellency Research Programme, launched in 2005, to help adapt Romanian research to the priorities of ERA and prepare the participation to the future FP7
  - Security Research Programme, launched in 2005, similar with the one in EU
  - INFRATEH Programme, started in 2004, to help the development of infrastructure and specialised services for technological transfer and innovation
  - RTD core programmes, started in 2003, to finance RTD activity in specialised research centres
  - Grants for research programmes, started in 1996. Its main objective was to sustain performant research teams.
  - National Plan for RTD & Innovation, started in 1999, with only 4 directions initially, and then extended covering 2001-2004 too. Now it has 14 sub-programmes and includes CORINT, the programme for international scientific collaboration.
- Research programmes coordinated by Romanian Academy;

A major objective of the Goverment for 2005-2008 regarding policies for scientific research and technological development is to increase the budget for it up to 1% of GDP by 2010.

To develop the RTD policies for 2007-2013, NASR launched in 2005 a project called "National RTD strategy for 2007-2013 based on strategic planning". This will end this year and has as main objectives:

- Elaborate national RTD strategy structured on a strategic plan for 2007-2013, which should enclose financing tools, process tools, evaluating and control tools.
- Elaborate national RTD plan for 2007-2013 and some proposals about contracting procedures and contracting, financing, monitoring and control mechanisms;
- National debate on the documents resulted, approved afterwards by the Government.

Almost 7% from the budget of the entire programme is dedicated to support Romanian participation to international research programmes, within CORINT programmes.

In 2005, in the 165 projects financed by the EU, there were involved 211 Romanian companies. Total contribution of EU to those 165 contracts was 617.17 Meuro.

State budged funds for 2003-2005 was :

| | 2003 | | | 2004 | | | 2005 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total $*10^9$ ROL | % From GDP | % from total | Total $*10^9$ ROL | % From GDP | % from total | Total $*10^9$ ROL | % From GDP | % from total |
| State budget | 3676 | 0,22 | 100 | 4610 | 0,21 | 100 | 7.227 | 0,26 | 100 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Ministry of Ed. and Research – research budget | 2563 | 0,15 | 70,0 | 3352 | 0,15 | 73,0 | 5370 | 0,19 | 74,3 |

Source : Law 511/ 2004 of state budget for 2005

NSRA wants tot structure and consolidate Romanian Research Area (RRA). RRA was realised by launching :

**Excellency Research Programme**, started in 2005, wants to develop RRA, to ensure :

- Increasing the romanian ability to integrate in ERA,
- Preparing the participation to the future FP7.

Accepted projects classification for the first competition 2005:

| Modules in Excellency Research Programme | No of accepted projects |
|---|---|
| I. Complex RTD projects | 536 |
| II. HR development for research | 92 |
| III. Promoting the participation to international research programmes | 13 |
| IV. Developing the infrastructure for evaluation and certification of the conformity | 91 |
| TOTAL | 732 |

The funds from the public budget for 2005-2006 are :
2005: 130 000 000 RON ( 36 500 000 EUR)
2006: 481 098 000 RON (133 650 000 EUR)

**National Plan for RTD & Innovation**. 10 out of 14 programmes are oriented towards: agriculture, environment, health, energy, transportation, industry, quality infrastructure, IT , biotechnologies, micro and nano-technologies, aeronautic and space technologies. In 2005 there were 2524 projects funded:

| Programmes from National RTD&I Plan | Ongoing projects in 2005 |
|---|---|
| 1. Agriculture and alimentation - AGRAL | 250 |
| 2. Life and health – VIASAN | 302 |
| 3. Space improvment and transportation – AMTRANS | 156 |
| 4. Environment, energy, resources – MENER | 211 |
| 5. Inventions stimulations – INVENT | 106 |
| 6. Research and Invation for economic growth - RELANSIN | 469 |
| 7. Quality and standardisation – CALIST | 90 |
| 8. INFRAS | 88 |
| 9. Informational society- INFOSOC | 63 |
| 10. Biotechnologies – BIOTECH | 126 |
| 11. New Materials, micro şi nanotechnologies - MATNANTECH | 158 |
| 12. Aeronautic and space technologies - AEROSPAȚIAL | 108 |
| 13. Fundamental research and cultural and socio – economic aspects – CERES | 397 |
| TOTAL | 2524 |

The funds from the state budget for 2004-2006 are :
2004: 178 760 000 RON (49 655 555 EUR)
2005: 222 231 000 RON (61 730 833 EUR)

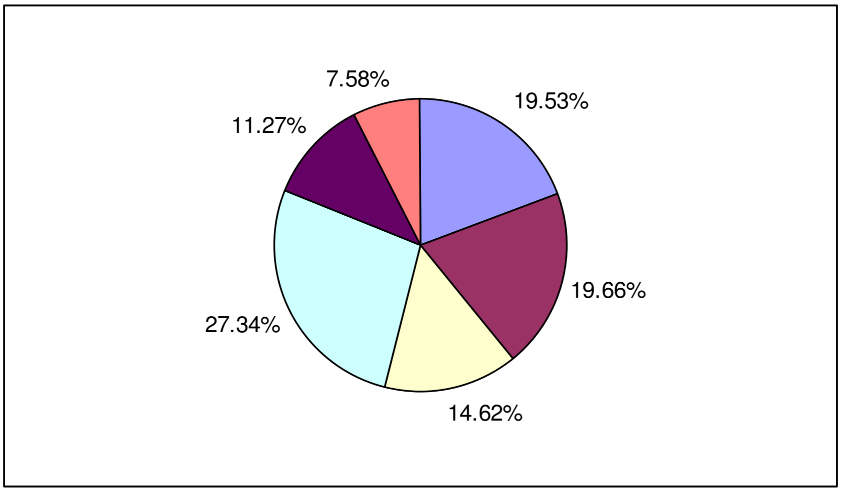
2006: 180 850 000 RON (30 141 666 EUR)

**MENER – Energy & Environment RTD program**: managed by University Politechnica Bucharest

**Scope**

- Supporting sustainable economic growth and market competition:
    - Protection and rational use of environment and natural resources
    - Improving the quality of the environment
    - Higher efficiency for production, transport and energy use; raising energy sector to European standards
    - Protection of the geological environment and rational use of mineral resources
- Securing the scientific and technological support to perform specific activities for nuclear energy.

Financing from the total budget was 10.03%, 198 603 209 mio lei ≈ 5 052 231 EURO (total budget for MENER)




Programmes Structure

- Priority Projects 19.53%
- Environment and climatic factors 19.66%
- Risc Management 14.62%
- Conventional, new and renewable energy 27.34% (54 298 117 tho ROL) ≈ 1 381 280 EURO)
- Nuclear energy 11.27%
- Mineral resources 7.58%

Subprogramme Conventional, new and renewable energy

Field: New and renewable energy

- New and renewable energy: conversion and integration of renewable energy sources in national energetic system
- Wind energy, thermo dynamic and photovoltaic conversion of solar energy, biomass, valorization of hydro potential in micro hydro power plants, wave energy, geothermal energy, heat pumps, hybrid systems
- Getting new and unconventional conversion and stocking renewable energy

- Fuel cells
- Standards and regulations in RES field, according to EU requirements
- Local and national techniques and methods to determine the exploitable potential of all RES, developing a national monitoring network. Updating Romanian database and correlating it with the ones already existing in EU

**Number of projects**
2004: out of 391 were selected 108 projects.
2005: out of 391 were selected 40 energy projects.

According to the European evolution, NSRA launched in 2005 a large campaign to develop national technological paltforms (TP) based on public – private partnerships, to allow the integration into the 26 European TPs.
In 2005 there were a lot of debates research – industry, organised according to the European model, with participants from public and private research centers, aiming at:
- medium and long term RTD research strategies
- action plan to follow the above strategies and accomplish the objectives.

Research personnel in 2003 : 39.985, of which:
- 25.968 directly involved in RTD activities (20965 full time)
- 9219 licensed researchers
- 8421 PHDs

# Annex II.7. Slovak case study

## II.7.1 General information and national energy RTD context

Proposal of the new Energy Policy of the Slovak Republic

Energy Policy is part of the economic strategy of the Slovak Republic. The provision of the economic growth in the terms of a sustainable development is conditional by responsibility of the energy supply by optimal costs and suitable environmental protection.
The former Energy Policy was approved on 12th of January 2000.
Energy Policy represents the basis for further development of:

- electro-power engineering
- thermal power engineering
- gas
- coal mining
- mining, processing and transport of oil
- exploitation of the renewable energy sources

The main objective of the Energy Policy is creating premises for the provision of sufficiency amount of energy, effective exploitation, safety and fluent transport and maximization of the consumption savings.
Energy Policy is elaborated in law 656/2004 of the Code for the power engineering for the next 25 years by the Ministry of Economy of the Slovak Republic.

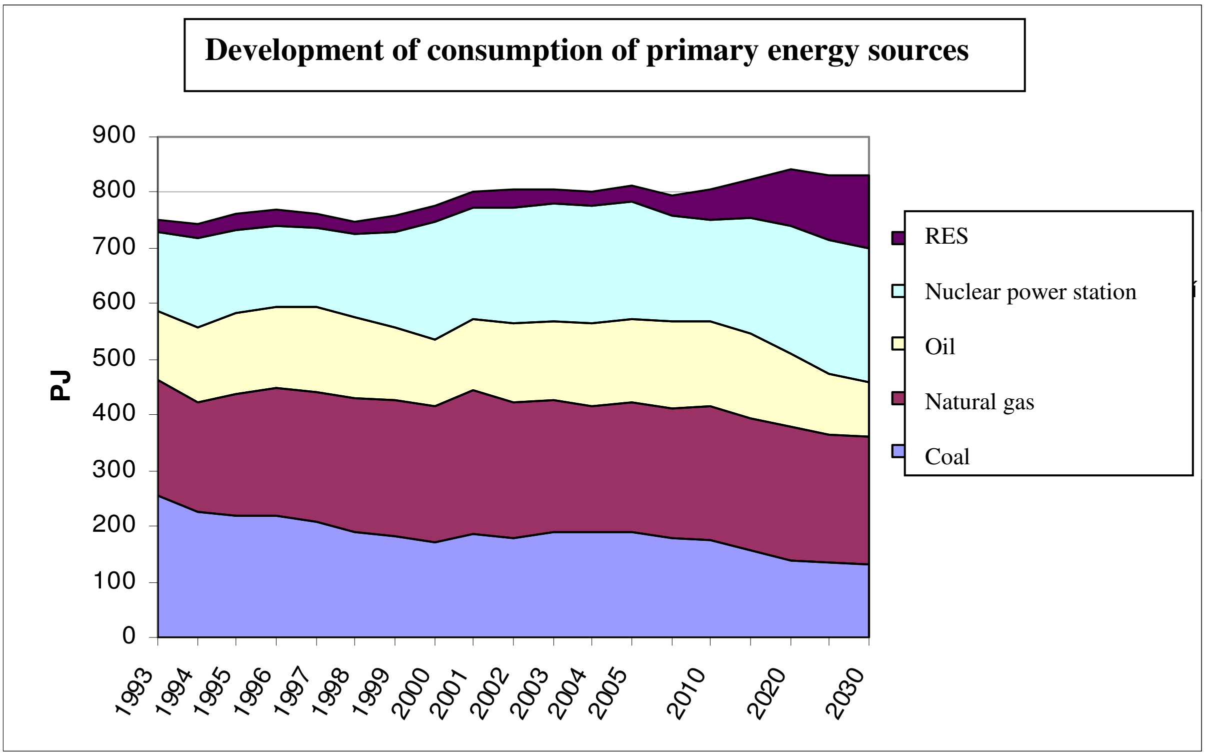



Diagram: Development of consumption of primary energy sources (Source: Ministry of Economy of the Slovak Republic)

**Renewable energy sources**

The exploitation of the renewable energy sources (RES) up to now is very low from different reasons, paradoxically to high potential of these sources on the territory of the Slovak Republic. In Slovakia come into consideration the following RES: solar energy, water energy, wind energy, geothermal energy, biomass, wood material, agricultural excess and different types of waste from which is possible to produce biogas and bio-oil.

At present, 5,2 TWh of electricity is being produced from RES including exploitation of hydro-energy potential of big hydro power stations. It is about 16% of the electricity consumption in households. Biomass is the most perspective RES for the heat production and it is also very suitable for the electricity production too. The most exploited RES is exploitation of hydro-energy potential. As far as the others RES (wind energy, geothermal energy, solar energy) their exploitation will be only the additional source. The price and transport responsibility of electricity and heat are very important factors.

Table: Renewable energy sources (RES)

| RES | Usable potential | |
|---|---|---|
| | PJ | GWh |
| Water energy | 23,8 | 6 600 |
| *Big hydro* | *20,2* | *5 600* |
| *Small hydro* | *3,6* | *1 000* |
| Biomass | 75,6 | 21 000 |
| *Dendromass* | *47,0* | *13 055* |
| *Agricultural biomass* | *28,6* | *7 945* |
| Biofuels | 5,0 | 1 389 |
| Biogas | 6,9 | 1 917 |
| Wind energy | 2,2 | 600 |
| Geothermal energy | 22,7 | 6 300 |
| Solar energy | 18,7 | 5 200 |
| TOTAL | 154,9 | 43 006 |

PJ= Peta Joule

Source: Ministry of Economy of the Slovak Republic

**Potential of renewable energy sources**

As far as renewable energy sources are concerned, the technical potential needs to be divided into various categories. The "full" potential, characterised by existing resources and the possibilities of using them for energy purposes through the implementation of existing technologies, does not provide much information, because it is only a theoretical quantity. Therefore, the following terms have been used for the study:

*Economic potential:* It is the share of the available potential that can be economically viable, given the society constraints (legislation, fiscal regulations, equipment and operation costs, discount rates, inflation, etc.).

*Market potential:* This corresponds to a fraction of the economic potential, which investors are ready to develop by themselves, considering the market barriers (investments risks, expected benefits, etc.).

**Targets**

The targets can be set in accordance with the White Paper of the European Commission i.e. at least a doubling of renewable energy's share in the energy balance the year 2010. In Slovakia, a target of 4% has been chosen for the year 2005; however, this target is unlikely to be realised under the present circumstances, as too many barriers remain to the development of these sources.

***Two sets of targets***

The low targets correspond to the adoption of a mild renewable energy policy, including the remaining measures necessary to implement the acquis communautaire. The higher targets reflect a stronger policy and are coherent with the scenarios describing energy consumption to the year 2012.

The high target proposed represents more than a doubling in the share of renewables up to the year 2012 (110% of increase of the present exploitation). This corresponds to approximately 3.2% of the share in energy consumption.

The main priorities for the renewable energy policy are to develop the biomass sector, particularly for use in district heating, and to encourage a better awareness about the viability and reliability of renewable energy technologies in general.

## RES in Slovakia

### Hydropower

The installed capacity of hydroelectric plants is 2,395 MW, representing 28.9 % of the total installed capacity of Slovakia´s electric grid. Out of that, the installed output of the Hydroelectric Power Plant Gabcíkovo is 720 MW and the installed output of the pumped storage hydroelectric power plants about 833 MW.

There are currently approx. 180 small hydropower plants with a total installed capacity of more than 60 MW in operation in Slovakia. In frame of the programme of development of hydroelectric power plants, there are overall 250 locations which have been selected as the building sites for small hydropower plants on the rivers Danube, Váh, Hron, Bodrog and Hornád which could bring total installed capacity of 93 MW. From among the most significant construction projects there is the Sered hydropower plant (52 MW), small hydropower plant on rivers Hron, Horný Váh and Poprad.

### Biomass

Biomass has the highest share of technical potential of RES (42%). This corresponds to an energy value of 40,453 TJ/year. Given the conditions prevailing in the Slovak Republic, it is realistic to use forest biomass, agricultural biomass and waste from wood processing and food industry, to develop energy plants and to use waste biomass from industry in the municipal sector for energy purposes. Considering the present use of biomass resources (12,683 TJ/year), the available potential is 27,770 TJ/year.

### Wind energy

As of today there are no large scale wind turbines. Yet small wind turbines with a size of one, three, and seven kW are produced locally for battery charging, water heating, and connections to the public grid.

Lack of a country wide wind-atlas, respectively state of the art measurements makes it difficult to estimate the actual resource potential of the country. As far as the legal frame work is concerned, the gradual full liberalization of the market is planned only following the privatization, although no firm time table for this has been agreed.

### Solar energy

The Slovak Republic is situated between 48 and 50 degree latitude. Solar radiation flux achieves maximum 1,050 kWh/m2, so that a half of year its values are 806 kWh/m2.

Solar energy can cover all our energy needs. Utilisation of solar collectors and passive solar energy use are the most cost effective ways and are becoming more and more popular in

Slovakia. These technologies can substitute huge part of our needs for heating and warm water preparation. Despite some financial restrains today, photovoltaic can be considered as the important source of electricity and is supposed to cover large part of our power needs in 2050.

**Geothermal Energy**

Geothermal waters in the Slovak Republic are being utilised on 35 locations offering an aggregate heating capacity of 75 MW and generation of 1,218 TJ/y to heat structures, swimming pools, greenhouses (at the town of Galanta it heats 1,240 flats and a hospital).

Slovakia has 25 prospective areas of geothermal resources with temperatures up to 150°C and in depths up to 5,000 m. The most abundant of them is the Košice with potential of about 300 MW, where eight planned pairs of wells with an output of about 100 MWth to be used for central heating of the city of Košice have hit Phase One of the implementation.

**Wood and straw**

Wood and straw potential can be estimated from recent numbers of wood and grain production. For the estimate of energy plantation we used Slovak experience with experimental plantation of Salix viminalis. Weight gain up to 15 t/ha/yr of dry matter can be expected (30 t/ha/yr fresh matter) with the density 10 000 cuttings per ha.

**Biogas**

For the estimation of biogas potential we can use the numbers of animals (cattle, pigs and poultry) and derive biogas production in m3. From this the heat and power production can be estimated according to domestic experiences with this technology.

**Photovoltaics**

Electricity produced by photovoltaics is becoming widely accepted as the major source of power in the future. Nevertheless here it is considered as the additional source to the "already realised potential" of wind, hydro and biogas. It is assumed that price advantage of these sources will lead to the full utilisation of their potential as estimated above. For the Slovak electricity needs it is estimated that 15 TWh/year should be covered by photovoltaics. Size of 100 mil. m2 seems to be sufficient for the production of this amount of electricity. This PV area is based on the average power production of typical PVs on the market today. For the average solar irradiation in Slovakia a typical PV system can produce 150 kWh per year per m2.

**FOSSIL FREE FUTURE IN 2050**

To summarise the potentials for renewables in Slovakia we can conclude that wind, hydro, biomass, geothermal and solar energy can cover all our energy needs in the future. It should be noticed that potentials of hydro and biomass are suggested to be fully utilised (technical potential) and higher gains most likely cannot be expected in the future. Potential for wind is based on recent possibilities and future increase of power production is likely due to the improvements in technology. Wind together with geothermal and solar energy can easily produce more than what is estimated here.

### II.7.2 Research and development in power engineering

Research and development (R&D) is very important object of interest in each economy. At present, the main problem of R&D is low financing and fact that in economic sector for R&D in power engineering there is not created any separate research workstation.

In the past, research was oriented on the area of nuclear power engineering, coal, gas and hydro-energy sources. R&D in the field of RES was insufficient. It was very difficult to provide suitable development in this field because of the various forms of RES. There is no complex and successful solution without some support in this field.

R&D activities were financed from the state budget through "State programs for R&D" and "State orders of R&D". The state sectional program for R&D "Application of progressive principles of production and energy changes" was created for the period 2002-2005.

The priority of R&D will be such fields of power engineering which will bring full-public benefits. The results of these fields will be an establishment of those technologies which will increase the competitiveness of Slovak economy. The resources for supporting of concrete projects oriented on international co-operation will be used from structural funds.

Priorities in R&D in the field of power engineering:

1. New and advanced technologies
   a) new technologies of changes, transport and energy accumulation
   b) systemic and regional power engineering
   c) technologies for elimination of nuclear equipments and deposition of burned out nuclear fuel

2. Sustainable development
   a) micro-regional systems of RES
   b) economizing and environmentalizing of power engineering
   c) coordination of consumption (demand side management - DSM) and rationalization of energy consumption

3. Innovation, new methodologies of R&D and education
   a) responsibility and safety of electric system
   b) knowledge power engineering
   c) nuclear safety and responsibility of nuclear energetic equipments