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VIRTUAL BALKAN POWER CENTRE FOR ADVANCE OF RENEWABLE ENERGY SOURCES IN WESTERN BALKANS

WORKSHOP 2.1: COUNTRY EXPERIENCES IN REGULATORY FRAMEWORK TO SUPPORT RES PENETRATION

AGENDA

National Technical University of Athens, Zografou Campus, Athens, Greece
18-19 April, 2005

Monday, 18^{th} April

9^{00} - 9^{30}	Welcome coffee - Registration	
9^{30} - 10^{00}	Welcome and Introduction of participants and guests	ICCS/NTUA
10^{00} - 10^{15}	Workshop objectives and agenda	ICCS/NTUA
10^{15} - 10^{45}	Participation of RES to the European Electricity Market	ICCS/NTUA
10^{45} - 11^{30}	EU regulatory framework to support RES penetration	EU
11^{30} - 12^{00}	Experiences of USA in regulatory framework to support RES Penetration (RFSRESP)	USA
12^{00} - 12^{30}	Experiences of GERMANY in RFSRESP	KEMA
12^{30} - 13^{00}	Experiences of SPAIN in RFSRESP	COMILLAS
13^{00} - 14^{30}	Lunch Break	
14^{30} - 15^{00}	Experiences of SLOVENIA in RFSRESP	IJS
15^{00} - 15^{30}	Experiences of ROMANIA in RFSRESP	UPB
15^{30} - 16^{00}	Experiences of CROATIA in RFSRESP	UNI-ZG
16^{00} - 16^{30}	Experiences of SERBIA-MONTENEGRO in RFSRESP	ETF
16^{30} - 17^{00}	Experiences of BOSNIA-HERGEGOVINA in RFSRESP	UNTZ
17^{00}	End of the first WS day	
20^{00}	Official Dinner	

Tuesday, 19^{th} April

09^{00} - 09^{30}	Welcome coffee	
09^{30} - 10^{00}	Experiences of GREECE in RFSRESP	ICCS/NTUA
10^{00} - 10^{30}	Experiences of FYROM in RFSRESP	CMU
10^{30} - 11^{00}	Experiences of NETHERLANDS in RFSRESP	KEMA
11^{00} - 11^{30}	Experiences of AUSTRIA in RFSRESP	ISTRABENZ
11^{30} - 12^{00}	Geothermal and its regulatory framework in GREECE	CRES
12^{00} - 12^{30}	Experiences of ALBANIA & BULGARIA in RFSRESP	CMU
12^{30} - 13^{00}	Discussion	ALL
13^{00} - 14^{30}	Lunch Break	
14^{30} - 15^{30}	Planning our future VBPC RES Project activities	
15^{30}	End of workshop	

Sixt Framework Programme, Priority 6
Sustainable Development, Global Change and Ecosystems
Contract: INCO-CT-2004-509205

Participants

ACRONYM	Institution	Participant
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6. Framework Programme, Priority: International Cooperation (INCO),
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Virtual Balkan Power Centre for Advance of
Renewable Energy Sources in Western Balkans

Balkan Power Center Report

Country experiences in regulatory framework to support RES penetration

Workshop T.2.1, WP 2

National Technical University of Athens, Zografou Campus, Athens, Greece
18-19 April, 2005

Balkan Power Center Report

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SUMMARY

The two days workshop "Country Experiences in Regulatory Framework to Support RES Penetration" was held at the National Technical University of Athens (NTUA), between April 18th and 19th, 2005. The Workshop WS2.1 is a part of the Work Package 2 (WP2) of the VBPC-RES project, entitled "Regulatory and organizational framework: barriers and incentives for Renewable Energy Sources penetration".

At the beginning of the workshop, Prof. Hatziargyriou, of ICCS/NTUA, as the host and the organizer of this workshop greeted the participants. His presentation comprised a short review of the WP2 goals, the way of our collaboration, review of best practice and practical experience in RES implementation. The program of the WS comprised 13 contributions from Project Partners. The main points of their contributions are presented below.

K. Keller, K. Petrov, KEMA Consulting, Germany: "Experiences of Germany in RFSRESP"

The regulatory framework in Germany is targeting to increase the share of total power supply from Renewable Energy Sources to at least 12.5 per cent by 2010 and at least 20 per cent by 2020. This target will be reached with the aid of feed-in tariffs as defined in the Renewable Energy Source Act of Germany. In addition to the Act, the German Government has launched smaller programs to promote the usage of renewable energy especially in the area of household customers.

During the last years the promotional scheme for Renewable Energy Sources (RES) was quite successful in terms of increasing the number of RES capacities installed. Especially electricity produced from wind power has increased significantly which also led to an adaptation of the promotional scheme in the amended RES Act. An additional difficulty is the need to upgrade the grid due to planned installations of off-shore wind parks in the north of Germany.

Contrary to the success of the promotional scheme of RES, the CHP financing and support methods are questionable. Currently, the German Association for CHP (Bundesverband Kraft-Wärme-Kopplung e.V., BKWK) is in doubt about the fulfillment of the CO2-reduction target that has been set in § 1 CHP-Law: It says that the promotion of CHP should reduce CO2-emissions by at least 20 tons in 2010 compared with 1998. It is therefore discussed whether the current promotional scheme will be prolonged for some years.

Another challenge Germany will have to face in the near future is the decommissioning of its nuclear power plants. These capacities have to be replaced so that may be even more production from RES could enter the German market.

V.H. Méndez Quezada, J.R. Abbad, T.G. San Román, Universidad Pontificia Comillas, Spain: "Experiences of Spain in RFSRESP"

The Spanish regulation has succeeded to highly develop wind generation, reaching 8000MW of installed capacity, and generating more than 6 % of total annual electrical energy consumption. This has been achieved through a specific regulation that gives practically no technical obligation to such generators (besides security related ones) and a feed-in-tariff, great enough to overwhelm the lack of updated connection standards, complicated licensing procedures (it takes up to five years to install a wind park), application of deep connection costs, etc. The expected trend in the next five years is to install around 1500 MW per year, if technical and administrative barriers do not stop such expansion.

As the penetration of the Spanish "Special Regime" has reached important levels, especially wind generation, there has been a changed in regulation to try to better integrate such generation units in the electrical system. For doing so, an economic incentive additional to the fixed premium has been established for all the installations that choose to access the wholesale electrical market. This option means to compete (making generation offers) with any other generating unit not only in the wholesale energy market, but also in all secondary electrical markets as secondary and tertiary reserves, etc. It means also to assume deviation costs in case the energy produced does not fit with the offered energy.

In the case of wind generation, there is a new and additional economic incentive to make wind parks technically immune to voltage dips. This incentive is important to future expansion of wind generation, as it is nowadays one of the main technical barriers to its growth.

This success story does not apply to the rest of RES technologies. There are problems especially to meet the objectives for biomass, which is considered as the other main RES technology in the near future. Anyhow, even in the case of wind generation, there are concerns about the future sustainability of such economic incentives and its efficiency.

S. Merše , "Jožef Stefan" Institute, Slovenia: "Experiences of Slovenia in RFSRESP"

The Slovenian legal framework for RES installation is based on the special status of Qualified Electricity Producer (QP), which can be awarded to electricity producers that generates electricity and heat with above-average efficiency during the co-generation of electricity and heat or uses RES in a manner consistent with the protection of the environment. The main supporting instrument is system of feed-in tariffs, composed by market price and premium, which varies by technology, size and used energy source and determined by the Government. Network operators are obliged to conclude long-term (10 years) contracts with QP's and are responsible for the purchase of all electricity offered by QP at the set price (QP may sell all or part of the produced electricity independently and shall be entitled to the payment of a premium for that sales).

Almost 25 % (3.125 GWhe 923 MWe,) of Slovenian electricity production is produced from Renewable Energy Sources (RES), most of it (80 %) from large hydro power plants. Around 130 MWe of small scale RES units bellow 10 MW are installed with yearly generation of about 470 GWhe (60 % small hydro PP, 30 % industrial biomass CHP, 9 % biogas). In spite of ambitious national target to achieve 33.6 % share of electricity production from RES in total electricity consumption until year 2010, recent development of new RES installation is rather slow, prevailing with new landfill and bio gas installations, limited number of new and retrofitted small hydro PP and increased interest in PV installations and wind.

Several action could contribute to the increase the RES penetration in Slovenia: increase of feed-in tariffs for some technologies, consistent and transparent spatial planning beside good project preparation (environmental aspects), simplification of licensing procedures, additional and more flexible financial support, further developing of green electricity market, Common Energy, Agriculture, Forestry, Policy and Actions for RES, etc.

M. Eremia, L.Toma, I. Tristiu, University "Politehnica" of Bucharest, Romania: "Experiences of Romania in RFSRESP"

The experiences of Romania in regulatory framework to support Renewable Energy Sources penetration in the country are very small. Several actions are in progress in Romania concerning the issuance of suitable law on RES. The recent approved the Electricity law no. 318/2003 sets the regulatory framework for carrying out activities in the field of electricity with competences and duties of the Romanian Energy Regulatory Authority (ANRE). Electrical energy sources of rated capacity less than 250 kW are not subject to the present law. The Government Decision No. 443/2003 sets the regulatory framework concerning the Promotion of Electricity Production from Renewable Energy Sources and stipulates that the electrical energy produced by Renewable Energy Sources should represent in 2010, 30 % of the national gross electricity consumption (this target includes all contributions of small and large hydro, which anyhow reaches today about 30 %) and 11 % of the gross energy consumption. It is therefore a lack of appropriate law in the field.

An appropriate mechanism for Green Certificates market will be issued in 2005. The feed-in-tariff will be firstly applied in order to stimulate the investments in RES technologies and to increase the RES quota in the total production; then, the quota system could be applied in order to achieve the proposed target and to increase the market competitiveness.

Instead, no special financial incentives to support the RES installations exist in Romania and also no standards and rules concerning the RES installations are either defined or applied in Romania, except the Decisions mentioned above.

Romania has a large experience in hydro generation but a low experience in wind farms and other renewable technologies. Some analysis concerning the country potential in different energy sources has been performed so far. Nevertheless, for electricity generation, only experimental projects exist in Romania concerning the wind generators and solar panels. On the other hand successful projects have been experienced in concerning the heat generation; of these, it should be mentioned the thermal plants running on sawdust and the many geothermal applications.

Several barriers to the development of RES exist in Romania, of which the nuclear project, the lack of appropriate legislation, sufficient energy production and limited investment capital, can be mentioned.

M. Božičević Vrhovčak, University of Zagreb, Croatia: "Experiences of Croatia in RFSRESP"

In the paper, the share of renewable energy in primary energy as well as in electricity production in Croatia is given. The overview of RES installations has been presented, with a special attention given to the new Renewable Energy Sources. The Croatian legal framework for RES use has been thoroughly described – from the package of energy laws adopted in 2001 to new and amended energy laws adopted in 2004, particularly the laws relevant for Renewable Energy Sources.

National Energy Programs dealing with Renewable Energy Sources have been presented as well as the Fund for Environment Protection and Energy Efficiency, mandated to finance preparation, implementation and development of programs, projects and similar activities in the sector for preservation, sustainable use, protection and improvement of environment. Although the licensing procedure for RES installations has not been accepted yet, the proposal has been presented in the article. The main barriers for a wider penetration of RES use in Croatia have been listed in the contribution.

N. Rajaković, Ž. Djurišić, University of Belgrade, Serbia and Montenegro: "Experiences of Serbia-Montenegro in RFSRESP"

The regulatory framework of RES penetration into electrical energy network of Serbia and Monte-Negro is defined through the Energy Policy Act of the Republic of Serbia until 2015, and Energy Law and National Program for Energy Efficiency. These are basic political, legal, scientific and educational documents which define RES implementation policy and practice in Serbia. The Energy Law has established the Energy Agency and Energy Efficiency Agency of the Republic of Serbia for implementation of RES practice in Serbia.

The low level of RES penetration in Serbia and Montenegro shows that more efficient regulatory tools and financial incentives are needed for decision makers, planners and industry in order to implement energy efficient and renewable energy technologies. Also, public awareness about RES should be improved especially for profitable RES projects with accurate technical and economic analysis. This analysis should include energy models and future energy needs, cost analysis, greenhouse gas emission analysis, financial analysis and sensitivity and risk analysis. Generally RES implemented projects have higher initial costs but lower operating costs and such an analysis is very important in low cost preliminary feasibility studies.

S. Halilčević, I. Kapetanović, V. Madžarević, University of Tuzla, Bosnia and Herzegovina: "Experiences of Bosnia-Herzegovina in RFSRESP"

The legislative and legal framework to introduce the RES into existing electric energy network in Bosnia and Herzegovina is enacted through the Energy Law (2002) and through establishment of the State Energy Regulatory Commission (2002). The further work respecting RES penetration question is strongly recommended, because the questions of tariff, subsidizing, taxing, etc. is not solved yet.

There is no financing of RES installations in Bosnia and Herzegovina by the state. The Ministry of Energy would be the start force in to RES installations. We hope that through the different EU programs the Bosnia and Herzegovina can start with RES penetration into own energy network. In this way we should make hard job, taking into consideration the standards and rules, information and promotion of RES, financial incentives for private investments in RES, financial incentives for investment in RES from public sector and funds, etc.

Today, the licensing procedures for RES installations in Bosnia and Herzegovina goes through the Ministry of Energy, Industry and Mines, then through the local community, which gives the permission for installing RES in its territory (building and communal permissions). In the future, the needed license will be the subject of the Energy Regulatory Commission, too.

There are number reasons to make as faster as possible the legal framework for RES in the Bosnia and Herzegovina. These reasons include reduction of pollutants from thermal power plants, introduction of the new and clear technologies, increase of the number of working places, change of the structure of the existing working places, improvement of the quality and reliability of energy supply in the rural and isolated regions, decentralization of the energy demands and stimulation of the local economy.

In general, there are no barriers to the development of RES in Bosnia and Herzegovina. Due to past war, Bosnia and Herzegovina is lagging in many subjects; one of them is RES penetration into energy networks. The first step should be to design the appropriate legislative framework based on the best EU practice. Then, the government should subsidize the start of RES projects. In the third step, the Regulatory Energy Commission should devise the framework for future investors into RES installations, so as to make the RES penetration process transparent, efficient and publicly acceptable. The public awareness of importance of RES for community can be enhanced only with the continually and practical systems of information and education.

N. Hatziargyriou, P. Georgilakis, A. Tsikalakis, National Technical University of Athens, Greece: "Experiences of Greece in RFSRESP"

In this contribution, the financial framework in Greece which supports the feed-in tariff model and provides various subsidies for RES installation costs was presented. According to the Greek regulatory framework, RES and CHP installations do not participate in the electricity market, they are priority dispatched and their energy is sold at fixed tariffs. RES electricity is sold at prices linked to the general LV customer tariffs. Energy is paid at 90 % of the respective retail price in island systems and 70 % in the mainland. In mainland, installed power is compensated at 50 % of the applicable consumer tariff. In island power systems, no credit is applicable to installed capacity (only to energy produced). Installation costs are subsidized at various levels depending on the technology and location. Technically, RES interconnection should comply with the utility technical guidelines and distribution network codes.

The framework applied in Greece is considered favorable for the installation of RES, especially in island systems and has attracted considerable interest for RES related investments, mainly wind power, from the private sector. Nevertheless, a number of barriers have been identified, that limit the wider implementation of RES installations. These include the complexity and long delays in the legal procedures to obtain the necessary installation and operating licenses, the weak grid or the long distance from the main transmission grid and the public opposition to RES installations in some regions of the country.

V. Glamočanin, Ss. Cyril and Methodius University, FYROM: "Experiences of FYROM in RFSRESP"

The current storage lakes in the Republic of Macedonia generate over 750 GWh which is more than 14% of the total demand for electricity. The role of hydro energy production can be improved by utilization of the potentials of several rivers: Crna Reka, Treska, Radika, Vardar, Mala Reka and Crn Drim, as well as by construction of 30 SHP. In addition, several projects which implement geothermal energy, biomass energy and wind potentials are initiated. Besides the Macedonian Energy Law, the draft of the Law on the establishing of an Energy Agency of the Republic of Macedonia, and the Energy Efficiency Strategy, two papers closly related to the RES legislation are presented: the Paper on provisions of Macedonia energy law related to sustainable energy and the Paper on environmental protection requirements for the Macedonian energy sector. The main barriers to the development of RES are related to the lack of policy for inclusion of renewable energy in the energy mix of the country, and insufficient legislative support in the forms of: funding mechanisms, electricity buyback policy, preferential taxation, etc.

K. Keller, R. Otter, K. Petrov, KEMA Germany: "Experiences of Netherlands in RFSRESP"

The Netherlands have changed their promotional scheme for Renewable Energy Sources (RES) within the last years. The growing demand for electricity produced from RES ("green energy") at the beginning of this decade was the result of the combination of the fiscal support for green energy, which was exempted from eco tax (administered through a green certificate system), production subsidies and the full opening of the retail market for renewable electricity in July 2001 while the retail market for non-green energy has been fully opened in the Netherlands in 2004.

However, the mechanism did not result in many initiatives for building new RES capacity in the Netherlands. Much of the green energy was imported (especially cheap hydro-energy). With the fear of tax money flowing abroad and the fact that the European trend was towards supply side support, this scheme has been turned around into a feed-in tariff. This already seems to lead to more initiatives to build RES capacity in the Netherlands.

B. Del Fabbro, A. Urbančič Istrabenz Energetski Sistemi, Slovenia: "Experiences of Austria in RFSRESP"

Renewable sources of energy currently constitute 27 % of Austria's energy consumption (e.g. hydropower, biomass, solar and wind energy, etc.). Country is the EU member state with the largest share of renewable energy production in its total electricity production. The level of exploitation of Renewable Energy Sources varies significantly among the different sources.

Environmental concerns have played a dominant role in Austrian energy policy-making for at least two decades. After successful reduction of SO_X and NO_X emissions, Austria has set ambitious target for CO_2 reduction up to 13 % in the frame of EU burden sharing agreement within Kyoto protocol.

Regulatory framework comprises instruments such as a higher taxation on gas and electricity, which was introduced in June 2000 (doubling the former tax levels), purchase obligations of network operators regarding alternative energies, “labeling” of energy supplied to end-consumers, feed-in tariffs for renewable energies as well as research and incentive programs for renewable energies sources. Support schemes and legislation in Austria are designed at three levels: state, province and local municipality levels.

The RES support there is in two sectors: green electricity and biomass based heat production. Green Electricity Act established the nation wide scheme of feed-in tariffs which is in force from 2003 and has replaced former scheme which varied from state to state. Tax incentives, based on Electricity Tax Act, modified in 2000, and investment subsidies schemes aimed to support innovative technologies, based on Environmental support Act, 2003.

Besides renewable electricity production, Austria has been very successful in promotion of biomass district heating systems, resulting in 50 new installations per year. Biomass heat production was promoted by local and regional authorities who were complemented by governmental support. The Austrian's experiences in RES present variety of mechanisms contributing to the success: energy taxes, public grants – investment support, technological development support, various promotion, education and training activities among others.

C. Karytsas, K. Karras, CRES, Greece:
“Geothermal and its regulatory framework in Greece”

Current status of Geothermal Energy development in Greece includes installed thermal power uses of 75 MWth, leading to annual energy savings of 8000 T.O.E. The relevant market is developed and stimulated by financial support to geothermal investments from national programs. It is foreseen that electricity produced by RES is purchased in priority, at a fixed high price by the power transmission system operator. Research activities are focused in utilization of 60-120°C low enthalpy resources as well as in the use of ground coupled heat pumps and they can be governmentally funded.

The new Greek Geothermal Law 3175/03 foresees that Geothermal or ground energy over 25°C is property of the Greek state and is managed by the Ministry of Development. The Geothermal energy user is defined as a separate entity from the geothermal energy producer/distributor. Geothermal energy under 25°C i.e. applications of Geothermal Heat Pumps are regulated by the special Article 11. According to the special Article 11 a simple license for each user is required from the Prefecture, without the need of an annual “fee”.

For Geothermal energy over 25°C geothermal producer/distributor licenses are required and are granted only after strict public bidding process with no exception (best offer for the public receives the grant for “geothermal field license”). Any license is issued for 15 years, with possibility of extension for a further 15 years period. In addition, a Bank guarantee issuance is required for the whole license granting period depending on the predicted entire geothermal potential of the field.

The annual “fee” required depends on the actual energy consumed at 5-10 % of price of natural gas is determined by the Ministry of Development annually.

For the cases of Geothermal Energy over 90°C a geothermal license is requested and is issued from the Ministry of Development. However, for Geothermal Energy over 100°C i.e. the main geothermal areas have already been “awarded” to PPC as the sole beneficiary for energy content and its utilization. Through the application of the new Greek Geothermal Law, a doubling of the installed geothermal capacity in Greece is anticipated within the next five years.

V. Glamočanin, Ss. Cyril and Methodius University, FYROM: “Experiences of Albania in RFSRESP”

The Albanian Power System relies practically only on hydropower plants (99 %) and therefore it is totally dependent on hydrological conditions that means that it is vulnerable and unreliable. The substitution of electricity with other sources of energy, both renewable and non-renewable is a major component of the Government’s action plan for the energy sector. The Government will also promote the use of solar panel technology for domestic hot water use. The strategic option for the Government to ease the affordability burden in Albania concerns energy efficiency. It is clear there is considerable scope for improving household energy efficiency as a way of lowering current levels of wasteful consumption and thus affordability problems. The third operational program "Reducing the Long-Term Costs of Low Greenhouse Gas - Emitting Energy Technologies" has the objective to accelerate technological development and increase the market share of low gas-emitting technologies that have not yet become commercial least-cost alternatives, but which show promise of becoming so in the future.

The main barriers for successful implementation of RES in Albania are as follows:

- The banks require very high collaterals.
- Banks approached by the SHPPs operators refused to become involved in this new sector, which is considered as too innovative and not yet sufficiently developed.
- Electricity prices are fixed only for one year. There are no long-term price guarantees.
- The concession contracts cannot be used as collateral.

V. Glamočanin, Ss. Cyril and Methodius University, FYROM: “Experiences of Bulgaria in RFSRESP”

Bulgaria is heavily dependent on energy as it imports more than 70% of its primary energy sources. The only significant domestic energy source is low-quality lignite coal with high content of sulphur. Energy intensity is one of the key measures of energy efficiency and an important component of a nation’s competitiveness. Much of the RES (biomass, small hydropower plants, geothermal energy, etc.) have a significant resource, technical and economic potential. Nevertheless, being used irregularly and insufficiently, their share in the total gross energy consumption is negligible. A serious obstacle to their development is the higher cost of initial investments. To overcome the existing barriers, an Action Plan will be drawn up that will include an integrated approach and instruments for the promotion of RES, as well as a campaign for their accelerated development. One of the main goals of the Energy Act is to provide conditions for sustainable development of the generation of electric power and thermal energy from Renewable Energy Sources in the interest of protection of the environment. In order to support the penetration of RES in the country, The Minister of Energy and Energy Resources specifies the minimal mandatory quotas for electric power generation from renewable sources as a per cent of the total annual generation by each producer for a ten-year period as of the date of introduction of the system for issuing and trade with green certificates.

Conclusion

The workshop has been finished with a Consortium meeting, where the results of the workshop were discussed and future activities identified in details.

1 Experiences of Germany in regulatory framework to support Renewable Energy Sources penetration

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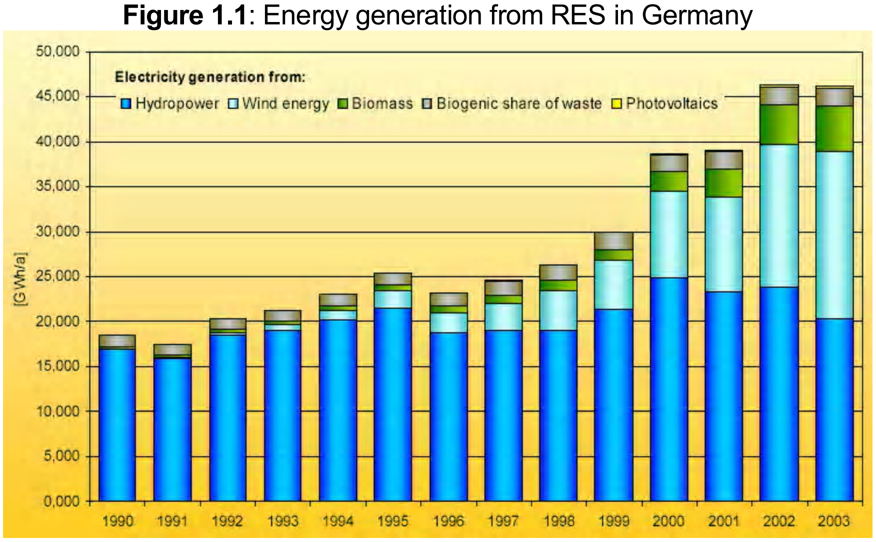
1.1 Introduction

In the following, we analyze the development and promotion of Renewable Energy Sources (RES) and central heat and power (CHP) in Germany. The indicative RES target to be achieved in Germany is to increase the share of total power supply from Renewable Energy Sources to at least 12.5 per cent by 2010 and at least 20 per cent by 2020. The increase of Renewable Energy Sources leads to a saving of CO2 emissions (around 53 million tones in 2003).

1.2 RES installations

The total power supply from Renewable Energy Sources is increasing permanently. As 2.1 depicts, more than 45,000 GWh/a are produced from RES; that is 7.9% of the total energy consumption in Germany.

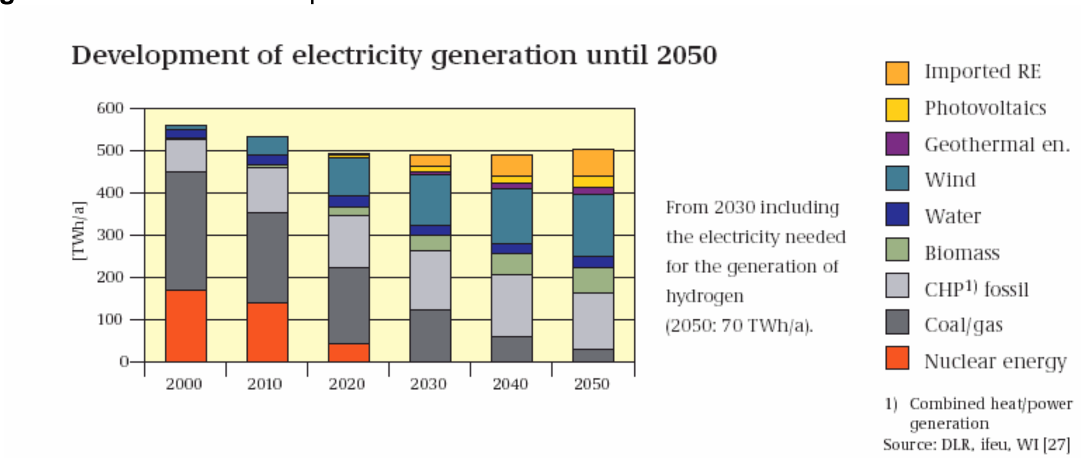
Figure 1.1: Energy generation from RES in Germany



Source: The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (2004): Environmental Policy. Renewable Energy Sources in figures – national and international development.

The decommissioning process in Germany raises the question of which generator types may replace the production of the nuclear plants. The following Figure 1. shows a scenario of decreasing generation shares from conventional plants favoring more and more generation from RES.

Figure 1.2: Scenario development of RES till 2050



Source: The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (2004): Environmental Policy. Renewable Energy Sources in figures – national and international development.

1.3 Legal framework for RES installations

The main responsibilities for the promotion of RES are in the hand of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (Bundesministerium für Umwelt, BMU). It is responsible for the legislation and rules for the promotion of RES and CHP. The electricity financing and support methods are laid down in the Renewable Energy Source Act (Gesetz zur Förderung Erneuerbarer Energien, EEG, amended 2004), the Law on Conservation, Modernisation and Development of Combined Heat and Power (Gesetz für die Erhaltung, die Modernisierung und den Ausbau der Kraft-Wärme-Kopplung, amended 2002), and the Biomass Ordinance (Biomasseverordnung, 2001).

The Federal Environmental Agency (Umweltbundesamt, UBA) is the scientific environmental authority under the jurisdiction of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. It hosts the German Emissions Trading Agency (Deutsche Emissionshandelsstelle, DEHSt) that is responsible for issuing emission allocations for each allocation period, maintaining emission allowance accounts and the national registry, and fulfilling the tasks and responsibilities arising in connection with the National Allocation Plan (NAP). Alongside, the UBA is responsible for the verification and processing of special allocations for CHP in connection with the allocation process and the benchmarking for new CHP-installations.

1.3.1 Framework for Promotion of RES Installations

The promotion of RES electricity in Germany is carried out mainly with the aid of feed-in tariffs fixed in the Renewable Energy Source Act. In 2003 2,605 Million Euros[1] were paid according to these rules. In addition to the Act, the German Government has launched smaller programs to promote the usage of renewable energy especially in the area of household customers. These programs are based on cheap loans and government grants. With the 100,000 Roofs Solar Power Program (1999-2003, replaced by the amended Renewable Energy Source Act) the installation of photovoltaic was supported with loan agreements of the KfW banking group. Within the context of the KfW CO2 reduction program and the KfW environmental program attractive loans are offered to private households and commercial enterprises for the funding of photovoltaic installations. The program to promote measures of the use of Renewable Energy Sources' (200 Million Euros in 2004) promotes the installation of Renewable Energy Sources at schools and especially the installation of solar thermal collectors with grants and soft loans. The program is funded by the ecological tax reform.

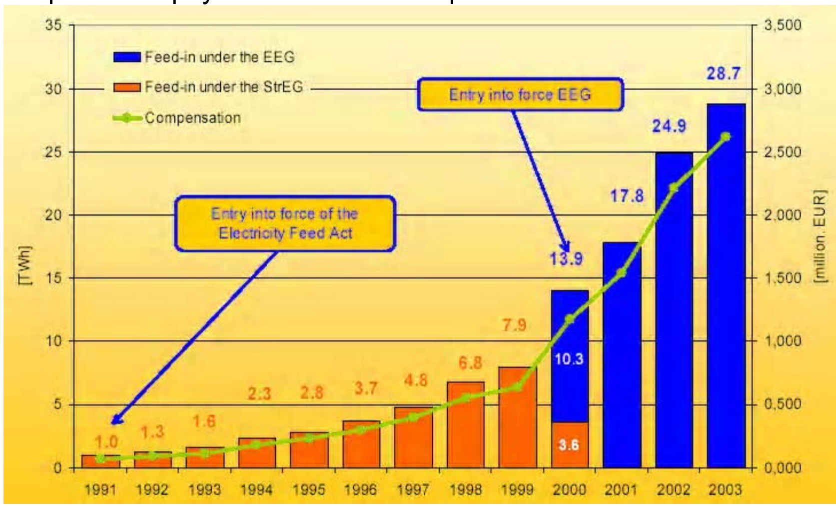
1.3.2 Renewable Energy Source Act (EEG)

The amended Renewable Energy Source Act (EEG) entering into force 1 August 2004 transposed the European Directive 2001/77/EC in German law. Precursors of the amended Renewable Energy Source Act were the Electricity Feed Act entering into force 1 January 1991 (Stromeinspeisegesetz, with amendments in the following years) and the Renewable Energy Source Act of 2000 that replaced the Electricity Feed Act. The Electricity Feed Act introduced into German law the obligation to connect Renewable Energy Sources to the grid and to pay them with feed-in tariffs.

The objective of the EEG is to increase the share of total power supply from Renewable Energy Sources to at least 12.5 per cent by 2010 and at least 20 per cent by 2020. The increase of Renewable Energy Sources leads to a saving of CO2 emissions (around 53 million tones in 2003). The network operators with the grid located most closely to the plant is obliged – if technically possible – to connect plants generating electricity from Renewable Energy Sources. The operator has to purchase the injected electricity and to guarantee priority transmission. The price of electricity is determined in the EEG in relation to the energy source, its location (in case of wind power), and the capacity of the unit.

[1] Rounded sum. See VdN, Jahresabrechnung EEG 2003.

Figure 1.3: Compensation payments for RES and produced RES-E



Source: The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (2004): Environmental Policy. Renewable Energy Sources in figures – national and international development

The expenses for the power purchases are shifted to electricity consumers. To prevent regional inequalities in the treatment of electricity consumers (that would occur e.g. because more wind power is injected in the north of the country) a nationwide equalization scheme is applied. The distribution operator reports to its particular transmission system operator[2] the amount of renewable energy (according to EEG) injected in its grid, its payment as well as the amount of electricity sold by the different retailers in its area. With the aid of this data, an average feed-in tariff per kWh and an average quota for renewable energy is calculated on the national level. To leverage the expenses for renewable energy, every retailer has to buy (virtually) renewable energy according to the quota from the transmission operators. The transmission system operators distribute these revenues among the distribution operators according to their actual burden. So via the retailers the expenses are passed through to the consumers and via the transmission system operators the distribution operators are compensated. Within this mechanism certain site criteria as subtraction of avoided network usage charges or as rules for energy-intensive industries has to be taken into account.

With the amended RES Act, the feed-in rates for power generated by different energy sources have changed. These changes are due to technical progress in generation and new estimations on energy efficiency of different locations. The following Table 2.1 provides an overview on the different RES generation units and the corresponding feed-in tariffs.

[2] In Germany there are four transmission system operators: RWE, E.ON, Vattenfall Europe, and EnBW.

Table 1.1: Feed-in tariffs RES Act, Germany

Source	Plant capacity	Rates	Capacity range	Period (years)	Comments
Hydro-power	Up to 5 MW	9.67 ct/kWh 6.65 ct/kWh	Up to 500 kW 500 kW to 5 MW	30	Some site restrictions from 2008
	5 MW - 150 MW	7.67 ct/kWh 6.65 ct/kWh 6.10 ct/kWh 4.56 ct/kWh 3.70 ct/kWh	Up to 500 kW 500 kW to 10 MW 10 MW to 20 MW 20 MW to 50 MW 50 MW to 150 MW	15	Only in case of modernisation and payment only applies to increased capacity
Landfill gas, sewage gas, mine gas	Unlimited	7.67 ct/kWh 6.65 ct/kWh 6.65 ct/kWh	Up to 500 kW 500 kW to 5 MW Mine gas from 5 MW	20	In case of landfill and mine gas, the power attributable to capacity beyond 5 MW is paid for at market price
	Unlimited	9.67 ct/kWh 8.65 ct/kWh 8.65 ct/kWh	Up to 500 kW 500 kW to 5 MW Mine gas from 5 MW	20	If certain technology is used
Biomass	Up to 20 MW	11.50 ct/kWh 9.90 ct/kWh 8.90 ct/kWh 8.40 ct/kWh	Up to 150 kW 150 kW to 500 kW 500 kW to 5 MW 5 MW to 20 MW	20	
	Up to 20 MW	3.90 ct/kWh	Up to 20 MW	20	If waste wood classified as AIII or AIV is used and plant was commissioned from July 2006
	Up to 20 MW	17.50 ct/kWh 15.90 ct/kWh 12.90 ct/kWh	Up to 150 kW 150 kW to 500 kW 500 kW to 5 MW	20	Applies only to specific (regenerative) raw materials
	Up to 20 MW	17.50 ct/kWh 15.90 ct/kWh 11.40 ct/kWh	Up to 150 kW 150 kW to 500 kW 500 kW to 5 MW	20	Applies only to the burning of wood as specified above
	Up to 20 MW	13.50 ct/kWh 11.90 ct/kWh 10.90 ct/kWh 10.40 ct/kWh	Up to 150 kW 150 kW to 500 kW 500 kW to 5 MW 5 MW to 20 MW	20	Applies to power from cogeneration in CHP plant
	Up to 20 MW	13.50 ct/kWh 11.90 ct/kWh 10.90 ct/kWh	Up to 150 kW 150 kW to 500 kW 500 kW to 5 MW	20	Applies to all power produced in CHP plant if certain innovative technologies are used
Geo-thermal energy	Unlimited	15.00 ct/kWh 14.00 ct/kWh 8.95 ct/kWh 7.16 ct/kWh	Up to 5 MW 5 MW to 10 MW 10 MW to 20 MW From 20 MW	20	
Onshore		8.7 ct/kWh		20	The higher rate is

Source	Plant capacity	Rates	Capacity range	Period (years)	Comments
wind farms		(initial rate) 5.5 ct/kWh (final rate)			granted for 5 to 20 years, depending on the reference yield.
Off-shore wind farms		9.10 ct/kWh (initial rate) 6.19 ct/kWh (final rate)		20	The higher rate is paid for plant commissioned before 2011. It is granted for 12 to 20 years, depending on site.
Solar energy	On buildings or sound barriers	57.4 ct/kWh 54.6 ct/kWh 54.0 ct/kWh	Up to 30 kW 30 kW to 100 kW From 100 kW	20	
	Façade-mounted	62.4 ct/kWh 59.6 ct/kWh 59.0 ct/kWh	Up to 30 kW 30 kW to 100 kW From 100 kW	20	
	Other	45.7 ct/kWh		20	Certain site criteria must be met

Source: BMU, Z III 1, August 2004.

1.3.3 Framework for Promotion of CHP Installations

The current CHP law came into force on 1 April 2002 replacing the 'Law for Protection of Electricity Generation through CHP' (KWK-Vorschaltgesetz, 2000). Power remunerated according to the EEG is not subject to the CHP law. The first CHP law of March 2000 introduced the right for compensation for injections of power from CHP. It was introduced to stop the decline of CHP in Germany and to reduce greenhouse gas emissions. With the amended CHP-law of 2002 especially the modernization of existing plants and the installation of small-scale units is promoted. Network operators are obliged to connect the CHP generation unit to the grid and to purchase the energy generated by them. The price for the electricity produced with CHP is not fixed within the law. There is the general rule that the network operator and the generator have to agree on a price for the injected energy or the "normal" price (e.g. the price on the power exchange) that has to be paid by the operator. In addition to the price for energy, the generator gets the network charges avoided because of its decentralized injection. The Association of Network Operators (Verband der Netzbetreiber, VdN) has fixed a (legally non-binding) procedure to determine the avoided network charges in the Association Agreement II+. In addition, the generator gets a supplementary payment according to the age and the capacity of its CHP-unit. The supplementary payments (in €-cents) are listed in the following Table 1.2:

Table 1.2: Supplementary Payment CHP

	2002	2003	2004	2005	2006	2007	2008	2009	2010
Existing old CHP plant (in operation before 31/12/89)	1.53	1.53	1.38	1.38	0.97				
Existing new CHP plant (Start operation between 01/01/90 and 01/04/02)	1.53	1.53	1.38	1.38	1.23	1.23	0.82	0.56	
Modernized CHP plant (Start operation after 01/01/02)	1.74	1.74	1.74	1.69	1.64	1.64	1.64	1.59	1.59
New small-scale CHP-plant between >50 and 2000 kW	2.56	2.56	2.40	2.40	2.25	2.25	2.10	2.10	1.94
New small-scale CHP-plant between ≤50 (Start operation before end of 2005) and fuel cell units	5.11 cent for a period of years beginning from the start of continuous operation								

Supplementary payments for small CHP plants up to 2 MW (including plants ≤50 kW) are made until total electricity injected from these plants reach 14 TWh. The network operators can refinance the supplementary payment with the aid of a mark-up on the network usage charges. VdN has calculated a mark-up of 0.284 Cent/kWh for 2004 and 0.336 Cent/kWh for 2005 for end-consumers with an annual consumption <100,000 kWh. (The increase is due to a shortfall for the year 2003) The CHP law limits the amount of CHP-mark-up for end-users with an annual consumption >100,000 kWh (on a single extraction point) to 0.05 Cent/kWh. This amount is halved for industrial consumers with annual electricity costs exceeding 4 per cent of their annual revenues. The different burdens of the network operators due to CHP payments are balanced between them on a national basis.

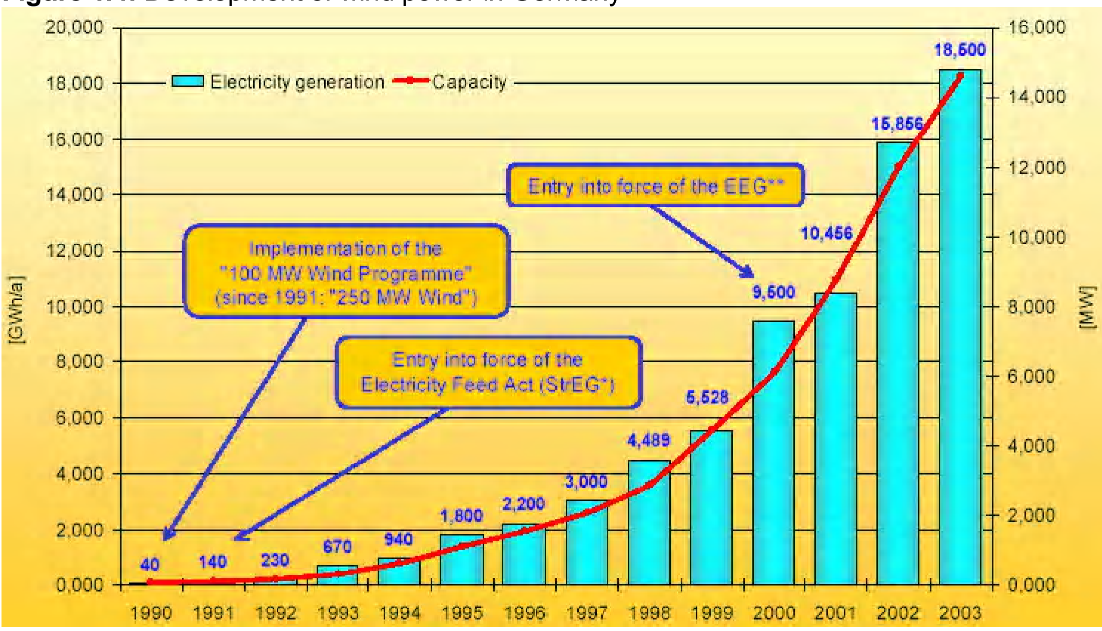
1.3.4 Licensing Procedures

The licensing procedures for RES installations depend on the renewable energy source to be installed. There are different requirements concerning environmental impact assessments and building lease procedures. The licensing procedure is accomplished by regional authorities. A CHP unit has to be certified by The Federal Office of Economics and Export Control (Bundesamt für Wirtschaft und Ausfuhrkontrolle, BAFA) to get the rights and payments after the CHP law.

1.4 Best practices: Wind power in Germany

Especially the generation of electricity from wind power has increased significantly during the last years. Starting with an annual production of 40 GWh/a in 1990 over 9,500 GWh/a (2000) in 2003 an annual production of 18,500 GWh/a with an installed capacity of 15,300 MW was reached. Payments for on-shore installations are reduced compared with the previous legislation to avoid potential excessive incentives for the installation of wind-farms. With a so-called reference yield the eligibility for payments is proofed. Plants, which are unable to achieve 60 per cent or more of the reference yield at the planned location, are not promoted within the RES Act. A special rule for "repowering" (modernization) of older wind farms has been introduced. This rule refers to plants in costal areas and avoids repowering of older wind-farms in the midland. The special promotion of off-shore wind energy with a high initial rate has been extended till 2010 (previously 2006). It can be prolonged for single installations depending on their distance to the coast and the depth of the water. The following Figure 1.4 show the development of the installed wind power capacities in Germany from 1990 to 2003.

Figure 1.4: Development of wind power in Germany



Source: The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (2004): Environmental Policy. Renewable Energy Sources in figures – national and international development.

Since wind farms are preferably installed in the north of Germany the increasing injection causes problems for system operation. The system operators state that these injections are responsible for an increasing need of balancing power, which raises the use of system charges. In February 2005, a large-scale research project of the German Energy Agency (Deutsche Energie Agentur, dena) was published, listing additional infrastructure investments needs that may occur because of additional wind farms.

1.5 Lessons learned

- Feed-in tariffs have been very successful to increase the production of electricity from RES. With the amended RES Act, the feed-in rates for power generated by different energy sources have changed, since some of them as the charges for wind-power have favored investments in parts of the country where the installation of a windmill was not fully efficient.
- Contrary, the success of the CHP financing and support methods is questionable. Currently, the German Association for CHP (Bundesverband Kraft-Wärme-Kopplung e.V., BKWK) is in doubt about the fulfillment of the CO2-reduction target that has been set in § 1 CHP-Law: It

says that the promotion of CHP should reduce CO2-emissions by at least 20 tones in 2010 compared with 1998. During the last years especially the investment in new small-scale CHP plants remained behind the estimations of 2001. Therefore, it is suggested to prolong the promotion of new small-scale CHP-plant for another five years, which implies a supplementary payment for ten years after installation. In addition an (additional) premium for new CHP-plants of 1.5 Cent/kWh is recommended.[3] It has been argued that the introduction of certificates for the support of CHP would have been more efficient in terms of installation of new plants and reaching the CO2-target. However, changing the support method within the current legislation period seems to be very unrealistic. For that reason, the BKWK enforces the increase of the supplementary payments and the prolonged promotion of small-scale units.

[3] Report and press release of the BKWK 27. November 2004, www.bkwk.de

2 Experiences of Spain in regulatory framework to support Renewable Energy Sources penetration

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Abstract: This document presents the experiences of Spain in regulatory frameworks to support Renewable Energy Sources penetration in the country.

2.1 RES installations

The regulatory schemes implemented in Spain to support Renewable Energy Sources (RES) have been designed to achieve the RES amount targets set in the national plan of promotion of renewable energy (see Table 1.1).

Table 1.1. The targets set in the national plan of promotion of RES.

RES	Targets set by the National Plan to support RES for the year 2010 (MW)
Wind	13.000 (initially 8.974)
Photovoltaic	115
Solar Thermal	200
Hydro < 10 MW*	720
Hydro 10 - 50 MW*	350
Biomass	1.708
Solid Wastes	168

* increment above the installed capacity in 1998

Nowadays, RES generation has an important share of the total energy production in Spain, as it is shown in the following table:

Table 2.2. RES and CHP in Spain in 2004

RES and CHP	Installed capacity (MW)	Energy production (GWh)	Percentage of total consumption
CHP	5744,92	18087,4	7,32%
Photovoltaic	16,3	16,6	0,01%
Wind	7849,2	15225,3	6,16%
Hydro < 50 MW	1660,7	4600,4	1,86%
Biomass	29,0	127,5	0,05%
Agricultural, industrial, and other wastes	1375,4	6040,5	2,45%
Total	16675,5	44097,6	17,85%

Source: Monthly report on energy production of RES and CHP (CNE), April 2005

The peak demand in Spain is around 44.000 MW in winter.

2.2 Legal framework for RES installations

In Spain, installation of RES generators has been promoted through specific legislation that recognizes a different status to RES and Combined heat and power (CHP) plants, known as “Special Regime”. This Special Regime allows such generators to follow specific technical rules (connection and operation) and gives them an economic incentive. The promotion of RES has been regulated mainly by two Royal Decrees: RD 2818/1998 (from 1998 to 2004) and RD 436/2004 (currently in force).

2.2.1 RD 2818/1998

According to this RD, RES revenues per each kWh produced were set to the average final hourly electricity market price plus a premium. In addition, some RES technologies, such as: wind, geothermal, wave energy, tidal power, and energy from hot and dry rocks, were allowed to sell their energy production at a established feed-in-tariff, independent therefore on the market price. In both cases, they did not participate in the energy market, as generators belonging to the Special Regime had the right to sell all their production (or surplus in the case of CHP) at the aforementioned price. These generators did not have practically any technical obligation, besides having the adequate protection equipment for system operation.

As a third option, since 2002, RES was encouraged to actively participate in the electricity wholesale market through the RD 841/2002. This RD did regulate new incentives for bidding in that market. For instance, long-term security of supply payments, known as capacity payments, were set at a higher level than for conventional generators, independently on the security of supply guaranteed by such generators; the RES participation in other ancillary services, as secondary and tertiary reserves, and management of transmission network constraints procedures were also recognized. Finally, to facilitate the entry of RES into the wholesale market, market aggregators were defined in order to be able to sum the production of several RES plants for bidding purposes, and therefore minimizing prediction errors.

2.2.2 RD 436/2004

This legislation takes a new step forward in the process of integrating RES generators in the market. In this sense, the final aim of the regulator is to achieve a level playing field for generators, no matter if they are RES or conventional. Therefore, an alternative to access market is proposed in this regulation where each generator will earn revenues in the market and will pay the services they consume, under the same rules. In addition, RES will have a supporting mechanism according to the associated externalities and trying to ensure its financial viability.

RES revenues can be determined by one of the two following alternatives:

- ***Feed-in-tariff***: the price paid per each kWh produced by a RES installation is regulated and fixed to a constant value, independently on the price market fluctuations. The annual evolution of this tariff depends on the evolution of the average reference electricity tariff in Spain[4] (RT), as feed-in tariffs are set as a percentage of the RT. The regulated feed-in-tariff for each RES technology depends on the type of the technology and on the year when the RES installation is put on service. This alternative is a heritage of the previous regulation. RES facilities greater than 10 MW are committed to give to distribution companies (DISCOs) a production schedule 30 hours in advance, being allowed to adjust such schedule 1 hour ahead of each intra-daily market (6 calls during a day). Hourly energy deviations from the production schedule are penalized at a price per kWh deviated equal to 10% of the RT. This penalization does not apply in a dead-band of 20% of the production scheduled for RES facilities and 5% for CHP plants. This rule, which implies a big change in RES regulation from the previous framework, will apply to wind farms only since January 1st 2006.
- ***Wholesale market:*** RES are given incentives to join the wholesale market, following in this case practically the same rules as ordinary generators. As the RES will face new technical and economic constraints by doing so, their remuneration scheme provides an additional economic incentive. The total income is the sum of the market selling price, plus a premium which stands to represent the externalities in a similar way to previous regulation, plus the above mentioned additional incentive to access the market. The premium and the additional incentive are set also as a percentage of the RT. As RES are integrated in the wholesale market, they have access to all the rest of electricity markets (daily, intra-daily, ancillary services, etc.). They can earn money if they are able to participate in such markets, or pay if they use such services, being the most important the cost of production deviations from the predictions. In this case, there is not any dead-band, and the price is settled through market mechanisms.

Both alternatives have an additional income associated to reactive power which depends on the time period (peak, flat, or valley hours) and it can be positive or negative depending on the power factor the unit is actually providing. This income encourages RES to consume reactive power (lagging power factor) in valley hours and to supply reactive power (leading power factor) in peak hours. In previous regulations, there was an incentive to keep the power factor equal to one.

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[4] The RT is calculated every year and represents the electricity average price including all electricity business: generation, transmission, distribution and retail, and it is used to set integral final costumer tariffs.

An interesting aspect of this RD is the economic incentive that has been fixed for wind farms to be able to cope with voltage dips without tripping. This is one of the main technical problems for wind generation expansion, with high penetration levels of wind generation that can trip all at a time due to a voltage dip in the transmission network; the stability of the system can be threatened. This RD has chosen to give as an economic incentive 5% of RT to each kWh sold by each immunized wind park against voltage dips during a period of 4 years.

The framework stated by the RD 436/2004 has been well accepted by RES owners because the evolution of the RT is foreseeable. Moreover, this framework provides regulatory stability: the future changes of the legal framework will apply only for new facilities and not for the existing ones.

2.2.3 Connection standards

The aforesaid legal framework does not include connection standards. These are regulated today by an old rule enacted in 1985 which is currently in force. These requirements were adequate in that period when the penetration of RES was not an important issue. Nowadays, the penetration of RES is increasing very fast and it is important to update the connection standard. Only photovoltaic plants smaller than 100 kVA and connected to low voltage networks (under 1 kV) have specific connection requirements enacted in the Royal Decree 1663/2000.

2.2.4 Licensing procedures

In order to be included in the *special regime* framework and therefore apply to all its technical and economic advantages, RES or CHP have to fulfill the requirements and procedures required by the administrative bodies. In general, the license to build and to operate *special regime* facilities is approved by the regional authority, besides the local authorization of the municipalities. In certain circumstances, the Ministry of Industry has jurisdiction to approve the license of a special regime facility. This procedure, which includes an environmental impact analysis, energy evacuation plan, etc. can be very long in time.

In addition, the owner of a special regime facility has to sign a contract with the DISCO where the facility is going to be connected to set the technical and economical conditions. The terms of this contract are regulated by the Ministry of Industry and apply for a period of at least 5 years.

The contract has to specify the following conditions:

- Location of metering devices and connection point to the network. It also has to specify the characteristic of control, protection, and metering devices.
- Estimations of the expected volume of sold energy and, when it applies, the consumption of energy, specifying maximum demand and production.
- Possible causes for modification and cancellation of the contract.
- Technical aspects of the interconnection, such as circumstances in which the DISCO will not be able to absorb the energy production.
- Economic conditions, which includes the chosen alternative for selling the energy and the agreement to remunerate the reactive energy. The DISCO has the obligation of paying all these concepts within 30 days from the reception of each bill.

DISCO has the obligation to sign the aforesaid contract in a 3 months period after the agreement of the location and technical conditions, even if the RES generator does not supply energy.

In addition, DISCO has to pay RES all the items corresponding to the *special regime* (premiums, economic incentives, etc.) in a 30 days period after it receives the bill. If DISCO does not pay during this period, it has to pay a penalization equal to 1.5% of the owed amount.

2.2.5 Administrative requirements to join the wholesale market

If a generator wants to operate in the wholesale market, it has to become a market agent. These means to fulfill all the market operator requirements (both technical and economic), which can be complicated in some cases. It is possible to avoid part of these requirements if the access is made through a broker, or making bilateral contracts with a market agent.

2.3 Best practices

There have been two different steps in the promotion of RES in Spain. Actually the second one has just begun, so it is only possible to judge the results obtained by the first one (RD 2818/1998). In this scheme, *special regime* generators didn't have practically any technical obligation, had the right of selling all its production (or its surplus for CHP) and was economically supported through a feed-in-tariff or market price plus a premium. The results depended basically on the economic support level, and on the administrative authorization process.

The results show that expansion of wind and partly CHP have been a success in terms of installed capacity. Regarding wind power, the objective stated for year 2010 in the national plan of promotion of renewable energy (8974 MW) is foreseen to be reached in the current year. What is more important, if there had not been a problem with the licensing process, there would be much more installed capacity. There are important regions of Spain where wind generator building has been completely blocked until an "official wind plan" has been developed. And some of them are still stopped, while others have just begun to give the mandatory authorization to promoters.

There are actually around 30.000 MW of additional wind installed capacity in different stages of registration as *special regime*. This does not mean that all of them will be built and operated, but it gives an idea of the strength of wind expansion in Spain. Only administrative barriers or technical limits of penetration can stop such an increase.

On the other hand, the development of the other RES technologies has not been satisfactory and it is probable that proposed targets will not be reached. In the case of biomass, the most promising technology in the National Plan, the reason is more complex than just not enough economic support.

Figure 2.1 shows the installed capacity of *special regime* generators during the period 1998-2004. The ratio of energy demanded by the Spanish power system to the energy supplied by *special regime* generators has been increasing and it is foreseen that this trend will continue (see Figure 2). Nowadays, *special regime* generators supply approximately 18% of the total demand.

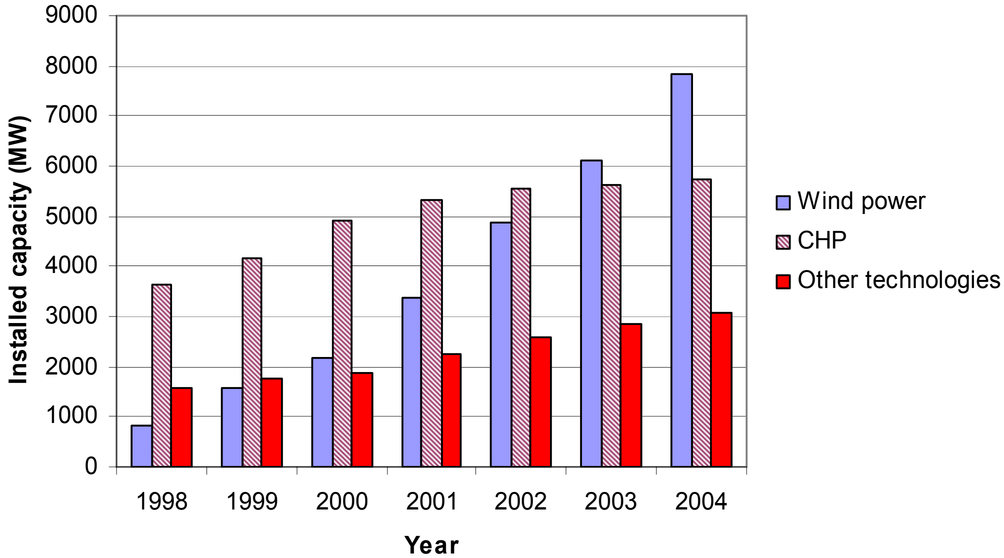

Figure 2.1. Installed capacity of RES.

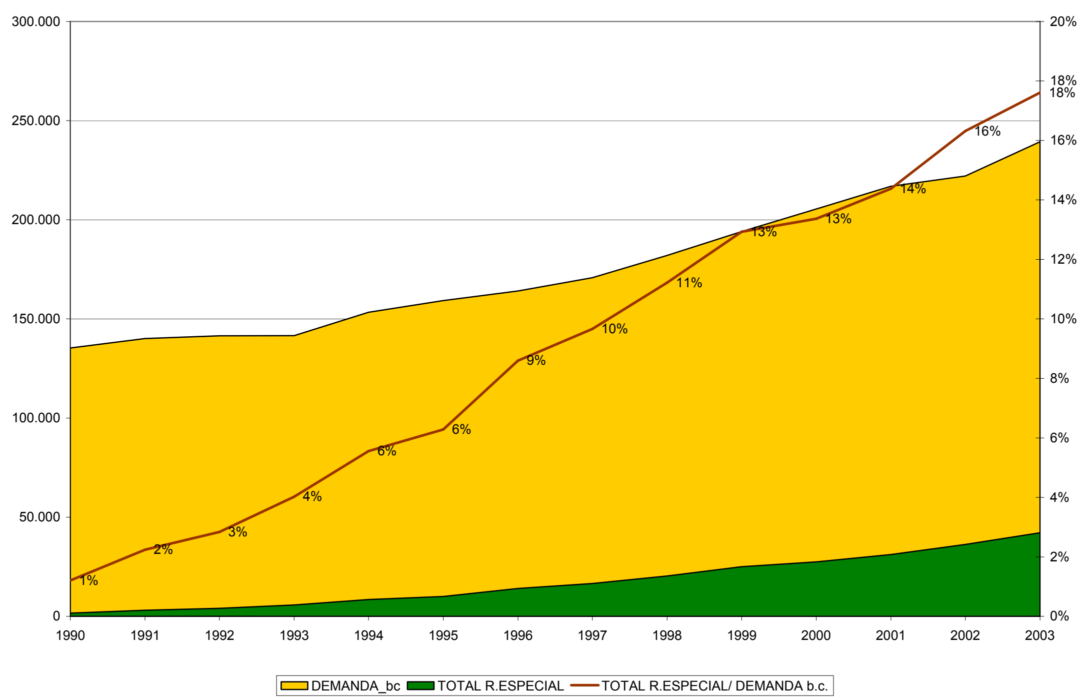

Figure 2.2. Energy supplied by RES

2.4 Lessons learned

- It is very important to define connection standards adapted to each technology, especially for small RES generators: photovoltaic began to be installed only when the RD 1663/2000 was published.

- Fixed premium is the more effective way to promote a technology, if it is high enough. What is being discussed now is the economic efficiency and sustainability of such support.
- Rules for expansion of RES at a marginal stage (small penetration of RES with respect to total demand) may not work properly for well established technologies with a higher penetration. In Spain the problem now is how to better integrate the huge amount of wind generation to allow a higher penetration.
- Licensing procedures are much too complicated, having to reach an agreement with four to six different authorities and agents. Wind growth has been very different depending on the region authorities: Galicia, Navarra and Castilla-La-Mancha are the most successful, while other regions have not given yet a single permission.

2.5 Main barriers to the development of RES

There are still several barriers to full development of most of the technologies. The most important ones may be the following:

- Technical requirements:
    - Connection standards are completely out of date in most cases.
    - Monitoring and communication devices may represent a barrier in case of trying to access the market.
    - In the case of wind generator, its ability to cope with dips without tripping may become essential.
- Network capacity to evacuate generated energy. As RES is not always situated near the electrical network, its development is crucial, especially for wind parks. These parks need high voltage lines, which construction is most difficult nowadays due to environmental reasons. Delays for their construction may be as long as 5 years.
- Administrative processes: a promoter has to negotiate with the state ministry, the regional authority, the municipality, the electrical company and, in case of accessing the market, with the market operator and system operator as well. The experience tells that the building a wind park may take 5 years.
- Economic support: as the premium is calculated ex-ante and decided by the regulator, not by the market, the fixed amount may be not enough or too high. In most of the technologies, it seems to be not enough. But in the case of wind, it looks like being too high. This may become a barrier too in the future, as all the economic resources have been dedicated to the first wind parks.
- Network connection deep-costs are applied in Spain, with all the problems this means.

3 Experiences of Slovenia in regulatory framework to support Renewable Energy Sources penetration

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Abstract: This document presents the experiences of Slovenia in regulatory framework to support Renewable Energy Sources penetration in the country.

3.1 RES installations

Table 3.1 presents the existing RES installed capacities in Slovenia, based on statistical data and some other sources and expert estimations. Prevailing is the share of small hydro power plants (78%), following by industrial wood biomass CHP plants (16%) and different biogas CHP units (4%), shares of PV and wind are almost negligible (less than 1%). As Slovenia should achieve ambitious target of 33,6% of electricity generation from RES till 2010, future additional capacities as forecasted in National Energy Program are shown in Table 2. More than half of almost 200 MW of new planned capacities till 2020 are wind turbines, following by small hydro power plants and bio gas installations.

Table 3.1: Installed RES capacities in Slovenia

	Wind turbines	Small Hydro	Biomass	Landfill gas	Sewage gas	Bio gas	PV	Total
Capacity [MW]	0,014	100	20,7	4,3	1,8	0,5	0,1	**127**
El. generat. [GWh]	0,021	275	155,2	30,3	9,1	2,5	0,1	**472**

Source: SURS, other sources

Table 3.2: Additional new RES installations in Slovenia (cumulative).

[MWe]	Wind turbines	Small Hydro	Biomass	Landfill gas	Sewage gas	Bio gas	PV	Total
2010	70	28	4	14	3	3	0,5	**122**
2015	95	37	4	17	4	4	0,7	**163**
2020	110	46	5	16	5	5	0,8	**189**

Source: National energy program strategy, 2003.

3.2 Legal framework for RES installations

All legal frameworks for RES installation are based on the special status of Qualified electricity Producer (QP), which has been introduced by Energy law (EA, Article 29). Status of QP can be awarded to electricity producers that generates electricity and heat with above-average efficiency during the co-generation of electricity and heat (CHP, total yearly efficiency > 78%), or uses RES in a manner consistent with the protection of the environment.

By EA the network system operators shall be responsible:

- for the purchase of all electricity offered by QP at the price determined by the Government
- QP may sell all or part of the produced electricity independently and shall be entitled to the payment of a premium for the sales of this energy from the system operator
- All costs incurred by the system operator arising from such purchase and sales, or the payment of the premium, shall be covered by the price for the use of networks.

Ministry for the Economy is responsible for preparation of policy instruments and measures as:

- Decree on the requirements to be met for obtaining the status of QP,
- Setting and updating of feed in tariffs and premiums for QP

Supporting of RES electricity and CHP has a long tradition in Slovenia. All small power plants (up to 10 MW) have been supported by feed-in tariffs (FIT) since the mid-80's. The new system of feed-in tariffs in operation since early 2002 is current the main supporting instrument.

3.2.1 Feed-in tariffs for QP

Feed-in tariffs for QP are defined by government decree[5] and are defined as a sum of **average electricity market price and premium for QP** as shown on Figure .

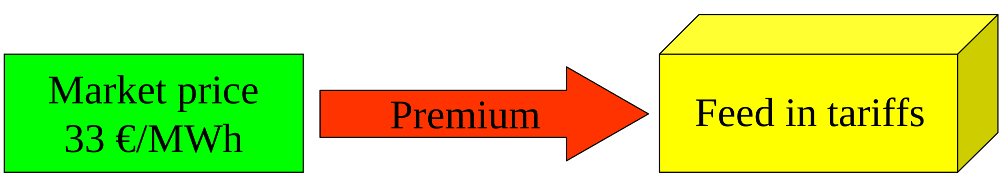

Figure 3.1: Structure of Slovenian Feed-in tariffs model.

Premiums vary for different technologies, unit size and used type of energy, as shown in Table 3. The difference between the market price and the feed-in tariff is covered by network charges (preferential dispatching supplement fee defined by the Ministry), paid by all electricity customers. Network operators are obliged to conclude long-term (10 years) feed-in contracts with QP's.

The following main stipulations modify the feed-in prices:

- if a power plant is connected to the transmission network, the price or premium is reduced by 5%,

[5] Decree on the rules for determining prices and purchasing of electricity from qualified electricity producers, Off. Gaz. of RS 25/2002).

- for plants in operation for 5 or more years the price or premium is reduced by 5%, for plants in operation for 10 or more years the price or premium is reduced by 10%
- if the QP has received a non-refundable subsidy from the state, the price is reduced by 5% for each 10% of investment cost, for which the plant has been subsidized

For own sales of produced electricity, the QP is entitled to the payment of the premium, whereas for own consumption of electricity (without use of public network), the QP is entitled to only 30% of premium.

Table 3.3: Feed-in tariffs for QP

Technology	**Unit size**	**Uniform price**	**Premium**
		EURc/kWh	*EURc/kWh*
Wind	<1 MWe	6,1	2,7
	>1MWe	5,9	2,5
Small hydro	<1 MWe	6,1	2,8
	<10 MWe	5,9	2,6
Biomass	<1 MWe	7,0	3,6
	>1 MWe	6,7	3,4
Geothermal		5,9	2,5
Land fill & sewage gas	<1 MWe	5,3	2,0
	<10 MWe	4,9	1,6
Bio gas (animal waste)		12,1	8,7
PV	<36 kWe	37,4	34,0
	>36 kWe	6,4	3,1

The QP producer can choose a uniform price, which is applied to all deliveries of electric power to the grid, or he can chose a time-of-day and seasonally variable price, according to the Table 4.4.

Table 3.4: Factors for the time-of-delivery tariff

	Factors applied to the uniform price/premium	
Time of supply to the grid/consumption	Peak hours (16h/workday)	Night hours, weekends
High season (Dec., Jan., Feb.)	1.40	1.00
Intermediate season (Mar., Apr., Sep., Oct.)	1.20	0.85
Low season (May, Jun, July, Aug.)	1.00	0.70

Note: Actual price or premium is determined by multiplying the set uniform price or premium.

For micro-power-plants (below 36 kW), the producer may opt to use the low-voltage supply tariff for households. Two-way counters are used and the subtraction principle applied.

The various feed-in-tariffs are being renewed once per year[6]. The government is obliged to consider the consumer prices index increase, and the expected prices of electricity on the market.

[6] Last revision in 2004 by Decision on prices and premiums for the purchase of electricity from qualified electricity producers, Off. Gaz. of RS 8/2004.

QP is not obliged to prepare schedules for network operator and is not paying balancing costs. All cost of network operator caused by QP operation is included in costs of preferential dispatch.

3.2.2 Minimum costs of network prices for use of electricity from QP

To stimulate the development of small QP (up to 1 MWe) and direct sales of electricity to small consumers, article 27 of EA among goals for methodology for calculating and defining the network charge, prescribed that **only minimum costs for use of network should be accounted for eligible customers buying electricity from QP up to 1 MW_e.** By provision in article 87 even households' consumers, which buy electricity from QP up to 1 MW are treated as eligible customers even before 1.7.2007.

According to a recent *Decision on setting prices for the use of electric power network*[7] customers pay the price for use of network reduced by a relief – they do not pay:

- the network charge for the use of transmission network (if customer and QP are connected on the same distribution network)
- supplement for preferential dispatch

The relief represents around 14% of current average final price for households or around 9% for commercial customers and is additional stimulations for development of green electricity market in Slovenia.

3.2.3 Subsidies and financing

Presently, investment subsidies are restricted and available only for biomass, biogas, heat pumps and PV installation offered on yearly tenders by Agency for Energy Efficiency and RES (AURE).

AURE is also financing (up to 50%) feasibility studies and preparation of project documentation

Environmental found of the Republic of Slovenia (public found) is offering soft loans for RES and other energy efficiency and ecological projects.

3.2.4 Standards and Rules

Conditions and procedures for connection of QP to the distribution network are defined by:

- *Decree on general conditions for the supply and consumption of electricity*[8]*,Regulation on system rules for operation of electricity distribution network*[9]. Network operators have also

internal technical rules, which should be considered (sometimes with some individual interpretations and requests), which could make problems for QP[10]

[7] Off. Gaz. of RS 84/2004.

[8] Off. Gaz.of RS 117/2002, 21/2003.

[9] Off. Gaz.of RS 123/2003.

[10] Only proposal for rules for connecting and operation of independent power plants has been prepared by IBE in 1994 and commonly used by network operators. Partly it was included in mentioned documents; remaining items are usually used as internal rules of network operators.

3.2.5 Licensing Procedures

Beside ordinary spatial and administrative procedures necessary for acquisition of building permit, QP needs to carry out also procedures for acquisition:

Status of QP (role to the Ministry of Economics)

License for the generation of electricity for units above 1 MWe, issued by Regulatory Authority (Public Agency for energy for Energy)

3.3 Best practices

Although there was no big “boom” of new RES capacities after the reform of feed-in tariffs, in general it appears that the existing supporting scheme is adequate and offers reasonable investment condition for most of the RES technologies. Indeed, an adequate rate of return for new investment for different RES technologies was the main criteria for the calculation of the feed-in tariffs[11]. Any higher FITs is likely to exceed the country’s limited financial resources, would be a too high price paid for limited environmental effect, would distort the apparent competition between RES sources and could not be justified by any additional benefits that may apply in other countries (boost of domestic technology production for example). At the same time it may be that the rate of return for RES technologies, and hence the FITs, should be adjusted somewhat to account for the increased risk, administrative costs, and general uncertainty. Improving the administrative and planning procedures will also contribute to an improvement. The development in Slovenia in recent years is underlined and shortly described in next subchapters.

3.3.1 Land fill gas utilization

The technology with the biggest development in recent years: Five new units (internal combustion engines, total capacity 3.6 MWe) has been installed in landfills in Ljubljana, Maribor and Celje[12]. Large potential still exist on these an others landfills.

Figure 3.2: Landfill gas engines installation in Ljubljana landfill

[11] An exception is only solar PV technology, where the existing tariff which is 6 times higher than the average is still not very attractive for investment.

[12] Unfortunately till now in most cases produced heat is used only in very limited scale.

3.3.2 Bio gas CHP plants:

Three projects (internal combustion engines, total capacity 0.5 MWe) have been recently finished, two on bigger pig farms, one on smaller private cattle farm Letuš.

Letuš farm installation of 2 gas engines (each 60 kWe capacity) is fuelled by biogas from two manure ferment ores (app. 2400 m^3/day) as shown on Figure 3.3. Bigger share of produced electricity is sold to the grid at set FIT One third of the produced heat is used for fomenters heating whereas residual heat is used for heating of near houses in winter and for hay drying in summer. Important result of installation is also significant reduction of local sting, decrease of water and soil pollution and reduction of methane (GHG) emissions and quality fertilizer production as a secondary product.

With substantial financial subsidy of AURE (32% of total 340.000 EUR investment costs) implemented bio gas plant on Farm Letuš had big demonstration effect (several new projects where initiated on presented results)

Figure 3.3: Biogas CHP installation on private farm in Letuš

3.3.3 Solar PV plants:

In spite of still high investment cost (also compared to some other EU countries) and FIT not offering fast return of investment (>10 years) several PV plants have been installed in recent period:

- 1,1 kW PV plant in Ljubljana as a first plant with on-grid connection (1000h/year)
- Several PV installations in mountains huts without el. network connection (52 kW)
- Nanos farm demonstration 4,5 kW PV plant (not connected on grid)
- Holiday houses PV installations (~25 kW)
- 5 kW PV plant on Technical university of Maribor (educational and demonstration effects)

- Latest and the biggest 16,5 kW PV installation on aircraft hangar in Bled airport

Figure 3.4: First 1,1 kW PV plant in Ljubljana and the latest biggest 16,3 kW PV plant in Airport Bled

3.3.4 Other RES technologies

Recent development of other RES technologies was rather limited:

- **Small hydro power plants:** limited number of new units have been installed with some refurbishment of existing plants
- **Wind plants:** except 5 smaller private installation with total capacity 14 kWe (alpine huts) no bigger investment has been realized although big interest exists[13].
- **Wood biomass:** Except current ongoing construction of new CHP plant on biomass (600 kWe steam engine) in district heating system in Železniki, no new projects has been realized beside some older industrial CHP plants operating in paper & pulp and wood industry.

3.4 Lessons learned

The so far experience of Slovenia in regulatory framework to support RES penetration could be summarized:

- Recent new development of RES was small and slow, still far from ambitious plans and targets.
- As RES utilization could have big environmental effects its support could not be automatic. Only well prepared feasible environmental and economical project should be supported.
- Environmental impacts of RES utilization are important factor that should take more important place in phase of planning and implementation to avoid conflicts and project opposition (case of large wind farms in Slovenia).

[13] Several locations have been analysed with wind speed measurements. Environmental problems appeared as a main obstacle as potential locations are in intact and protected areas (Natura 2000, regional natural parks, etc.), quality of wind potential .is still uncertain and is rather limited.

- Besides consistent and quality project preparations by investors, prompt and consistent project proceedings by the government, further attention should be paid also on increase of public awareness and communication.
- FIT are rather efficient and adequate, for faster RES development some of them (biomass, etc.), it may be necessary to recalculate the level of the FIT making adjustments for the appropriate inclusion of transaction costs, costs of financing or risk-premium.
- To stimulate the green electricity market some additional regulation for energy balancing should be issued to avoid current conflicts between QP and network system operators at independent electricity sell.
- As RES projects have multidimensional effects on the energy sector, environment, agriculture, etc., supporting schemes should be combined and included not only in energy policy (bio gas, biomass, etc.).
- There is a need for improving and simplifying administrative and (spatial) planning procedures.

3.5 Main barriers to the development of RES

The main barriers to the development of RES in Slovenia are not different from those in other countries:

- Insufficient FIT for some technologies (biomass, PV, micro installations, etc)
- Consistent and transparent spatial planning, with clear definition of potential investment area (exclusion of national parks, intact areas) to avoid conflicts of interests and speed up procedures.
- Low electricity prices: especially households prices are under rated at the moment, uncertain market conditions in other sector not stimulating investments in electricity production.
- Complex and time consuming procedures
- Not enough flexible financing instruments
- Bad project preparation, big environmental effects and low whole economy effects of RES projects that could result in big damage for other RES projects.

4 Experiences of Romania in regulatory framework to support Renewable Energy Sources penetration

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Abstract: This document presents the experiences of Romania in regulatory framework to support Renewable Energy Sources penetration in the country.

4.1 RES installations

Table 4.1 presents the RES installed base as well as future RES installation in Romania. It can be seen that the wind and solar potential was not developed up to now; only experimental installations exist.

Table 4.1: Installed RES in Romania.

Wind Parks (MW)	**Small Hydros(MW)**	**Biomass (MW)**	**PV (kW)**
~ 1	~300	Not for electricity	< 80
Plans for RES installations, in 2010			
120	730	No data	Very low interest

4.2 Legal framework for RES installations

4.2.1 Existing laws

Several actions are in progress in Romania concerning the issuance of suitable law on Renewable Energy Sources:

- *Electricity law no. 318/2003* sets the regulatory framework for carrying out activities in the field of electricity with competences and duties of the Romanian Energy Regulatory Authority (ANRE). Electrical energy sources of rated capacity less than 250 kW are not subject to the present law, and therefore these are not under ANRE duties. The concerned law provides stipulations on the use of Renewable Energy Sources stimulations;
- http://www.minind.ro/foaie/Legea_energiei_electrice.doc
- *Government Decision no. 443/2003* sets the regulatory framework concerning the *Promotion of Electricity Production from Renewable Energy Sources*. The decision stipulates that the

electrical energy produced by Renewable Energy Sources should represent in 2010, 30% of the national gross electricity consumption (this target includes all contributions of small and large hydro, which anyhow reaches today about 30%) and 11% of the gross energy consumption;

- *The road map for the energy field in Romania*, approved by G*overnment Decision (GD) no. 890/2003*, provides the targets, objectives, programs, terms and financial sources concerning the implementation of energy policy.
  http://www.minind.ro/foaie/Etape_de_parcurs_eng.doc
- *The law no. 143/1999* regarding the financial incentives sets the modality of authorization, granting, control, inventorying, monitoring and reporting the state aid, for creation and maintaining of a competitive environment;
- *The law no. 199/2000 on energy efficiency* stipulate that economic agents with an activity in the field of generation, transport or distribution of fuels or electricity are obliged to take appropriate measures for promotion of solar, wind, geothermal energy, biomass and biogas and of energy produced from waste. The incentives provided by this Law, in change, refer only to increasing energy efficiency.

According to the law no. 318/2003, ANRE sets the technical conditions of connection to the electrical network and also conditions concerning the trade with electricity produced from renewable sources. **The law does not stipulate special conditions concerning the connection of electricity producers based on RES**. The connection of these producers to the public electrical network is carried out according to “Regulation regarding the users connection to the public electricity network” approved by GD no. 867/2003. According to stipulations given in this regulation, for the connection to the electrical network, a technical approval issued by the network operator is required. The connection tariff is set up through a methodology issued by ANRE.

Starting from the *Road map for the energy field in Romania*, in 2010, the electricity produced in large hydro (>10 MW), including, of course, the power installed in new plants, will assure at more 26% of the national gross electricity consumption. The difference of 4% remains the duty of the “real” renewable sources: hydro stations of small rated power, wind energy, solar energy, bioenergy (mostly the biomass). This difference represents about 2.9 TWh, which, evaluated in power, means about 750 MW capacity installed in small power plants of 10 MW rated, wind generators, combined heat and power (CHP) plants running on biomass.

4.2.2 Green certificates

Two Government Decisions were issued related to the promotion of electricity produced from RES (E-RES): the GD no. 1429/2004 approving the rules for issuance the *Guarantees of Origin* for E-RES; the GD no. 1892/2004 approving the promoting system of electricity produced from renewable sources. The support scheme is a quota-based system developed through a market of green certificates. The certificates will be issued monthly for E-RES producers by Transelectrica, the Romanian TSO, and the green certificates market will be administrated by OPCOM, the Market Operator. A part of the costs of the electricity produced in RES will be covered by the sale of green certificates at the market price. Another part will be financed through an obligation of suppliers to purchase a certain amount of green certificates from E-RES producers according to a fix percentage of their total electricity supply/consumption. 2005 will be the first year for support scheme application.

The wind, solar, biomass sources and hydropower plants with an installed power less or equal to 10 MW, installed or refurbished starting with 2004, are envisaged for support.

The green certificates are expected to increase gradually starting with 2005 to over 100 millions Euro in 2010.

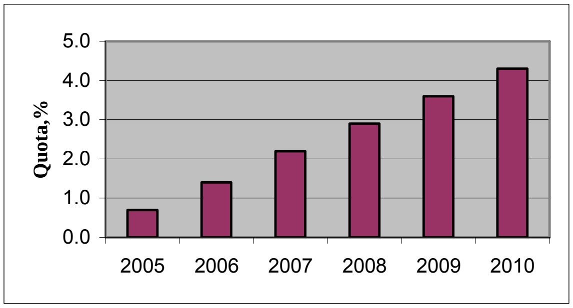


Figure 4.1: Trading of green certificates

4.2.2.1 Definition of certificates

The green certificates are:

- issued for producers for every electrical energy unit produced by an eligible RES plant (authorized);
- denominated for electrical energy unit (e.g. 1 MWh);
- generally, electronically submitted for easier trading, pursuance and storage.

4.2.2.2 Demand for certificates

In Romania, the RES with a great potential for which there exists advanced technologies of producing electricity from these sources are considered eligible, that is: hydro-plants of installed capacity < 10 MW, wind energy, biomass and the solar energy. For the evaluation of different mechanisms for energy produced from RES, taking into account the current national situation, four analysis criteria are defined: technological efficiency, economical efficiency, investment safe and accordance to the liberalized electricity market.

Three options for electricity produced from RES are defined:

Option 1: The feed-in-tariff for energy produced from RES

- the feed-in-tariff is set for each type of source, eligible or promoted; the feed-in-tariff value can be differentiated on geographical areas or can be the same at the country level;
- a producer of electricity from RES can benefit of the feed-in-tariff if holds a guarantee of origin;
- the disadvantage consists in low competitiveness.

Option 2: The quota system

- this is conditioned, on one hand, by the existence of demand of electricity from RES, and on the other hand, by the existence of supply of electricity from RES;
- this system is known as being financial incentive;

- the quota of electricity from RES necessary to be produced is converted into green certificates, every certificate has a value of 1 MWh being given to producers according to the electricity produced from RES.

Option 3: The mixed feed-in-tariff and quota system

- have the advantages of both feed-in-tariff and quota systems;
- it consists in either simultaneous or successive approaching; because, currently, in Romania no scheme for RES promotion exists, the mixed system can be implemented, by successive application of the feed-in-tariff and the quota; the feed-in-tariff will be firstly applied in order to stimulate the investments in RES technologies and to increase the RES quota in the total production; then, the quota system could be applied in order to achieve the proposed target and to increase the market competitiveness.

4.2.2.3 Creation of suitable environment for certificates trading

The main functions of the RES promotion on the electricity market are:

- authorization of elective consumers;
- issuance of certificates;
- quality control (verifying and audit);
- mechanism for transfer and trade with green certificates.

The implementation of these functions requires:

- clear rules for market control and operation;
- authorities responsible for control, implementation and operation of these functions.

4.2.3 Financing of RES Installations

No special financial incentives to support the RES installations exist in Romania

4.2.4 Standards and Rules

No standards and rules concerning the RES installations are either defined or applied in Romania, except the Decisions mentioned above.

4.2.5 The main authorities in Romania in the field of RES technology

- Minind – Ministry for Economy and Commerce: www.minind.ro
- MEC – Ministry for Education and Research: www.mec.ro
- ANRE – Romanian Energy Regulatory Authority: www.anre.ro
- ICEMENERG – National Institute for Energy Research and Development: www.icemenerg.ro
- ISPE – Institute for Energy Studies and Design: www.ispe.ro
- ARCE – Romanian Agency for Energy Conservation: www.arceonline.ro

- ENERO – Center for Promotion of Clean and Efficient Energy in Romania: www.enero.ro
- UPB – University "Politehnica" of Bucharest: www.pub.ro

4.3 Best practices

Currently, the quota of renewable energy in gross energy consumption is:

- about 10%, with large hydro, and
- 6.5%, without large hydro.

and the quota of electricity from RES to gross electricity consumption:

- about 30%, with large hydro, and
- 0.6%, without large hydro.

4.3.1 Hydroelectric resources

In Romania there are about 385 Hydroelectric Power Plants (HPP) with an overall installed capacity of 6319 MW (and available capacity of 5812 MW), which means 32.3% (33.8%) of the overall installed capacity in Romania of 19593 MW (and available capacity of 17163 MW). In 2001, the total electricity produced in HPP was 14850 GWh, representing 27.6% of the total production. In rainy years, such as 1998 and 1999, the hydro sector produced 35.3% and 36.1% of the overall production of the country.

The development strategy indicates a gradually increase of the hydro energy towards 18000 GWh/year until the year 2015. The technical hydro potential of Romania is high, being estimated to 40000 GWh/year and 11600 MW capacity. From this potential, about 23000 GWh/year may be obtained under market competitive conditions.

The modern hydro-constructions in Romania has become since 1880, at Sinaia, when the first turbine of 185-horse power was put into operation. The industry of such micro-hydro power plants has expanded very fast. The large experience has concluded in 1928 when the first large power plant of 14 MW capacity, with 4 Pelton turbines, was constructed on the Ialomita River.

The largest hydroelectric power plant in Romania is Portile de Fier I (Iron Gates I), on the Danube River, being the biggest HPP in Europe, with an installed capacity of 1050 MW (the Romanian part only). Here, a medium flow of 5500 m^3/sec is processed in 6 turbines rated 175 MW each (on both Danube parts of Romania and Serbia and Montenegro).

The rivers with the largest potential in Romania are: Olt, Lotru, Bistrita, Somes, Dragan, Arges, Dambovita, Raul Targului, Sebes, Raul Mare, Cerna, Bistrita, Buzau, Motru, Danube. Figure 4.2 illustrates the map of water resources in all country. Having a surface of 237500 km^2, Romania encounter 4000 rivers which totalize more than 60000 km. The hydraulic network flows in Black Sea by means of the Danube River.

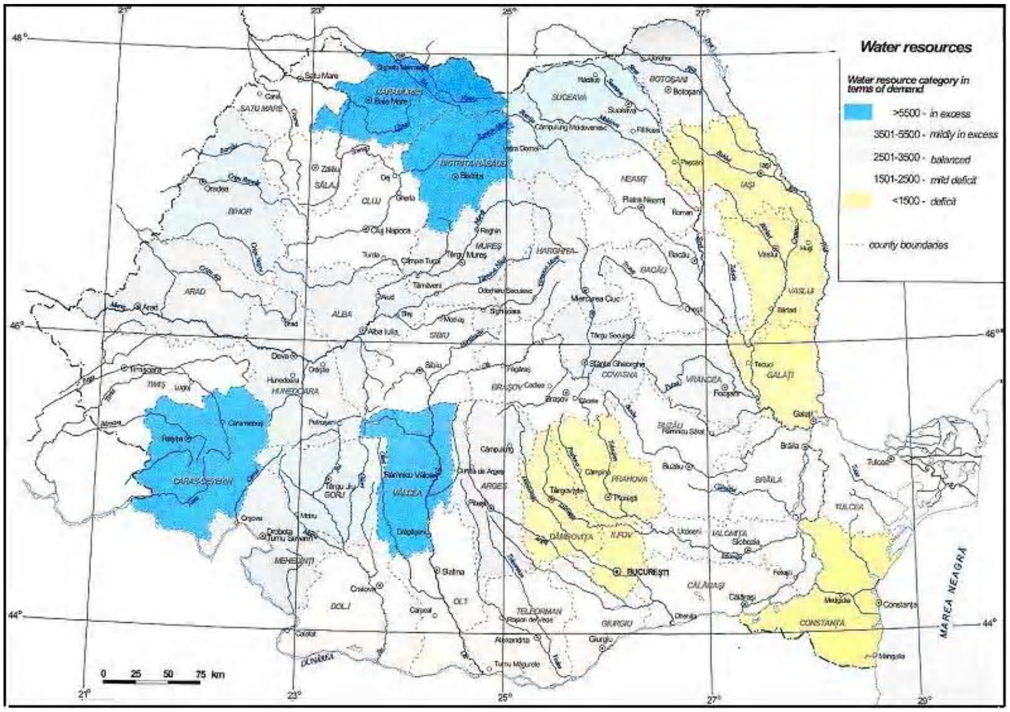


Figure 4.2. The map of water resources in Romania.

For the period 2006-2015 the capacity installed in hydro power plants is expected to increase up to 400-900 MW (government declarations).

Small hydro power plants (less than 10 MW capacity)

The potential, regarding small hydro power plants, is estimated to 2150 MW, producing 6 TWh/year. About 300 MW installed capacity, of which only 1/3 is operational, was developed so far in HPP or rated power less than 10 MW. Almost all of these units need refurbishment and modernization; 125 MW capacity is stalled since the construction phase, 14 years ago.

In addition to the larger hydroelectric facilities, there are also many smaller power stations that could be mentioned. The Raul Mare River has a series of 10 hydroelectric power plants, each between 10 and 15 MW. Similarly, the Strei River has a series of seven small hydroelectric power plants, each less than 10 MW.

In May 2002, Hidroelectrica S.A., the company that own the majority of the hydro sector, took over from the other National power companies, mainly from Electrica S.A., about 210 small hydro units. Those units totalize over 200 MW installed capacity and 600 MWh/year potential output.

Some of the existing and the potential small hydro power plants in Romania are counted in Table 4.2.

On long term, the total power installed in new plants, of less than 10 MW rated power, is planned to about 430 MW (new capacities or already started).

Table 4.2: Small hydro power plants in Romania

		Small **200 … 3600 kW**	**Micro** **20 … 200 kW**
Potential	No. of units	2800	2000
	Installed capacity, MW	1400	600
	Output, GWh/year	3000	750
Existing	No. of units	241	88
	Installed capacity, MW	212	8.6
	Output, GWh/year	695	40

4.3.2 Biomass resources

In Romania, a country where over 6000 thou hectares are reported as covered by forests, and even larger agricultural areas, the biomass potential is estimated to around 318×10^9 MJ/year, which represents 19% of the total primary resources consumption in year 2000, as follows:

- wood from forestry exploitation and firewood: 49.8×10^9 MJ/year;
- waste wood – sawdust and other wood waste from industrial processes: 20.4×10^9 MJ/year;
- agriculture waste such as straws, corncobs, maize stems, hemp and flax waste, vine cords, sunflower needs shells, etc: 200.9×10^9 MJ/year;
- biogas: 24.6×10^9 MJ/year;
- urban garbage: 22.8×10^9 MJ/year.

The current biomass consumption in Romania, expressed in MJ/year, is given in Table 4.3.

Table 4.3: Biomass consumption weight in the total

	1996	1997	1998	1999	2000
Total consumption of primary resources	2341×109	2146×109	1934×109	1666×109	1689×109
Biomass consumption	205×109	141×109	127×109	118×109	116×109
Biomass weight	8.76%	6.57%	6.56%	7.10%	6.87%

The biomass is used mostly (89%) for domestic heating purposes in rural areas, following traditional stove burning. Only a small part is used in modern small and medium size boiler burning processes.

The existing auto-producers thermal plants account about 550 steam boilers. The biggest part of these boilers is indigenous manufactured and the capacities range from 0.3 MW to 5 MW and generate steam in range of 0.7 to 16 bars within a temperature of 114 ^{o}C to 350 ^{o}C. Most of the applications were built in the 1960's and 1970's and only a few of them were modernized and equipped with modern technology. The expected development of the wood industries will favor the rehabilitation of the existing boilers and construction of the new ones.

The biomass consumption in Romania has decreased in the last 15 years (see also Fig. 3) due to the expansion of the natural gas distribution network, despite the wood processing industry has increased very much. The sawdust resulted became thus a pollutant agent, especially of the rivers. The developing of the wood processing industry in Romania is due to the fact that the forests were assigned to the private property and also to the irrational exploitation. Appropriate means for efficient energy transformation are therefore needed.

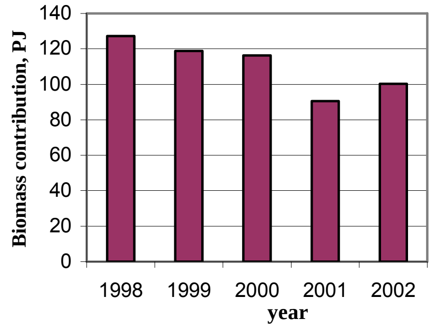


Figure 4.3: Biomass contribution.

The project “Sawdust 2000”, promoted in the framework of the Kyoto protocol policy, has resulted in modern thermal plants running on sawdust: two boilers running on liquid light fuel where replaced by two new boilers, type TERMADL 0.6 made in Romania by an original concept, running on sawdust with low calorific value of 8790 kJ/kg, at the thermal plant Campeni, located in Campeni town; thermal plant with one boiler of 2.5 MW_{th} running on sawdust and wood waste at Tasca village – Neamt county; thermal plant of 18 MW_{th} capacity, of which 2 boilers of 6 MW_{th} each running on sawdust and 1 boiler of 6 MW_{th} running on liquid fuel, at Vatra Dornei (Fig. 5.4) – Suceava county; thermal plant of 4 MW_{th} capacity running on sawdust, at Huedin – Cluj county.

Figure 4.4: The thermal plant at Vatra Dornei.

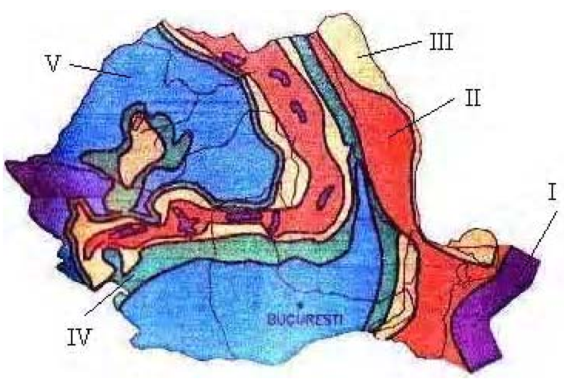
4.3.3 Wind resources

So far, only experimental projects of wind turbines were encountered in Romania. Of these, the following are motioned: V66 Vestas of 660 kW rated power turbine having 79 meters height, built at Ploiesti (Fig. 5.5,*d*); two wind turbine of 300 kW each on the Semenic Mountains (Fig. 5.5,*c*); 3 kW wind installation, at Surducel, used for householder utilities.

a. First attempt b. Second attempt c. Semenic d. Ploiesti

Figure 4.5: Experimental wind turbines in Romania.

A wind-map of Romania (Fig. 5.6), prepared by the National Institute for Energy Research and Development (ICEMENERG) in 1993, is based on WA^{s}P software and meteorological data deserved during the period 1980-1990. There are five areas identified of the wind potential in Romania, in terms of environment and topo-geographical conditions.



LEGEND

I (violet) – highII (red) – moderate

III (yellow) – middle

IV (green) – low

V (blue) – very low

Figure 4.6: Wind map of Romania (Source: ICEMENERG).

A more recent situation of the wind potential in Romania, based on recordings (after 1990) at 50 meters medium height, is given in Table 4.4.

Table 4.4: Wind potential in Romania (Source: ICEMENERG)

Wind potential	**A High mountains**		**B Open sea**		**C Sea cost**		**D Open plain**		**E hills**	
	m/s	W/m^2	m/s	W/m^2	m/s	W/m^2	m/s	W/m^2	m/s	W/m^2
I	> 11	1800	> 9	>800	> 8.5	>700	> 7.5	>500	> 6	>250
II	10-11.5	1200-1800	8-9	300-800	7-8	400-700	6.5-7.5	300-500	5-6	150-250
III	8.5-10	700-1200	7-8	400-600	6-7	250-400	5.5-8.5	200-300	4.5-5	100-150
IV	7-8.5	400-700	5.5-7	200-400	5-6	150-250	4.5-5.5	100-200	3.5-4.5	50-100
V	< 7	<400	< 5.5	<200	< 5	<150	< 4.5	<100	< 3.5	<50

It was concluded that the most favorable sites as wind resources in Romania are located in:

- *The mountainous area* generally in complex terrain, with altitudes over 1500 meters and with wind speeds of 6 – 9 m/s.
- *The coastal area of the Black Sea* (Fig. 5.7), where the wind speed – at a standard height of 10 meters – varies from 7.5 m/s on the continental platform (with water depth less than 10 meters) to 5 m/s on the coast. The seacoast zone enjoys the majority of the exploitable wind potential of the country.

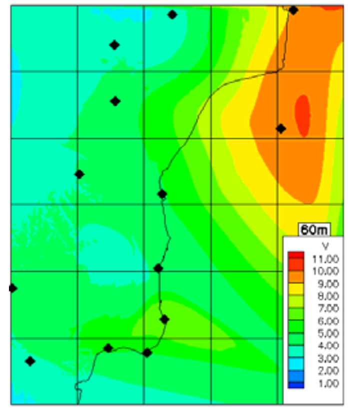


Figure 5.7: Mean wind speed map on the Black Sea coast at 60 m a.s.l (*Source: OPET Romania ENERO)*

The feasible wind farms potential in Romania is estimated to around 2000 MW and 4500 GWh/year output.

Black Sea coast and platform represents an advantage for such wind power installation from the point of view of location as well as power consumption for major economic entities (port operators: oil, ore, containers).

One current project consisting in 26.7 MW installed capacity is being developed by ABB; the funds dedicated to the project are still uncertain. The components of the wind farm will be:

- 4 wind turbines of 2 MW and 67 m height each, built at 900-1000 m distance on the North breakwater alveolus;
- 22 wind turbines of 850 kW each at 30 m height above the sea level built on the western sea front of the port, the river maritime area, in the neighborhood of the existing electrical power station Port III.

4.3.4 Solar resources

A small market for PVs is represented by the electricity supply of remote households, in rural area or in holiday sites. Less than 80 kW are installed presently in PV panels in Romania.

The average solar radiation map of Romania elaborated by the National Institute for Meteorology and Hydrology, based on recordings and also on experience, is given in Figure 4.8. Five geographical areas are identified in Romania, separated according to the measured energy flux.

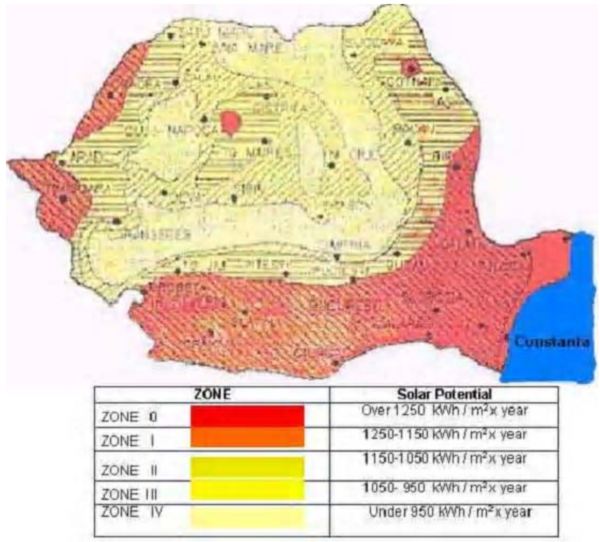


Figure 4.8: *Solar map of Romania (Source ICEMENERG)*

Recent demonstrative capacities, less than 1 kW, have been installed at individual level:

- combined solar/wind project located at Plesi locality, Alba county, consisting in 8 photovoltaic modules of 53 W each and a wind turbine of 1000 W, for householder utilities supply;
- combined solar/wind project located at Surducel locality, Bihor county, consisting in 8 photovoltaic modules of 53 W each and a wind turbine of 3 kW, for householder utilities supply;
- solar project located at Cermei locality, Arad county, consisting in 4 photovoltaic modules of 53 W each.
- Two solar thermal systems with collectors of Vitosol 300 type have been installed in 2001 at the mini-hotels Beta and Gamma in Costinesti locality, Constanta County, for domestic hot water preparation during the summer period;
- Other photovoltaic systems of various rated power were developed also in Romania by R&D programs (e.g. individual households, socio-cultural centers in Apuseni Montains, etc.), telecommunication stations in remote areas, water pumping installations, public lighting, etc.

Solar thermal heating

The realistic technical potential for solar applications is substantial, about 40000 TJ/year, taking into account that the average radiation in horizontal plane is 1100 to 1300 kWh/m^2/year. The most favorable area is the Black Sea coast with an insulation period above 2300 hours/year. In exploitation, the solar irradiation should not be at high level because the passive solar systems can operate efficiently also in areas less attractive from the irradiation level point of view (e.g. the north part of Transilvania and Moldova).

Till 1989, 1000000 m^2 solar collectors, mainly flat plate, were manufactured and installed in Romania, within large systems up to 9000 m^2. Since 1989, the former solar thermal applications have been abandoned. No new equipment was manufactured in Romania or imported, except small R&D demonstrations. Starting 2002, an incipient market for small size solar thermal applications appeared. The most market attractive systems are small domestic solar systems (4-8 m^2).

The solar potential in Romania, necessary for heating and hot water purposes, is estimated to about 60 PJ/year, which would replace 50% of the current hot water and 15% of the heating consumption. For the meteorological conditions in Romania, a solar thermal collector would operate, in safely conditions, from March to October with efficiency between 40% up to 90%.

4.3.5 Geothermal resources

Romania is endowed with the third geothermal potential of the European countries, characterized mostly by low temperature resources. The hydro-geothermal sources temperature (with drilling – extraction exploitation) of "low enthalpy" is between 25 ^{o}C to 60 ^{o}C, in deep water, and 60 ^{o}C to 125 ^{o}C, in mezzo-thermal waters. The drilling depth does not exceed 3300 m.

The geothermal resources of "low enthalpy" are employed for spare water heating in individual houses, social services (offices, education, commercial and social places, etc.), industrial sector or agro-zootechnic places (green houses, animal farms, etc.)

Currently, there are 70 wells in operation used for hot water (of temperature higher that 60 ^{o}C), in different geographical places. 45 wells, with attested energy potential, are currently in conservation.

Eight geothermal systems have been put into evidence. The areas with the best geothermal potential are: Oradea, Bors, West Banat, the Getic Platform, Bucharest – Otopeni, etc.). The heat delivered is about 1000 TJ/ year.

The equivalent energy produced and delivered, at the well's place, is about 1326×10^{6} GJ/year, with an average yearly usage of 22.3%. The investigated potential of the geothermal resources is about 7000×10^{6} GJ/year.

4.4 Lessons learned

The interest for use of Renewable Energy Sources, expect the hydro potential, at large scale is new in Romania because this is one of the conditions of integration in the European Community. Some conclusions can be mentioned:

- There is a need for appropriate legislation in the field of RES technologies;
- There should be financial incentives from the government for investment in renewable technologies;
- The thousands of houses without electricity located in mountains and in the Delta Danube is an additional reason for investment in RES technologies.

4.5 Main barriers to the development of RES

The main barriers to the development of RES in Romania are the following:

- The nuclear power production is a priority for the national energy strategy in order to fully meet the rising electricity demand. Because of that no pressure to develop alternative sources exists.

- The existing large hydro sector, once included in the renewables category, is perceived as covering the “green energy” and other political commitments; also, many of the existing hydro power plants in Romania are rather old and need rehabilitation, that is, investments;
- There is no financial mechanism in place yet to allocate additional funds to renewable activities;
- Limited availability of investment capital;
- Sufficient electricity production;
- Lack of appropriate Romanian laws and standards related to RES.

Acknowledgements

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5 Croatian regulatory framework to support Renewable Energy Sources penetration

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Abstract: This document presents the Croatian regulatory framework to support Renewable Energy Sources penetration in the country.

5.1 RES installations

Renewable energy use in Croatia has a long tradition and today it makes about 16% of the total primary energy consumed, which in 2003 equaled about 400 PJ. The largest share of renewable energy is produced in large hydro power plants, about 12%, and by traditional use of biomass – fuel wood, about 4%. Biomass used for energy transformations makes only about 0,6% of the total primary energy used for transformations. New renewable sources of energy that are expected to contribute to the energy supply are solar, wind, biomass, geothermal energy and small hydro power plants. Solar and biomass energy are expected to participate both in thermal applications and in electricity production, geothermal energy is expected to contribute in heat production and wind energy as well as small hydro power plants will be used for electricity production.

Apart from the large hydro electric power plants, the largest number of existing renewable facilities is small hydro plants. There are 15 small hydro plants in operation, the oldest of which originates from 1904. The majority is being owned by the Croatian electric utility (HEP), 3 are privately owned and 2 are owned by the industry.

According to the official statistics, solar energy is currently not used. However, there is a number of solar heat collectors installed along the Adriatic coast but there is no official monitoring and the reported level of use is under the actual level. Apart from the thermal applications, solar energy is also used for small-scale electricity production, primarily for GSM base stations, light-houses emergency equipment and parking machine. To the knowledge of the author solar PV facilities have been installed on two family houses – one in Zagreb with 7,14 kW and the other in Čakovec with 5,6 kW of peak power. As there is no system of reporting or monitoring, the reported level of solar energy use for electricity production also equals to zero.

Biomass has an important role in the primary energy consumption but only as traditional use of fuel wood. Apart from this, there are few CHP plants within wood industry, two small biogas plants and numerous industrial heating plants, but no district heating so far. Biodiesel production has also been planned.

Geothermal energy is being used for water and space heating in several recreational and health objects.

The largest interest currently is in wind energy use for electricity production. There is only one wind power plant in operation – a 6 MW wind park at the island of Pag for which a power purchase agreement has been signed by the investor and the Croatian electric utility (HEP). A similar agreement has been signed for a wind power plant Krtolin near Šibenik which is yet to be constructed with a planned capacity of 5 MW as well as a wind power plant near Obrovac with a capacity of about 10 MW.

5.2 Legal framework for RES installations

At the beginning of 1994, the Government of the Republic of Croatia adopted a new scientific-research program PROHES - Development and Organization of Croatian Energy Sector. The first results (published in 1995) have shown that for the complete realization of the program goals it is necessary to elaborate a detailed study on the development of Croatia, on the global level as well as on the level of sectors. This document is the first to contain the idea for launching the National Energy Programs (NEP) as an important precondition for elaboration of the new strategy for energy sector. The National Energy Programs, launched by the Croatian Government in March 1997 consist of the following:

- PLINCRO- Croatian natural gas program
- KOGEN - co-generation program
- MIEE - industrial energy efficiency network
- MAHE - small hydro power plants construction program
- SUNEN - solar energy utilization program
- BIOEN - biomass and waste utilization program
- ENWIND - wind-energy utilization program
- GEOEN - geothermal energy utilization program
- KUENzgrada - program for energy efficiency in building construction
- KUENcts - program for energy efficiency in centralized heating systems

In July 2001 the Croatian Parliament accepted the legal energy sector framework which entered into force in 2002 and consisted of the following acts: Energy Act, Act on Energy Service Regulation, Act on Electric Power Market, Act on Gas Market, Act on Oil and Petroleum Products Market. The legal framework has in the meantime been revised. The Energy Act has been revised and two new laws have been passed – Electricity Market Act and Energy Regulation Act.

In the amended Energy Act the areas that have been regulated in an entirely new way include Renewable Energy Sources and cogeneration, environmental protection measures, energy efficiency, public services in energy activities, prices and tariff systems. Regarding compensation for encouragement of Renewable Energy Sources and cogeneration, appearing for the first time in the Croatian legislation, the Act provides that such compensations will be payable as part of both regulated and free energy price for all forms of energy. The collected compensations will be used to purchase electricity produced from such sources at an incentive price specified in the tariff system which will be adopted by the Government of the Republic of Croatia.

By the new Electricity Market Act transmission system operator is obliged to take over the electricity produced from renewable sources and cogeneration and a minimum share of electricity produced from renewable sources and cogeneration will be set for all suppliers. The Decision on minimal share of Renewable Energy Sources in electricity consumption has not been passed yet, but it is expected that it will equal 4,5% of total electricity consumption in 2010 which is about 900 GWh.

5.2.1 Fund for Environment Protection and Energy Efficiency

Fund for Environment Protection and Energy Efficiency was established in 2003, mandated to finance preparation, implementation and development of programs, projects and similar activities in the sector for preservation, sustainable use, protection and improvement of environment. Its financing is based on the so-called 'polluter pays' principle – all polluters are obliged to pay a fee according to the scope of their environmental impact.

The Fund's activities are divided into two major areas– environmental protection and energy efficiency. The field of energy efficiency consists of programs, projects and activities in energy efficiency as well as in renewable energy projects. About the renewable energy, the Fund will support the use of various Renewable Energy Sources as well as education, research, development and demonstration of renewables.

According to the Fund's expenditure plan, the following activities concerning renewables have been envisaged in 2005:

- Solar energy use for heating, cooling and electricity production (off-grid) will be supported. In 2005 the Fund will participate in project development and realization.
- Regarding the wind energy use in 2005, the Fund will participate in projects aiming at removing barriers for wind energy use, such as electrical grid reinforcement, wind speed measurements and wind atlas development. The Fund will support multipurpose wind mills installations such as irrigation and desalinization.
- In the year 2005 the Fund will support biomass use projects, such as heating plants in wood industry, installation of small motors using gaseous or liquid biomass, district heating installation projects and municipal waste use. Further, biofuel production will also be supported.
- Fund will participate in pilot projects implementation for small hydro power plants.
- Regarding geothermal energy, the Fund will participate in research and development of the existing and new geothermal energy sources.

The total expenditures for Renewable Energy Sources projects development, education and RD&D in 2005 will amount to about 27 million HRK (around 3,6 mill €).

5.2.2 Licensing Procedures

The licensing procedure for RES installations in Croatia has not yet been finalized, but it is expected to comply with the following steps:

- Building permit and other necessary permissions for a facility are given by local authorities, according to the space planning procedures;
- The Croatian energy regulatory agency issues an energy permit and an eligible producer certificate;
- Electric and thermal facilities for own consumption or of installed capacity under 1 MW and 0,5 MW respectively do not require energy permits;
- It is expected that the Croatian energy regulatory agency will also be responsible of issuing a certificate proving that producer is eligible for a feed-in tariff, according to the tariff system yet to be adopted by the Government;
- The producer signs a contract with the system operator;
- The transmission system operator is obliged to accept all electricity production from eligible producers except in case of threat to the electric system normal operation (the by-law is expected to enter into force by the end of 2005).

5.3 Main barriers to the development of RES

The barriers regarding the RES development are mostly universal: high up-front investment and uncertainties connected to the energy system liberalization. Another important barrier is the needed cross-sectoral approach which is difficult to accomplish: Renewable Energy Sources are a part of different strategies, laws and ministries.

Apart from these obstacles, financing mechanisms for use of Renewable Energy Sources are missing in Croatia. Until recently only commercial loans were at disposal and it remains to be seen whether the Fund for Environment Protection and Energy Efficiency will act according to its work plan.

Further, an important barrier to the development of RES in Croatia is the lack of secondary legislation. The Energy Law which has entered into force in 2001 specifically stipulated that the Rules on Renewable Energy Sources will be adopted by the Ministry of Economy six month after the adoption of the Law. Unfortunately, this has never happened. The Energy Law has in the mean time been amended (December 2004) and the same time frame has been set for supplementing by-laws necessary for a wider RES penetration. It remains to be seen whether the task will be accomplished.

It will be only after these preconditions – favorable financing opportunities and legislative framework – have been met that other barriers for a successful RES penetration will come into focus, such as legal framework complexity, necessary grid expansions or public resistance.

6 Experiences of Serbia and Montenegro in regulatory framework to support Renewable Energy Sources penetration

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Abstract: This document presents the experiences of Serbia and Montenegro in regulatory framework to support Renewable Energy Sources penetration in the country.

6.1 RES installations

Table 6.1 presents the RES installed in Serbia and Montenegro.

Table 6.1: Installed RES in Serbia and Montenegro.

	Wind (kW)	Small Hydros (MW)	Rest of RES
Electric Power System of Serbia	13	49	≈0
Electric Power System of Montenegro	500	8	≈0
Total	513	57	≈0

It is obvious from Table 6.1 that the RES penetration in power systems in SCG is very small, except for small hydros. All generation capacities in Table 6.1 are connected to main networks, so, they do not operate in isolated systems. Wind plant of 500 kW, in operation since 2004. Within power system of Montenegro, is currently out of operation due to damage caused by lightning stroke. There are some PV modules which operate as isolated systems in SCG, or, more precisely, they serve as backup systems for supply of remote communication equipment. Their installed powers are about a few kW.

Future plans for RES installations are available for the Republic of Serbia (without Kosovo and Metohia province). These plans (with prospects until 2015) are established as an integral part of the Energy Policy Act. The Energy Law provides legal framework for these plans. The expected level of RES installations in the Republic of Serbia is presented in Table 6.2.

Table 6.2: RES installations in Serbia in 2015

	Small Hydros (GWh/year)	**Rest of RES (Wind + Biomass+PV+Geotermal) (GWh/year – electricity and CHP)**
Scenario of slow economy development	450	700
Scenario of fast economy development	450	2000

From data given in Table 6.2, it can be seen that plans for small hydro installations are defined in the same pace in both scenarios. For other RES installation plans particular plans are not available mainly due to fact that potentials are not precisely examined. In Table 6.3 the verified resources of RES in Serbia are given (without Kosovo and Metohia province).

Table 6.3: Resources of RES in Serbia*

Small hydros	1800 GWh/year	electricity
Biomass	2,58 mil. toe/year	heating
Geothermal	180 000 toe/year	heating
Wind	not available	
Solar	3,8 kWh /m2/day	global yearly average Solar radiation

*Sources: Energy Efficiency Agency of the Republic of Serbia

6.2 Legal framework for RES installations

The most relevant political, legal, scientific and educational corridors which define RES implementation policy and practice in Serbia are:

- **Energy Policy Act of the Republic of Serbia until 2015.** This Act is proposed by Ministry for Mining and Energy in Serbia and Government verified this Act in December 2004.
- **Energy Law,** The Law was published in the “Official Gazette of the Republic of Serbia” No. 84/2004 of July 24, 2004
- **Projects within RES** field financed by the Ministry for Science and Environmental Protection in Serbia.

The Energy Policy Act and the Energy Law make together the political and legal frame for RES applications. The Energy Law defines the law codes for implementation of RES goals introduced in the Energy Policy Act.

6.2.1 Future RES priorities in energy sector of the Republic of Serbia

Within the Energy Policy Act particular future priorities in connection to RES expansion plans are established:

Particular strategic priority I: usage of new RES and usage of new more efficient and more environmentally acceptable energy technologies and equipment.

Particular strategic priority II: installation of new infrastructure projects and new power and heat plants for combined production (CHP).

6.2.1.1 Procedures

- Procedures and measures which should enable the RES goals realization for particular strategic priorities are:
- Procedures for energy market introduction on regional level in order to improve energy market conditions. Also introduction of tariffs which reflects realistic costs for energy supply is very important. Tax, custom and antimonopoly regulations are also needed to improve RES penetration. Procedures for Kyoto Protocol ratification.
- Programs for financial incentives for private and other investments in profitable RES projects.
- Pilot and demonstration projects in RES technologies and best RES practices should be made public.

In the Energy Law privileged power producers are introduced as the special category (article 84): *RES as privileged power producers shall enjoy priority on the organised electrical power market over other producers who offer electrical power under equal conditions. Privileged power producers shall be entitled to subsidies, tax relief, customs exemptions and other relief in line with laws and other regulations on taxes, customs and other duties, i.e. subsidies and other incentive measures (article 86).*

6.2.1.2 Instrumentations and techniques

The Energy Law has established two agencies which represent institutional base for implementation of RES practice in Serbia:

- ***The Energy Agency of the Republic of Serbia*** shall be established as a regulatory body for promoting and directing energy market development based on the principles of non-discrimination and effective competition, monitoring the implementation of regulations and energy systems operation codes, adjusting the activities of energy entities in ensuring the regular supply of energy and services to consumers and their protection and equal position, as well as other activities stipulated by Energy law.
- ***The Energy Efficiency Agency of the Republic of Serbia*** shall be established as a special organization for carrying out professional activities of improving conditions and measures for energy and energy sources rational use and saving, as well as increasing efficiency of energy use within all sectors of energy consumption. The Energy Efficiency Agency shall carry out activities related to drafting proposals for implementing energy efficiency, Renewable Energy Sources exploitation and environmental protection.

Universities and institutes involved in research activities connected to RES projects are involved in new RES projects via program which is financed by Ministry for science and environmental protection of the Republic of Serbia (program has been established in 2002.):

- ***National program for energy efficiency*.** This program has the goal to increase the RES participation it total energy (heat and power) supply. Number of pilot projects has been initiated and some of them have shown very good results. Professionals and university students who want to learn how to better analyze the technical and financial viability of possible clean energy projects are involved in these projects.

6.2.2 Financing of RES projects

Within the national program for energy efficiency the following types of RES pilot projects are financed:

- RES
  Installation of Small Wind for isolated system. Exploitation of geothermal energy and exploitation of biomass for thermal or electricity production. Development of small hydro turbine. Integration of wind parks in distribution networks.
- Energy Saving Projects
  Projects that reduce losses in the industrial process or use part of the rejected energy.
  Projects that reduce heating losses in building.

6.2.3 Standards and Rules

The following standards and rules are applied to RES installations in Serbia:

- **"***Basic technical requirements for integration of small plants (distributed generation) into distribution networks of the EPS*“, Recommendation No. 16. Elektroprivreda Srbije 2003. Recommendations deal with all small plants with the range of sizes of up to 16 MVA (small hydro plants, wind, solar, biomass, geothermal,...) which should be connected to the networks of 0,4 kV, 10 kV, 20 kV or 35 kV.

Recommendations define the following criteria:

1. Range of sizes for distributed generation plants;
2. Flicker tolerance limits;
3. Higher harmonic content limits;
4. Short circuit capacity limits.

Also the legal framework for the electricity market should be introduced by extensive set of legal rules (included in the Energy Law) that regulate the Serbian electricity market (non-technical).

6.2.4 Licensing Procedures

The licensing procedures for RES installations in Serbia are as follows:

- Each prefecture gives the necessary permissions for installing RES in its territory,
- A permissions shall not be required for RES with installed capacity of up to 1 MW,
- An energy permit shall be issued to domestic and foreign persons under the same conditions,
- The decision on issuing an energy permit shall be brought within 30 days as of the date of the application submission,
- Energy permits shall be issued by the Minister in charge of energy sector activities.

6.3 Best practices

In Serbia and Montenegro there is no representative set of RES practical applications, so the correct comparison for identifying the best practice is not possible.

6.4 Lessons learned

Implementations of RES technologies are slow and still pioneering process and RES penetration progress is not satisfactory. That means the regulatory and financial incentives should be more efficient.

6.5 Main barriers to the development of RES

The main barriers to the development of RES in Serbia and Montenegro are the following:

Vertically organized power sector:

- RES potentials are not enough investigated;
- There is no enough programs for financial and credit incentives and tax reductions in RES implementations;
- Public awareness of RES technologies and their advantages should be improved;
- There is no enough RES professionals and RES educated people;
  There is no enough local, regional and state coordination in promoting and implementing RES.

In conclusion it is obvious that in Serbia and Montenegro more developed tools for decision makers, planners and industry are needed in order to consider energy efficient and renewable energy technologies. Also, public awareness about RES should be improved especially for profitable RES projects with accurate technical and economic analysis. This analysis should include energy models and future energy needs, cost analysis, greenhouse gas emission analysis, financial analysis and sensitivity and risk analysis. Generally RES implemented projects have higher initial costs but lower operating costs and such an analysis is very important in low cost preliminary feasibility studies.

7 Reasons to support regulatory framework of Renewable Energy Sources penetration into energy network of Bosnia and Herzegovina

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Abstract: This paper presents the results of the several researches that are conducted in the aim to support Renewable Energy Sources penetration in the country and to underline the importance of making the appropriate regulatory framework. That importance specially mirrors the pollution reduction from the thermal power plants, which can be reduced by means of the solar and wind energy that can satisfy the part of domestic needs for electricity, heating and cooling. Taking into account the solar irradiation and wind power data in Bosnia and Herzegovina we made electricity production estimation of the photo-voltage panels and wind turbines. From these data the possibility of the pollution reduction is estimated. However, data obtained can be the base for making the regulatory framework of Renewable Energy Sources in Bosnia and Herzegovina, since that framework for now does not exist.

7.1 Introduction

Through the several past years have been conducted activities to establish the laws regarding electric energy policy. The first law which has been accepted was the Law about transmission, regulator and operator of Bosnia and Herzegovina power system (Public news of Bosnia and Herzegovina, No. 7/02 and 13/02). The second one was the law of electric energy (Public news of Federation of B&H, No. 41/02). From the European point of view, as the first step toward common strategy of developing the Renewable Energy Sources (RES) in Europe, the European commission has been proposed on the end of 1996., the document under title «Green Paper». The European parliament has underlined the importance of RES into decreasing of green-house effect, then into increasing of the energy security and opening of the new work-places. The European Union has been established the new document under title «White Paper» and suggested the activity plan regarding RES on the base of the broad analysis of the present energy situation.

Recently, the world's trend is request that electric energy becomes a task of the municipalities and/or regions. This is specially enhanced into power and energy market circumstances. Namely, the power market enables a possibility of the regions to solve own energy problems into own framework depending on the specifically demands of consumers and possibilities to enable the different kinds of energy. However, the main electricity sources such as thermal power plants that represent almost 50% of power plants capacity in Bosnia and Herzegovina (B&H), should be competitive at the power market and, at the same time, they should satisfy pollution constraints.

Some aspects of the electric energy policy should stay into the hands of state. That is necessary because of the appropriate planning and enlargement of the power system. Beside of the care to satisfy the power consumers demands, the appropriate government body should take into consideration the very important aspects of pollution. That is needed from the local and global point of view. Certainly, effort of each of the municipalities and/or regions (local acting) can give contribution to the overall amelioration of the world pollution picture (global acting). Through the civilization efforts to make environmentally better world the several conferences (Rio, Kyoto) are held to emphasis the importance of each country to enforce their efforts to protect our Earth.

In that situation, the role of each country and region can be of the great value. The many regional organizations, as for example the European Union, set up the pollution constraints to be the conditions for membership. In addition, the produced kWh of the thermal power plants with the high contamination is penalized and because of that, the price of kWh is higher and it can not be competitive at the power market. As a solution for the old thermal power plants that have a high level of pollution and low efficiency level the new technologies in the view of the Pressurized Fluidized Bed Combustion (PFBC), Integrated Generation Combined Cycle (IGCC) and similar, represent the possibility of generators to be competitive at the power market. Certainly, the reparation of the old thermal power plants is very expensive and for that kind of operation the help of the monetary institutions for the undeveloped countries (like Bosnia and Herzegovina) is very important.

Since the energy development, especially the electric energy development, is necessary for development of whole society, many countries try to introduce the different alternatives to satisfy consumer demands and preserve nature. These alternatives encompass rationally using of energy and Renewable Energy Sources (RES). In many European countries like Germany, Dutch, France, Spain, Greece, etc., the RES become more and more reality. The RESs enable a new power concept that is based on the decentralized energy sources in the view of the solar collectors for generation of heat and electricity, then, micro-turbines, home-size fermenzators and fuel cells. By using of that kind of energy sources the thermal power plants engaging can be reduced and in that way the pollution level can be decreased.

The engaging of the RES should the great financial support. Because of that, it is questionable a recently introducing of RES into energy systems of the states that have a great reserves of coal and/or oil. Accordingly to the intentions of the many Asian states, especially Chine and India, we can except a great number of the new thermal power plants. That is a not big problem, but thermal power plants that will be build on the old technologies of combustion and transformation of coal into electricity will bring a huge pollution. The similar problems can arise in the other undeveloped countries. This problem needs to be solved on the collaborative base among rich and undeveloped states. A common interest exists and the global energy network can become the reality taking into account a new technologies of the developed states and energy resources of the undeveloped states. In that way the global environmental Earth's picture can be better.

The purpose of our research has been on that straight. How could we in Bosnia and Herzegovina (B&H) contribute to the better environmental picture and, at the same time, to satisfy consumer demands and to be competitive on the European energy market. These answers should be the main basis for making the regulatory framework to support RES penetration into existing B&H's energy network. We made estimation of pollution level in B&H taking into account operation of our thermal power plants. As the reference regarding allowable pollution levels that are in accordance with the Kyoto protocol we used Clean Air Act Amendments (CAAA) – the program which recognized emerging energy and environmental issues, as global climate change and capping SO_2 and NO_x emissions.

7.2 One of the reasons to make the legal framework for RES installations

Carbon emission in B&H' thermal power plants can be estimated by using the pollution equation which represents important variables that influence the carbon emission (the same equation can be applied to the other pollutants):

$$Carbon = \frac{Carbon}{\text{GWh}} \bullet \frac{\text{GWh}}{Gross\ National\ Product} \bullet \frac{Gross\ National\ Product}{Population} \bullet Population \qquad (1)$$

Taking into account the B&H thermal power plants characteristics the first relation of (1) can be estimated on 400 tons of carbon per produced GWh of electricity. The second relation presents the amount of consumed electric energy per gross national product, i.e., the energy intensity and at the our circumstances it is about 3,3 kWh/euro. The third relation of (1) takes into consideration the living standard which in B&H can be estimated about 990 euro per citizen. Current population in B&H is about 3.700.000 people. Taking into account all mentioned parameters, the estimated amount of produced carbon in B&H's thermal power plants is about 4,8 millions of tons per year.

The equation of pollution presents a clear picture of the factors that less or more influence the carbon emission in one region. It is obvious that the higher efficiency rate of the consumers (motor, lights, etc.) enables the lesser energy intensity. Namely, the energy intensity exceeds the technologically and economically justified needs thus indicating a possibility of reducing carbon through conservation measures and efficiency improvement. The problem arise from the third and fourth ratio of (1) due to desire to have a greater living standard that implies the using of more energy and, as a consequence of that, more carbon emission (in existing circumstances). In addition, if there is a constantly increase of population in one region the higher rate of carbon emission can be expected.

The first term of (1) is technically problem of electric energy sources that are based on the fossil fuels. Through the concept of the Clean Coal Technology (as PFBC and IGCC types of thermal power plants) can be reached the high improvement regarding carbon emission and other pollutants as a sulfur dioxide (SO_2), nitrogen oxides (NO_x), and particulate matter. It is known from the operation experiences of PFBC and IGCC technologies at the many places as in Japan, Sweden and Germany, that emission of these pollutants can be reduced. The carbon emission can be reduced for 10% to 15%, NO_x for 75%, and SO_2 for 90%.

The pollution limit regarding NO_x is 0,72 kg/MWh and for SO_2 is 1,7 kg/MWh with respect to the CAAA. The estimated average one-year production of electric energy in B&H's thermal plants is about 12.000 GWh. Taking into account the above mentioned quantities the allowable emission of NO_x and SO_2 would not cross the 8.640 tons and 20.400 tons, respectively. Unfortunately, the emission of these pollutants in B&H is greater due to the old technologies and great energy intensity. The estimated quantities of NO_x and SO_2 emission are 24.000 tons and 36.000 tons, respectively.

There are three ways to reduce pollution:

- to apply the new technology regarding thermal power plants,
- to decrease the energy intensity, and
- to introduce the RES.

7.2.1 The B&H RES Capacity as a Movable Force to Support RES Penetration into Existing Energy Network and to Decrease Pollution

7.2.1.1 Solar energy

There are two ways to use the solar energy: passive and active.

The passive using of solar energy means the appropriate architecture of houses, and active one means using the heat-solar collectors and photo-voltage equipment.

Taking into account the researches that has been conducted in 1996 in Tuzla region, we can say that exist conditions for extensive using of solar energy. Due to limited space we can not present all solar radiation characteristics in the Tuzla area, but here, we present one of the worst case regarding the solar energy irradiation, Table 7.1, which is recorded in December, 1996, between 13^h and 14^h.

Table 7.1: Energy of solar irradiation in Decembar, 1996, Tuzla's region in B&H

Day	E(Wh)
1	9,411849
2	8,920561
3	8,927784
4	24,63784
5	8,941013
6	8,947015
7	9,206114
8	9,212305
9	9,218013
10	9,223236
11	9,227972
12	10,82921
13	21,47675
14	17,78631
15	20,46778
16	27,45273
17	12,45262
18	21,35406
19	23,56181

Day	E(Wh)
20	18,32651
21	11,16456
22	9,510473
23	10,60966
24	9,507085
25	10,05255
26	9,501378
27	9,497659
28	9,493366
29	13,86935
30	13,20995
31	9,737627

The collected solar energy for considered time period is 405,7351 Wh.

For the overall year, the estimated electrical energy which come from the solar iradiation in the area of B&H for 100.000 households and industrial/administration buildings is about 2000 GWh. That means reducing of thermal power plants operation and, at the same time, the reducing of pollution. Taking into account the obtained results regarding possibilities of solar energy in B&H, we estimate reduction of NO_x and SO_2 for 4000 tons and 6000 tons, respectively, or in percentage, the NO_x and SO_2 emission can be decreased by 17% for both pollutants.

7.2.1.2 Wind energy

At our Faculty we conducted research to find the answer on the question how much wind energy in B&H we can use.

Taking into consideration the data about parameters of wind which appear in B&H we found that the most appropriate regions for wind turbines are the middle and south area of B&H. The wind turbine which is mounted at the 60 m height above the surface, with the average wind speed of 5,15 m/sec., the average electric energy which can be obtained with 600-kW asynchrony generator is 738,84 MWh per one year. The expected electric energy from the above-mentioned wind turbine is presented in Table 7.2.

Table 7.2: Electric energy from the 44-m wind turbine diameter for different wind speeds

v(m/s)	P(v)	t(v)	P_t(W)	E(kWh)
1	0,0575	504,04	0	0
2	0,1052	922,18	0	0
3	0,1361	1193,05	0	0
4	0,1475	1292,99	0	0
5	0,1412	1237,76	32585	40332
6	0,1224	1072,96	76416	81991
7	0,0972	852,06	137313	116998
8	0,0712	624,14	209736	130904
9	0,0485	425,15	298628	126961
10	0,0307	269,99	400330	108085
11	0,0181	158,66	483273	76676

v(m/s)	P(v)	t(v)	P_t(W)	E(kWh)
12	0,01	87,66	563069	49358
13	0,0052	45,58	613622	27968
14	0,0025	21,92	638666	13999
15	0,0011	9,64	659846	6360
16	0,0005	4,38	686408	3006
17	0,0002	1,75	686100	1200
18	0,0001	0,88	705847	621
19	0	0	702430	0
20	0	0	670320	0

The symbols in Table 7.2 have the next meanings:
v – wind speed (m/sec.),
P(v) – probability of wind speed in accordance with the Weibull probability distribution,
t(v) – duration of wind speed (hours),
P_t – power at the wind turbine (kW),
E – expected energy at the output of the generator (kWh).

The one-year estimated amount of electric energy from 30 wind turbines distributed at the different places of B&H is about 30 GWh. That means additionally reducing of NO_x and SO_2 for 60 tons and 90 tons, respectively. Further pollution reduction is possible by introducing of other RES as fuel cells and biomass.

In addition, by introducing the RES into power network, the new concept of power system control, protection and planning is necessary. In those circumstances, the local energy operation centers become very important. They have to be capable to operate with different kind of distributed energy sources.

7.3 Framework for financing of RES installations

There is no financing of RES installations in B&H through the state's authority. In B&H, the Ministry of Energy would be the start force in to RES installations. We hope that through the EU's different programs the B&H can start with RES penetration into own energy network. In this way we should make hard job, taking into consideration the standards and rules, information support and promotion of RES, financial incentives for private investments in RES, investment in RES from public sector and funds, etc.

At the fist workshop conducted into University of Tuzla, Faculty of Electrical Engineering, B&H, through the work-package 1, the partners in consortium presented the large possibilities of RES in B&H, such as solar, wind, biomass and small hydro plants. Due to these possibilities the B&H's government and the local communities, in cooperation with scientific community, must take care to make the legal and regulatory framework, by which the processes of RES penetration can be more efficiently and faster. In addition, all actions should be set up in accordance with EU and national laws, like White paper of EU, European energy testament (ECT), Directives of EU, 92/96 and the constitution of Bosnia and Herzegovina.

The results of the several researches that have been conducted in the aim to decrease pollution in area of B&H and to promote the RES penetration into B&H energy network show and promise the good business for investors.

However, small states like B&H can help in stabilization and emission of greenhouse gas in to atmosphere. By using the solar and wind energy the reduction of pollutants as carbon, NO_x and SO_2 can be 20%, 18%, and 19%, respectively. Additional pollution reduction can be realized by using the PFBC and IGCC thermal power plant technologies.

Here we presented only data about pollution from thermal power plants, but considerable pollution comes from the traffic and other industrial plants, where RES can have important role through the economical and ecological aspect.

7.3.1 Licensing Procedure

The licensing procedures for RES installations in B&H go through the Ministry of Energy, Industry and Mines of B&H Federation, then through the local community, which gives the permission for installing RES in its territory (building and communally permissions). In the future, the requested license will be the subject of the Regulatory Energy Commission.

7.4 Lessons that can be learned

There are number reasons to make as faster as possible the legal framework for RES in the B&H. These reasons can be numbered as follows:

- reduction of pollutants from thermal power plants,
- introduction of the new and clear technologies,
- enlarge the number of work-places,
- change the structure of the existing work-places,
- improve the quality and reliability of energy supply at the rural and isolated regions,
- decentralization of the energy demands,
- stimulation of the local economy.

7.5 Main barriers to the development of RES

In generally, there are no barriers to the development of RES in B&H. But, due to past war, B&H lates for the many subjects; one of them is RES penetration into energy networks. We think that firstly must be designed the appropriate legislative framework based on the best EU practice. Then, the B&H government should subsidize the start of RES projects. However, the Regulatory Energy Commission should devise the framework for future investors into RES installations, so as to make the RES penetration process transparent and efficient.

The overall RES installations should be public acceptable. At same time, one should enhance the public awareness of importance of RES for community. It can be done only with the continually and practical systems of information and education.

8 Experiences of Greece in regulatory framework to support Renewable Energy Sources penetration

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Abstract: This document presents the experiences of Greece in regulatory framework to support Renewable Energy Sources penetration in the country.

8.1 RES installations

Table 8.1 presents the RES installed in Greece and Table 9.2 shows the future RES installations in Greece. It can be seen that wind parks represent the 85% of RES installed in Greece. In the future RES installations, the share of wind parks will be 89%.

Table 8.1: Installed RES in Greece.

	Wind Parks (MW)	**Small Hydros (MW)**	**Biomass (MW)**	**PV (kW)**
Hellenic Transmission System	341.0	61.0	20.6	105
Island Networks	128.4	0.6	0.4	735
Total	**469.4**	**61.6**	**21.0**	**840**

Table 8.2: Future RES installations in Greece.

	Wind Parks (MW)	**Small Hydros (MW)**	**Biomass (MW)**	**PV (kW)**
Hellenic Transmission System	3039.4	348.6	40.5	760
Island Networks	204.3	3.8	8.5	590
Total	**3243.7**	**352.4**	**49**	**1350**

8.2 Legal framework for RES installations

Greece follows the feed-in tariff model, according to Greek laws 2244/94 and 2773/99. The main points of the legal framework for RES installations in Greece are the following:

RES and CHP installations do not participate in the electricity market, they are priority dispatched and their energy is sold at fixed tariffs.

RES electricity is renumerated at price linked to the general Medium Voltage (MV) customer tariffs. Energy is paid 90% of the respective retail price for island systems and 70% for the mainland.

In mainland, the produced power is compensated at 50% of the applicable consumer tariff. In island power systems no such credit is applicable. (Only to energy produced).

For CHP using non-renewable sources similar tariff system applies, as well as for self-producers.

8.3 Framework for Financing RES Installations

The financing of RES installations in Greece is implemented through the 3rd Community Operational Framework Program "Competitiveness" of the Ministry of Development of Greece (www.antagonistikotita.gr). The secretariat for competitiveness is in charge of this program. This secretariat consists of four Units:

- Programming-evaluation unit
- This unit creates and publishes the criteria for participation in the program and evaluates the proposals.
- Administrative and monitoring of the projects of the program
- This unit is in charge of monitoring the progress of the project within the program. Sectors of this unit exist in each prefecture of Greece.
- Control

  Controls the actions for their validity according to EU and national laws.
- Administrative and organization unit
- This unit helps in any technical matter of the secretariat.

More specifically, within the 3rd Community Operational Framework Program "Competitiveness", Measures 2.1 and 6.3 of Axes 2 and 6, respectively, are the ones that are related to RES installations.

8.3.1 Measure 2.1

Measure 2.1 is entitled "Aid for investment in co-production, Renewable Energy Sources (RES) and energy saving systems".

The objectives of measure 2.1 are:

- Diversification of energy sources and reduction of the dependence on imported energy sources
- Decrease of operating cost in industrial and public services sector
- Environmental protection via the reduction of fuel consumption in order to comply with the Kyoto Commitment protocol.
- Support local development via RES installation. Increase of local employment at the RES installation sites

The research priorities of measure 2.1 are:

- Information, support and promotion of CHP, RES and RUE measures.
- Expansion of infrastructure in CHP, RES and RUE
- Financial incentives for private investments in RES

- Investment in RUE from Public sector, like Schools, Hospitals etc. These investments may consist of:
    - Replacement of conventional fuels infrastructure with Natural gas,
    - Energy efficiency measures,
    - RES and CHP installations,
    - PV installations on public buildings of Greek islands.

8.3.2 Measure 6.3

Measure 6.3 is entitled “Special energy infrastructures for islands and for the promotion of Renewable Energy Sources (RES)”.

This measure aims at the improvement of quality and reliability of electricity supply at the island regions covering their energy needs with innovative solutions joint with their other needs such as water. Moreover, it aims at the promotion of RES investments in regions where despite their high potential, the existing system of transport requires aid or/and the network of distribution requires reinforcement or extension. Therefore these actions aim at:

- Meeting the very rapidly increasing demand of electric energy and in the islands and solve problems of fluctuations of voltage and frequency
- Helping RES installation on islands, aiming at the decentralized electricity production to stimulate local economy
- Network expansion so that RES at regions with high wind potential can be installed.

The research priorities of measure 6.3 are:

- Interconnection of island systems either at High or with Medium voltage sub sea cables in order to increase Wind power installation and reduce diesel oil consumption
- Novel solutions of energy supply of islands facing at the same time water supply needs or/and waste water treatment
- Emphasis on applications of geothermal energy and co-generation.
- Reinforcement of distribution systems on islands so that RES and co-generation facilities can be built
- Reinforcement of the Hellenic Transmission system so that RES projects can be installed within a specified time schedule

8.3.3 Financing of RES Installations

The following types of RES projects are financed:

- Installation of RES
- Installation of Wind or Solar parks, exploitation of Geothermal energy and exploitation of Biomass for thermal or electricity production.
- Energy Saving Projects
- Projects that reduce losses in the industrial process or use part of the rejected energy
- CHP projects
- Update the existing thermal production infrastructure to produce electricity and vice versa. Installation of CHP units

The financing of RES installations in Greece is as follows:

- Wind Energy 30% of the installation costs
- PV more than 40% of the installation costs
- Geothermal more than 50% of the installation costs
- Biomass energy more than 50% of the installation costs
- Energy saving programs more than 40% of the installation costs
- CHP more than 35% of the installation costs

8.4 Standards and Rules

The following standards and rules are applied to RES installations in Greece:

- Utility Technical Guideline for the Connection of DG to the Grid
- Sets forth the technical conditions and requirements for the connection of RES and other DG to the distribution grid. Issues are slow and fast voltage variations, flicker, harmonics, interconnection protection, short circuit level etc., for LV and MV installations.
- Distribution Network Code
- Principles for the operation, maintenance, planning and expansion of the distribution network, determines the jurisdiction and obligation of the Distribution Network Operator. Inevitably affects DG.
- Other Technical Guidelines
- Technical policies implemented by the utility engineers in various network issues, including the ones affecting DG installations.
- Legal Framework for the Electricity Market
- Extensive set of legal documents (laws, decrees etc.) that regulate the Greek electricity market after recent deregulation (non-technical).

8.5 Licensing Procedures

The licensing procedures for RES installations in Greece are as follows:

- Each prefecture gives the necessary permissions for installing RES in its territory
- Regulatory Authority for Energy (RAE) approves or not the investment plan and gives permissions for signature to Ministry of Development
- Ministry of Development signs authorizations.

8.6 Best practices

The places with high RES penetration in Greece (above 10% in electricity) are the following:

- Crete Island: instantaneous 38%
- Kythnos Island: above 40% for 1000 hours, 100% for few hours a year
- Lesvos Island: instantaneous 42%

8.6.1 Crete

Since 2000, 10% of the annual energy consumption in Crete comes from wind power production. The average RES penetration in Crete is shown in Figure 8.1.

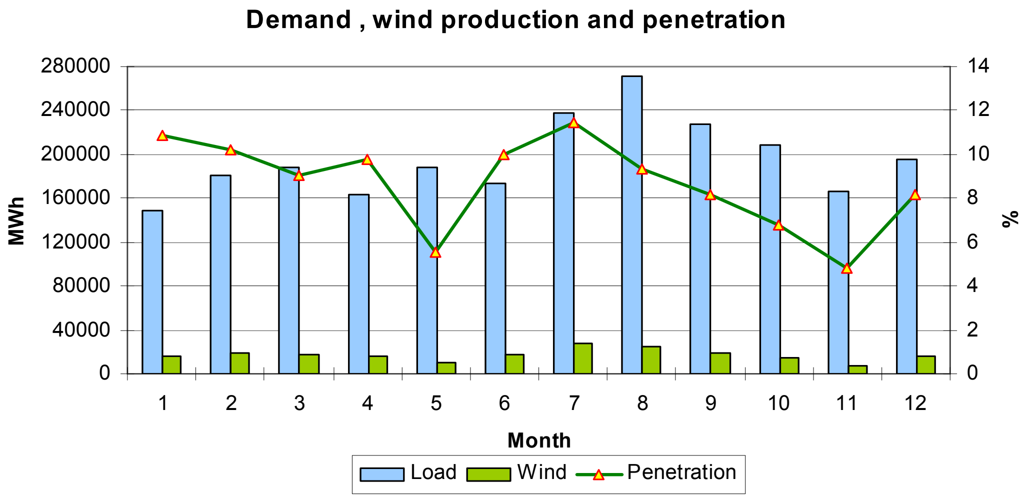

Figure 8.1: Demand and Wind Penetration Chart in 2003 in Crete

The installed Wind Parks in Crete are as follows:

- Before the Greek law 2244/94, the installed wind parks were 7.10 MW
- Currently the installed wind parks are 87.1 MW. This means that wind parks installation capacity has increased more than 11 times in 10 years (1994-2004)
- There are also 114 MW wind parks with installation license. At this point, it should be noted that the license procedures from Cretan Prefecture is three times quicker than in other regions of Greece.

8.6.2 Kythnos

This is an historical place for DG since on 1982, the first wind park in Europe of 5 Wind Turbines of 20 kW each was installed. Now, the installed capacity on the island of Kythnos is 665 kW wind turbines and 100 kW of PV. There is also a storage mean, battery of 400 kWh/500 kW.

In Kythnos, the RES penetration is above 40% for 1000 hours and 100% for few hours a year, as it can be seen from Figure 2.

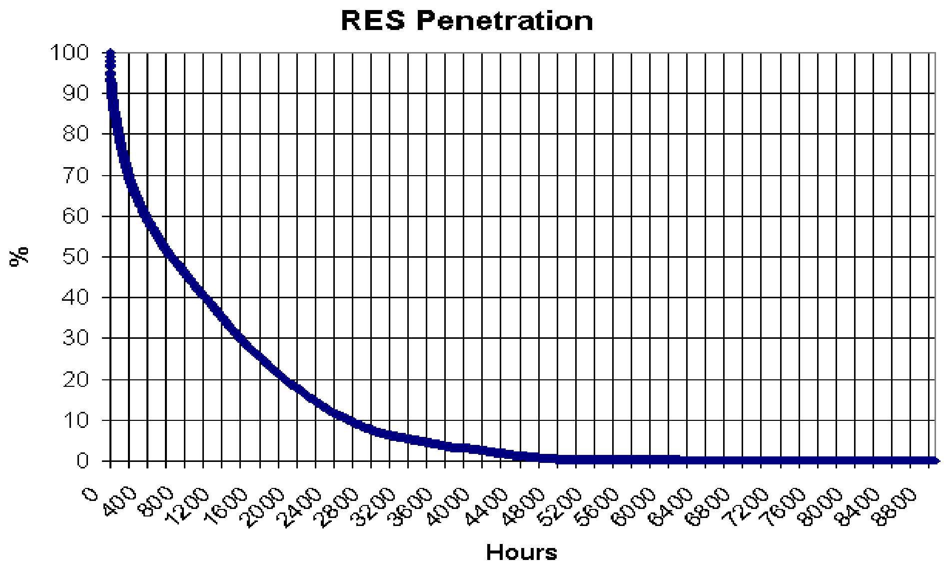

Figure 8.2: RES penetration on the island of Kythnos during 2002.

8.7 Lessons learned

The so far experience of Greece in regulatory framework to support RES penetration has shown that:

- There is a need for speeding up licensing procedures
- The licensing procedure should be differentiated according to the RES type installation
- Effective co-operation of the local authorities with the investors was the key for speeding-up the procedure (Crete and Thrace).

8.7.1 Main barriers to the development of RES

The main barriers to the development of RES in Greece are the following:

- Most important is the complexity of the legal framework and particularly the licensing procedure, frustrating for many small investors.
- The often inhibitive cost for the interconnection to the grid (mostly reinforcement or construction of new network lines).
- For larger stations (more than ~20 MW) and in certain areas with very high wind potential, lack of sufficient HV system capacity. Due to environmental restrictions and local community protests, expansion of the HV system is in some cases completely blocked.
- In the case of wind farms, public acceptability has also been an issue in certain cases, basically due to visual impact or other reasons.

9 Experiences of FYR Macedonia in regulatory framework to support Renewable Energy Sources penetration

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Abstract: This document presents the experiences of FYR Macedonia in regulatory framework to support Renewable Energy Sources penetration in the country.

9.1 RES installations

The basic data about Power System in Republic of Macedonia is presented in the following table[14]:

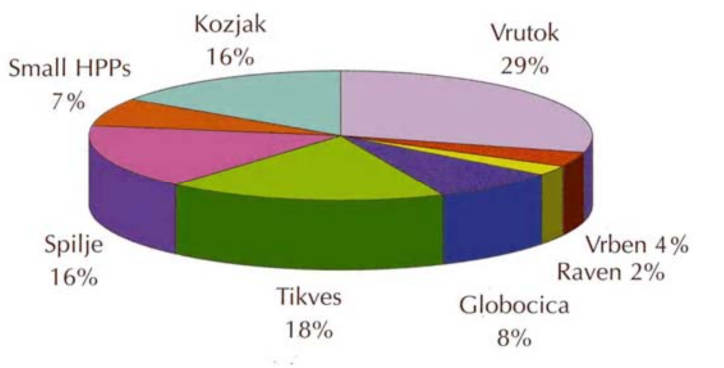
Installed capacity of TPP	1010.0 MW
Installed capacity of HPP	51 3.8 MW
Total installed capacity	1523.8 MW
Total Consumption	7215.5 GWh
Daily peak energy consumption (28 December)	28953.0 MWh
Power peak load (28 December 19 h.)	1417.0 MW
Power mini load (23 May 04 h.)	431.0 MW
Net production	
TPP	4902.5 GWh
HPP	1370.1 GWh
Total production	6272.6 GWh

The installed capacities of hydropower plants and the basic data are presented in the following table:

	Number of units	Nominal power [MW]	Year of installation	Plant type	Reservoir volume
Vrutok	4	150.0	1957/1973	reservoir	227
Raven	3	19.2	1959/1973	run of river	
Vrben	2	12.8	1959	run of river	
Globocica	2	42.0	1965	reservoir	15
Tikves	4	92.0	1968/1981	reservoir	272

[14] Electric Power Company of Macedonia ESM - 2003 Annual Report

	Number of units	Nominal power [MW]	Year of installation	Plant type	Reservoir volume
Spilje	3	79.4(84)	1970	reservoir	212
Small HPPs	22	35.8	1938/1993		115
Kozjak	2	80.0	2004	reservoir	260



The peak demands in the diagram of the consumption are covered by the electricity generated in the hydro electric power stations. The total installation of hydro capacities in the Republic of Macedonia is 480 MW that can be divided into three types. The first type, storage power plants whose volume and capacity of the accumulation lake give the opportunity of monthly and seasonal transfer of the water that covers the variable part of the consumption during each period of the year. The second type of hydro electric power plants is running power plants that are first in basic part of the diagram but have a tremendous importance in the total electricity production. As the last type we can conditionally take the small hydro electric power plant into considerations and assist the total electricity supply of the consumers. The total volume of storage lakes in the Republic of Macedonia is 1.101 million cubic meters, and the total generation is over 750 GWh, that is more than 14% of the total demand for electricity in the Republic of Macedonia.

Macedonia has implemented a “Program on energy conservation, substitution and rational use”. The program received funding through 1991, and resulted in 200 energy efficient projects with a 5% reduction in industrial energy consumption. The energy efficiency interventions were not continued when the funding ended.

According to ESM[15] the possible investment projects for SHP are listed in the following table and:

N°	Name	Location flow	Rated power [mVs]	Rated power [MW]	Average product. [GWh]	Cost mil. EURO	Design level and year of performing
1	Aldinci	Studenicani	2,45	4,48	17,2	6,50	Primary design, 1966
2	Baciste	Zajas	1	4,37	17,54	5,05	Study, 1985
3	Belesnica 1	Belica	2,07	0,65	2,99	1,00	Primary design, 1984

[15] Production Investment Projects”, Skopje 2004

N°	Name	Location flow	Rated power [mVs]	Rated power [MW]	Average product. [GWh]	Cost mil. EURO	Design level and year of performing
4	Belesnica 2	Belica	2,82	0,79	3,65	1,00	Primary design, 1984
5	Brajcino	Resen	1,25	1,21	5,83	2,3	Study, 1990
6	Drenovo	Veles	1,6	2,12	10,83	1,50	Study, 1986
7	Drugovo	Drugovo	0,56	0,9	5,8	0,64	Study, 1986
8	Ehlovec 1	Drugovo	0,4	0,18	0,86	0,83	Preliminary study, 1984
9	Ehlovec 2	Drugovo	0,4	0,67	3,25	2,02	Primary design, 1984
10	Gari	Rostuse	1,31	2,91	12,27	2,34	Primary design, 1987
11	Gradecka	Vinica	0,5	1,32	5,3	1,35	Primary design, 1984
12	Jablanica 1	Lukovo	0,39	0,7	3,2	0,7	Study, 1972/83
13	Jablanica 2	Lukovo	0,78	1,4	6,80	1,2	Study, 1972/83
14	Jabolciste	Caska	1,6	2,12	9,88	2,20	Study, 1986
15	Kosovrasti	Debar	30	5,13	20,54	10,53	Primary design,1990
16	Kostur	K. Palanka	1,35	1,2	5,26	1,9	Study, 1989
17	Lisice	Caska	3,2	4,24	17,93	3,50	Study, 1986
18	Mokliste	D. Kapija	2,8	5,28	24,5	6,56	Detail design,1984
19	Patiska Reka	Sopiste	0,55	0,74	3,8	1,57	Primary design,1990
20	Satoka	Mariovo	0,98	1,79	8,78	2,33	Preliminarydesign,1989
21	Samokov	Samokov	0,9	2,6	13,06	3,9	Detail design,
22	Selce	Rostuse	V	3,36	11	6,44	Study, 1987
23	Sv. Petka	Debar	1,1	1,2	5,13	1,66	Primary design,1987
24	Tresonce	Rostuse	2,5	8	26,3	15,60	Study, 1987
25	Vitacevo	D. Kapija	2,8	3,84	16,7	4,03	Detail design, 1961 Feasibility study, 1983
26	Zbazdi	Lukovo	3	4,8	20	5,10	Study, 1972
27	Zletovo 1	Zletovo	3,2	6,2	22,1	15,40	Primary design,1994
28	Zletovo 2	Zletovo	3,2	4,93	20,1	6,80	Primary design,1994
29	Zletovo 3	Zletovo	3,5	3,8	14,22	7,80	Primary design,1994

According to ESM the possible investment projects for hydropower plants are listed as follows:

- The concept for the utilization of the r. Crna Reka from Skocivir up to the emptying of the r. Crna Reka into the r.Vardar, anticipates formation of three dam storages (lakes): Cebren, Galiste and Tikves. The available potential of the r.Crna Reka has been so far utilized only in the bottom gorge (ravine) stretch, executing the construction of the high dam "Tikves". The upstream water storages "Cebren" and "Galiste" has exclusively power (energetic) importance, providing conditions for formation of huge water storages and leveling of the running waters of the r. Crna Reka, all with the purpose of their complete utilization. The development of a cascade of Hydro Power Plants (HPP) in Crna River is an important investment not only for the national economy but for the regional electricity market as well. The HPP cascade should incorporate reversible units to supply the increasing peak demand in the region using the Crna river inflows as well as low cost pumping during night hours.

- HPP St. PETKA (MATKA 2), is the missing link for the optimal use of the hydropower resources of the Treska River. The site of the HPP St. Petka is located between the new HPP Kozjak (about 16 km upstream of St. Petka) and the existing HPP Matka I, situated downstream. The main purpose of HPP St. Petka within the multipurpose hydro-system Skopsko Pole-subsystem Kozjak-Matka, is to utilize the available hydro potential of the HPP Kozjak discharge and the local waters in the river Treska catchments area, in the part between the HPP Kozjak dam site and the HPP St. Petka dam site. The dam is of double arch dam and the height is conditioned by Kozjak HPP. The power house is of dam type located in the river bed.
- Storage Lukovo Pole is located on the Korab mountain, on the River Radika in so called Gorna Radika area. This storage will be a part of the existing water system Mavrovo. There are three power plants constructed on this water system. With construction of this storage one of the plants which is runoff river will have a storage and overflow of the water specially in spring period will be avoided. Also the quantity of the total annual water in the big storage Mavrovo will be increased for approximately 60 million m^3 and additional electricity generation of 115 GWh in the existing hydro power plants will be provided. It is predicted constructing of dam and accumulation with intake facilities on all streams of the river basin of Gorna Radika River, and channels in length of 20 km. With construction of the dam storage with total volume of 39 million m^3 and 38 million m^3 useful volume will be formed.
- HPP Veles is predicted to be constructed on the river Vardar near village Basino Selo upstream of Veles. The railway Skopje - Veles will be flood out with future accumulation Veles. That's why it will be dislocated on the higher level and this scope of works must be predicted before dam construction. The access to the dam site is possible through highway Skopje-Veles. HPP VELES is dam site facility with concrete gravity dam.The power house is located close to the dam in the river bad.
- HPP Gradec is predicted to be constructed on the river Vardar, 30.4 km from the Macedonia-Greek border. The access to HPP GRADEC is possible through highway Skopje-Gevgelija directly to the dam crest. Power house is an integral part of the dam and there are predicted two units with kaplan turbines. The railway Skopje - Gevgelija will be flood out with future accumulation Gradec. That's why it will be dislocated on the higher level and this scope of works must be predicted during the dam construction.
- Ten HPPs in Vardar Valay are planned to be constructed in a purpose to use whole water potential of the river Vardar. For these plants technical documentation is on the level of study.
- HPP Boskov Most is predicted to be constructed on the river Mala Reka, near Debar and main road Skopje-Debar-Ohrid. It is predicted constructing of dam and accumulation with intake facilities on all streams of the river basin of Mala Reka, derivation channels, main intake-derivation tunnel, penstock and power house.At the end of the intake tunnel is cylindrical surge tank. The water from surge tank is transferred through two pipelines to the power house.
- HPP Spilje II is located on the river Crn Drim, close to the Macedonian-Albanian border near city Debar on the existing storage Spilje. There is an existing hydro power plant on this storage so called Spilje with installed flow of 108,00 m^3/s. The storage volume of the plant is

big and ratio of installed flow and average flow for this plant is less than two. That's why in spring there are overflows and the existing plant should generate all the day as a base plant. With construction of HPP SPILJE II installed flow and installed capacity will be enlarged. The enlargement will be provided with construction of new power plant and new intake tunnel. New power house will be located 120 m downstream of the HPP Spilje.

There are sevreal projects of RES iplementation in Republic of Macedonia, dealing with geothermal energy, biomass energy, but most of them implement hydro energy.

- “Geothermal system Kocani”, Grant of 400.000€ by Austrian government, 1998
- “Geothermal system Vinica”, Grant of 420.000€ by Austrian government, 1999
- “Using biomass for energy needs of factory AD Lozar in Veles”, PSO Programme of Dutch government, 2003
- 7 small hydro power plants build in Macedonia in the last 60 years: Pena, Matka, Pesocani, Zrnovci, Sapuncica, Dosnica, Kalimanci
- 3 small hydro power plants (Turija, Glaznja and Lipkovo) were build in the Former Yugoslavia
- Research paper for potential sites for installation of new small hydro power plants in Macedonia, 1982-83. About 400 new locations were selected with about 200MW and 400GWh. The project documentation exists for almost 100 out of 400 potential new small hydro power plants
- small hydro power plants (4 in Tetovo, 1 in Kicevo, 4 in Strezevo, 1 in Veles) were build in the 90’s.
- A project of creation of a national wind map is planned to be finished in 2005.

9.2 Legal framework for RES installations

There are several legislation documents dealing with energy and RES issues: the Macedonian Energy Law and amendments (97, 99, 00, 02 an 03), the draft of the Law on the establishing of an Energy Agency of the Republic of Macedonia, as well as The Energy Efficiency Strategy with a primary goal to reduce Macedonia’s energy intensity.

In addition to the previous documents several papers were delivered as the documents which regulate the provisions for:

1. Paper on provisions of Macedonia energy law related to sustainable energy with two key objectives: to implement the EE framework envisaged in the Energy Efficiency Strategy, and to be in compliance with the Directives of the European Union, the Kyoto Protocol (which was recently ratified by Macedonia’s Parliament) and other multilateral agreements such as the Energy Charter Treaty, which deal with EE, environmental protection and the promotion of Renewable Energy Sources. Proposed recommendations by Paper on provisions of Macedonia energy law related to sustainable energy are:

- The target for electricity generated from RES should take into account the fact that Macedonia already produces a large percentage of its electricity from hydro sources.

- Therefore, the target set for the use of RES should be higher than the existing baseline in order encourages the construction of new RES generating units.
- The target must, however, be reasonable in light of the RES potential in Macedonia and the fact that many of the most economic hydropower locations have already been developed.
- This paper proposes an increase of 10%, with an extended target date of 2015, rather than the 2010 date set for the EU.
- The use of "green certificates" or "renewable energy certificates" ("RECs"). The reasons for recommending the development of a certificate instrument are as follows:
    - "green certificates" do not distort internal or regional competition among generators for the sale of electricity;
    - the burden is spread evenly across all consumers;
    - the number of countries adopting certificate instruments is growing
- The Energy Agency should be the "Issuing Body" for RECs, rather than the ERC, because the Energy Agency will have the specialized expertise needed to operate the program.
- To encourage the production of heat from Renewable Energy Sources (such as geothermal) by providing tax incentives to distributors of heat which use RES (only certain regions of Macedonia have geothermal resources, many of which are owned by bankrupt spas).

2. Paper on environmental protection requirements for the Macedonian energy sector.

9.3 Best practices

Preliminary study for selection of the most suitable sites for financing of new small hydro power plants was funded by WB. The study proposed the following sites for new installations:

- Strezevo: 2 small hydro power plants
- Struga: 2 small hydro power plants
- Kavadarci: 4 small hydro power plants
- Debar: 1 small hydro power plants

The project "Mini hydro power plants – MK" is implemented and supported by WB, 2001-2004 :

- Two sites (proposed by the preliminary study) were selected:
- Kavadarci (with 4 small hydro power plants) and
- Debar (with 1 small hydro power plant)

Approximatelly 35% of the new investments was funded by WB (750000$) and the rest of 65% was financed by local investors.

9.4 Lessons learned

Macedonia has promising native resources of renewable energy. These include hydropower, geothermal energy, biomass energy, and in the longer term wind energy. To address these issues, the projects exploring various investment options are of the highest priority for the country.

Renewable energy projects have been identified by different project developers. However, these projects are not being implemented because of:

- institutional and
- financial constraints.

9.5 Main barriers to the development of RES

The Ministry of Economy has developed a “pipeline” of 4 projects proposed by public sector entities and 11 mini-hydro projects proposed by private investors. These projects have all been screened for technical and financial viability, but:

- they mostly still face institutional constraints (e.g. the solving of water rights issues) and
- all suffer from limited access to finance.

Project promoters have developed a list of 8 expansion and rehabilitation opportunities for the existing geothermal schemes for use in greenhouses and for space heating. The projects appear to be financially viable but many face substantial institutional problems such as public ownership of the near-bankrupt spas who own the existing boreholes.

Lack of an enabling framework for renewable energy. At present, there is no policy for inclusion of renewable energy in the energy mix of the country, and no rules to guide private sector development. In addition to the institutional barriers mentioned above, there is insufficient legislative support in the forms of:

- funding mechanisms,
- electricity buyback policy,
- preferential taxation, etc.

Furthermore, local administrations are unwilling to make funding decisions for multi-year projects and local project planning and implementing capacity is inadequate with no guidelines for preparing feasibility studies, business plans and “bankable” project proposals. Moreover, there is a lack of capacity in the Ministry of Economy where only a small number of people are involved in the energy sector.

10 Experiences of the Netherlands in regulatory framework to support Renewable Energy Sources penetration

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10.1 Introduction

In the following we analyze the development and promotion of Renewable Energy Sources (RES) and Central Heat and Power (CHP) in the Netherlands. The indicative RES target to be in achieved in the Netherlands in 2010 is 9% of the gross electricity consumption according to the EU Directive 2001/77/EC on the promotion of electricity from Renewable Energy Sources.

10.2 RES installations

In the Netherlands the annual consumption of electricity is increasing permanently. To provide a general overview, Figure 10.1 depicts the annual consumption of electricity in the Netherlands with respect of different energy sources.

Figure 10.1: Annual consumption of electricity in the Netherlands

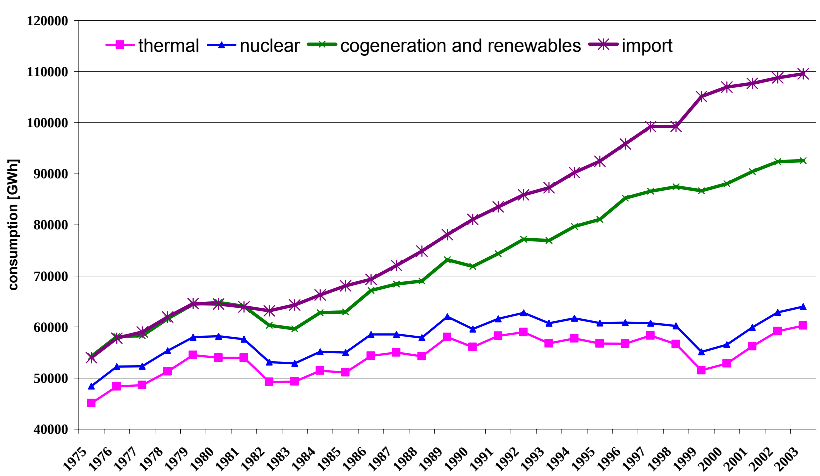
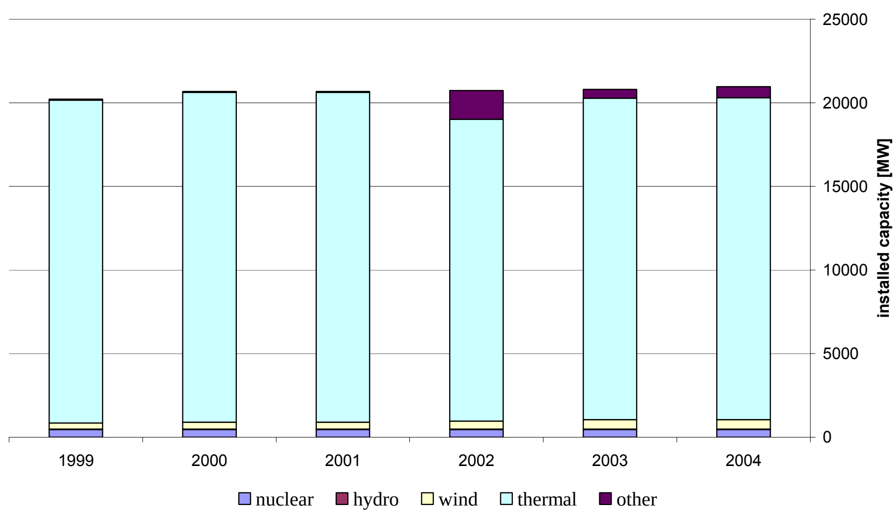


Figure 10.2 shows the installed capacities in the Netherlands for 1999-2004. A slight increase in wind power as well as “others” energy sources, which cover RES, can be observed.

Figure 10.2: Installed capacities in the Netherlands (1999-2004)



To complete the overview on the current numbers on RES installations in the Netherlands, the following Table 10.1 lists the installed RES capacities in 2003:

Table 10.1: RES-electricity production - installed capacities (in MW)

RES-E Technology	**2003**
Biomass	205
Biowaste	414
Hydro	37
Photovoltaics	46
Wind on-shore	884
Total	**1586**

Source: Central Bureau of Statistics The Netherlands

In 2001, an agreement has been signed to achieve the goal of at least 1500 MW of wind energy capacity in 2010 (Mitre p. 3). Meanwhile it is planned to install an off-shore wind park with 450 MW till 2008 and to increase this efforts to 6000 MW till 2020.

Table 10.2 presents the development of RES production of electricity (RES-E) in the Netherlands between 1997 and 2002.

Table 10.2: RES-electricity production in 1997 and 2002 in GWh in the Netherlands

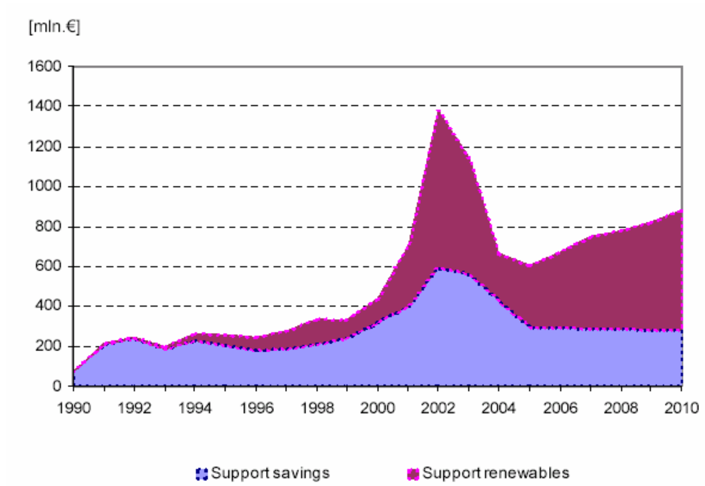
RES-E Technology	**1997**	**2002**	**Average annual growth**
Biogas	251	304	4%
Solid biomass	42	1260	97%
Biowaste	873	971	2%
Hydro (large scale)	91	123	6%
Hydro (small scale)	1	1	3%
Photovoltaics	1	17	86%
Wind on-shore	475	910	14%
Total	**1734**	**3586**	**16%**
Share of total consumption (%)	1.8%	3.4%	

Source: REACT.

In addition to the goal of promoting Renewable Energy Sources as a contribution to sustainable energy supply, the reduction of CO2 and other emissions of conventional energy production is the main driving force for RES. The expenditures for emission reductions can be divided into the direct support of energy saving measures and of RES.

Figure shows the development of RES support and energy saving expenditures in the Netherlands. The peak around 2002 has been caused by a promotional mechanism favouring imports of electricity produced from RES as will be explained further below. These expenditures were up to 1,3% of total governmental expenditures.

Figure 10.3: Yearly financial support for energy savings and renewable energy in the Netherlands



Source: ECN (2005), p. 5.

In the following we analyze the supporting / promotional measures, which have led to these developments.

10.3 Legal framework for RES installations

The Dutch Ministry of Economic Affairs is responsible for the legislation on support of RES and CHP. While during the first years of this decade the promotion of RES was based on the stimulation of demand for electricity produced from RES by means of fiscal measures, it is now based on feed-in tariffs.

The growing demand for electricity produced from RES ("green energy") at the beginning of this decade was the result of the combination of the fiscal support for green energy, which was exempted from eco tax (administered through a green certificate system), production subsidies and the full opening of the retail market for renewable electricity in July 2001 while the retail market for non-green energy has been fully opened in the Netherlands in 2004. On 1 July 2002 Green Prices counted 1,000,000 green energy customers in the Netherlands.

However, since imports have been eligible for green certificates and hence the eco-tax exemptions since early 2002, this situation led to large imports of RES especially from Germany - rather than investments in generation units in the country. This has been regarded as politically unacceptable and changes were proposed. The government reduced the eco tax exemptions in 2002 and increased the feed-in tariffs to favor domestic production over imports. In 2005 the eco tax exemptions for green energy have been abolished.

In November 2002 the anticipated policy changes came in the form of a proposal for an amendment to the Electricity Law of 1998, called "Environmental quality of electricity production" (Milieukwaliteit Elektriciteitsproductie, MEP). The MEP aims to increase certainty to investors and improve the cost effectiveness of renewable electricity support. The MEP provides for operating support through a combination of feed-in tariffs and a fading out of the eco tax exemption. The feed-in tariffs are financed through an annual levy on all electricity connections to the grid. The reduction of the eco tax exemption seeks to reduce the level of imports, while maintaining the dynamics of the renewable electricity market and associated green certificate trade. Since there is a vast supply of low-cost renewable electricity available in the EU, which can be imported to the Netherlands, it was expected that in the short run imports would not diminish as a consequence of the reduction/abolishment of the eco tax exemption.

Under the MEP the total level of support is determined by the sum of the MEP feed-in tariff and the value of the ecotax exemptions in 2003. The government guaranteed this total level of support for a period of 10 years after entering into operation. Subsequently, this mechanism is described in more detail.

10.3.1 Framework for Promotion of RES Installations

Key elements of the Dutch policy for the promotion of renewable energy over the past decade were:

- The energy tax (eco tax) on the use of electricity and natural gas
- Fiscal instruments to lower investment costs
- Diverse subsidy schemes to increase the attractiveness of new initiatives and investments.
- Environmental quality of electricity production scheme (Milieukwaliteit Elektriciteitsproductie, MEP)

10.3.2 Energy tax (Energiebelasting) and green certificates

The energy tax or eco tax is a tax paid by consumers based on the volume taken off. It is meant to reduce consumption and is not related to any support scheme. In addition, the tax on labor could be lowered and a broader base of governmental income was created. Until recently, households that bought green electricity did not have to pay the energy tax.

In 2001 green certificates have been introduced in the Dutch market, which guaranteed that a certain quantity of the electricity was produced from an eligible renewable source. Electricity suppliers could claim tax exemptions against submission of green certificates. In addition, eligible electricity generators got a fixed production subsidy rate obtainable for eligible Renewable Energy Sources for the production of electricity. RES-generators in Member states could also apply for green certificates. As already mentioned, this led to an increase in imports of renewable electricity in 2002 and finally to a revision of the promotion scheme and the introduction of MEP.[16] By 2005 there is no longer a reduced tax tariff for green energy. The current (2005) tariffs are listed in Table :

Table 10.3: Energy tax 2005

Annual consumption	**€/MWh**
under 10 MWh	8.32
between 10 and 50 MWh	3.13
between 50 and 10,000 MWh	1.02
Over 10,000 MWh	0

For dwellings and small businesses there is an annual fixed reduction of € 230.86.

10.3.2.1 Fiscal instruments: EIA, MIA and VAMIL

- **EIA and MIA** are tax reduction schemes for enterprises investing in listed types of RES, including bio-energy. Depending on the investment and the type of techniques, part of the investment can be deducted from corporate taxes. Both schemes have a limited annual budget.
- **VAMIL** gives the opportunity to select a custom write-off scheme for investments to minimize corporate taxes. There is no fixed budget for this support. It can be used in combination with the two EIA and MIA.

[16] See ECN (2005) p. 29-33.

10.3.2.2 Diverse subsidies

- **EPR (EnergiePremieRegeling)** Subsidy for energy friendly appliances and techniques to be implemented in households. This scheme was run until 2003. The current status of this scheme is under debate and there is no budget allocated.
- **EET: Besluit Subsidies Economie, Ecologie en Technologie** Subsidy for innovative projects (not only energy) to mitigate start up risks. This scheme has a limited budget.
- **BSE: Besluit Subsidies Energieprogramma's** Subsidy scheme to stimulate research and development for RES. Both feasibility studies and R&D studies can apply for this scheme. Budget is limited.

10.3.2.3 Environmental quality of electricity production (Milieukwaliteit Elektriciteitsproductie, MEP)

As already mentioned above, the so-called "Environmental quality of electricity production" (Milieukwaliteit Elektriciteitsproductie, MEP) was introduced in July 2004 in order to replace the fiscal based promotion of RES through a combination of feed-in tariffs and a fading out of the eco tax exemption. The MEP feed in tariffs are listed in the following Table:

Table 10.4: MEP feed in tariffs

RES	**MEP 1 January 2004**	**MEP 1 July 2004**	**MEP 1 January 2005**
	€/MWh	€/MWh	€/MWh
Mixed biomass streams[17]	29	29	29
Installations for pure biomass (capacity until 50 MW)	67	82	97
Installations for pure biomass (capacity over 50 MW)	40	55	70
Photovoltaic, wave and tidal energy	67	82	97
Pure biomass – animal	0	6	21
Hydro	67	82	97
Wind on land[18]	48	63	77
Wind at sea	67	82	97
Landfill gas	0	6	21

The MEP feed-in tariffs are financed through an annual MEP levy on all connections to the electricity grid in the Netherlands. The MEP levy is essentially a type of system benefits charge that is collected by the distribution network operators and consequently passed on to the national transmission system operator. The levy amounts to €34 per connection in 2003 and is increased to

[17] In installations with a minimum efficiency of 26%.

[18] Limited to 18,000 full load hours.

€40 in 2006. The planned annual increases of the MEP levy at the time of introduction of MEP law are represented in

Table below. The burden of MEP levy on final energy consumers is compensated by an equivalent reduction in annual eco tax charges. The MEP is therefore financial neutral to electricity customers.

Table 10.5: Indicative MEP budget for the period 2003 – 2006 at the introduction of the MEP law

	2003	**2004**	**2005**	**2006**
Total budget [mln Euro]	258	281	298	316
Budget for renewable electricity [mln Euro]	141	164	181	199
Number of connections [mln]	7.53	7.63	7.73	7.83
Tariff per connection [Euro]	34	37	39	40

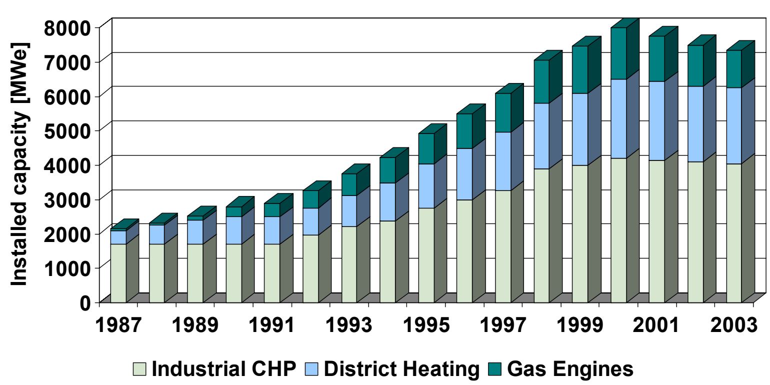
However, due to anticipated budget constraints the levy in 2004 already increased to € 39. In 2005 the levy will be € 52.

With the introduction of feed-in tariffs the tax rebate for certified green energy it has been reduced and only Dutch producers are eligible to receive a premium. The green energy certificates have been replaced by guarantees of origin (GO) as per 1 January 2004 for which the generators can apply.

10.3.3 Framework for the Promotion of CHP

Since the liberalization of the energy markets CHP support has been installed to keep the capacity level rather than support new CHP capacity. This more or less is succeeded as shown in Figure 10.4. The installed capacity only decreased slightly.

Figure 10.4: Development of cogeneration in the Netherlands until 2003



*Source: COGEN Nederland

As the support has been very focused on efficiency, low efficient installations have been decommissioned.

In the early years of the promotion of CHP (2000) the efficiencies were depending on annual output. A CHP plant would have got support if it had an average efficiency higher than the so-called Senter[19]-efficiency:

$$\eta_e + 2/3 * \eta_{th}$$

It says that the sum of the annual operational efficiency plus 2/3 of the annual heat efficiency must be higher than 60%.

For existing installations this had to be higher than 60% and for new installations the value was 65%. Generators had to apply for the support by submitting fuel input, heat output and power output. First this was done on an annual basis; however, mostly due to seasonal dispatch of the installations this has been changed to a monthly-based scheme. The support figure for the first half of 2004 was 5.7 €/MWh based on all produced electricity.

As the political priority shifted from energy saving to emission reduction the scheme has been changed to a new system that is in place since 1 July 2004. The new system is implemented in a similar way as the MEP. This means that installations have to be certified and measured by the same organizations (subsidiaries of the System Operator) as for RES. As this scheme is also intended for maintaining the current level of CHP capacity until emission trading is in place, up to now it seems to work fine. New initiatives are expected when emission trading comes into place.

CHP certificates are issued for electricity that is produced “emission neutrally”. These certificates cannot be traded and are used only to apply for the support. Emission neutral electricity is calculated by multiplying the CO_2 index of the installation with the power output.

The CO_2 index is calculated as follows:

$$Index = (1-(B*Kb-W*KRW)/(KRE*P))*100\%$$

B	Fuel input
Kb	Specific CO2 emissions of fuel
W	Heat output
KRW	Specific CO2 output of reference installation per unit of heat
KRE	Specific CO2 output of reference installation per unit of electricity
P	Total power output (and output of mechanical output)

Figures of reference installations are published on an annual basis. A reference installation is an installation in the same group, regarding age, voltage level and heat conditions. Gas engines are treated separately. The indexes are published on an annual basis.

Support for 2005 is 26 €/MWh calculated by using the index. This figure will be changed annually and will be valid for only one year. Amounts of support will be established on a monthly basis on measurements of the electricity, heat and mechanical energy produced. Gas engines quantities are calculated on nominal specifications. Electricity used on site is also taken into account.

[19] Senter is the agency of the Ministry of Economic Affairs that used to be responsible for the CHP support.

10.3.4 Standards and Rules

The following standards and rules are applied to RES and CHP installations in the Netherlands according to the different codes set by the Dutch regulator:

- Net Code
  Certification of RES and CHP installations, issuing, and handling of certificates by TSO. This is dealt with by two subsidiaries of the TSO, Certiq and Enerq. Currently a scheme valuing the technical advantages of embedded generation is under debate.
- Metering Code
  Measurement of certified RES and CHP installations. This describes the general specifications for the meter.

10.3.5 Licensing Procedures

The licensing procedures for RES / CHP installations in the Netherlands are not different from any other industrial installation. Basically an environmental permit procedure has to be followed, including an environmental impact study. In general the licensing procedure has been estimated as:

- Long and expensive
- Unclear in testing framework, large numbers of parties involved, lack of coordination between legislation and regulations.
- In addition, a lack of enforcement and sanctions has been observed for cases in which the authorities exceeded statutory deadlines.[20]

To overcome these problems, NOVEM, a government agency under the Dutch Ministry of Economic Affairs that is focused on encouraging the sustainable development of energy and the environment, monitors the actual practice of the licensing procedure since 2004.

10.4 Lessons learned

The mechanism developed to support RES in the early 2000 had been based on the demand side. Consumers benefited directly when they were allowed to switch to green energy suppliers by mid 2001. The green electricity market had been opened earlier than the normal electricity market (opened in mid 2004).

To allocate the support to the supplier resulted in a large demand for green energy and consumer awareness. Especially as this electricity could be offered at a lower price than normal electricity. However, the mechanism did not result in many initiatives for building new RES capacity in the Netherlands. Much of the green energy was imported (especially cheap hydro-energy).

With the fear of tax money flowing abroad and the fact that the European trend was towards supply side support, this scheme has been turned around into the MEP feed in support. The transition to a full supply support scheme is finished in 2005. This already seems to lead to more initiatives to build RES capacity in the Netherlands.

[20] Cf. Ministry of Economic Affairs (2003), p. 6-7.

10.5 Main barriers to the development of RES

As the main barriers to the development of RES and CHP in the Netherlands the following points could be identified:

- Licensing procedures
- “Not in my backyard” (NIMBY) attitude (can also be seen as part of the licensing procedures. There are many possibilities of appeal during the procedure)

10.6 Literature

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11 Experiences of Austria in regulatory framework to support Renewable Energy Sources penetration

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Abstract: Renewable sources of energy currently constitute 27% of Austria's energy consumption (e.g. hydropower, biomass, solar and wind energy, etc.). Country is the EU member state with the largest share of renewable energy production in its total electricity production. The level of exploitation of Renewable Energy Sources varies significantly among the different sources.

Environmental concerns have played a dominant role in Austrian energy policy-making for at least two decades. After successful reduction of SO_X and NO_X emissions, Austria has set ambitious target for CO_2 reduction up to 13% in the frame of EU burden sharing agreement within Kyoto protocol.

Regulatory framework comprises instruments such as a higher taxation on gas and electricity, which was introduced in June 2000 (doubling the former tax levels), purchase obligations of network operators regarding alternative energies, "labeling" of energy supplied to end-consumers, feed-in tariffs for renewable energies as well as research and incentive programs for renewable energies sources. Support schemes and legislation in Austria are designed at three levels: state, province and local municipality's levels.

The article is focused on RES support in two sectors: green electricity and biomass based heat production. Detailed overview of major present supporting policies is given.

Green Electricity Act sets nation wide scheme of feed-in tariffs is in force form 2003 and has replaced former scheme which varied from state to state. Tax incentives, based on Electricity Tax Act, modified in 2000, and investment subsidies schemes aimed to support innovative technologies, based on Environmental support Act, 2003.

Besides renewable electricity production, Austria has been very successful in promotion of biomass district heating systems, resulting in 50 new installations per year. Biomass heat production was promoted by local and regional authorities which were complemented by governmental support. Article presents variety of mechanisms contributing to the success: energy taxes, public grants – investment support, technological development support, various promotion, education and training activities among others.

11.1 General information

Austria has a land surface of 83.858 square kilometers and a population of 8,1 million. It is a federal country (member of the EU since 1995) with nine independent provinces (Länder):

Three levels of legislation are existing:

- the Central State ("Bund"),
- the provinces ("Länder"),
- the local municipalities ("Gemeinden").

All federal legislation has to pass the two parliamentary chambers, i.e. the National Council ("Nationalrat") and the Council of Provinces ("Bundesrat"). However, the influence of the provinces on federal legislation is rather weak, as the National Council has the right to overrule decisions taken by the Council of Provinces. Despite the dominance by the Central State in terms of federal legislation, the Austrian provinces are relatively autonomous in legislation and administration in their own matters, including fiscal policies. Regarding the energy policy, responsibilities are shared between Federal and regional government, as we will explain later.

Austria is a highly developed industrialized nation with an important service sector. The foremost industries are foodstuffs and luxury commodities, mechanical engineering and steel construction, chemicals and vehicle manufacturing. In 1997 the primary sector (agriculture and forestry) accounted for only 2,8% of Austria's gross domestic product, while the secondary sector (commodities manufacture, energy, mining) accounted for 34,8%, and the tertiary sector (services, banking, public services, commerce, transport, tourism) accounted for 62,5% of GDP.

Some 18% of Austria's surface area is covered by farm land, 27% by grassland and 47% by woods and forests. 41% of Austria's total area is suitable for agriculture. 5% of all employed persons in Austria work in agriculture and forestry. With its 20.000 organic farmers, Austria occupies a leading position in this branch of agriculture in Europe.

11.2 Penetration of renewable energy in Austria

Austria is the EU member state with the largest share of renewable energy production in its total electricity production. In 2001 this share amounted to 68%. Its main source of renewable electricity is hydro power, which accounted for 96% of total renewable production in 2002. Second is biomass, which accounts for 4% of total renewable electricity production in 2001. Other sources make only marginal contributions.

Figure 11.1: Share of RES in renewable electricity production (Source: Eurostat 2001)

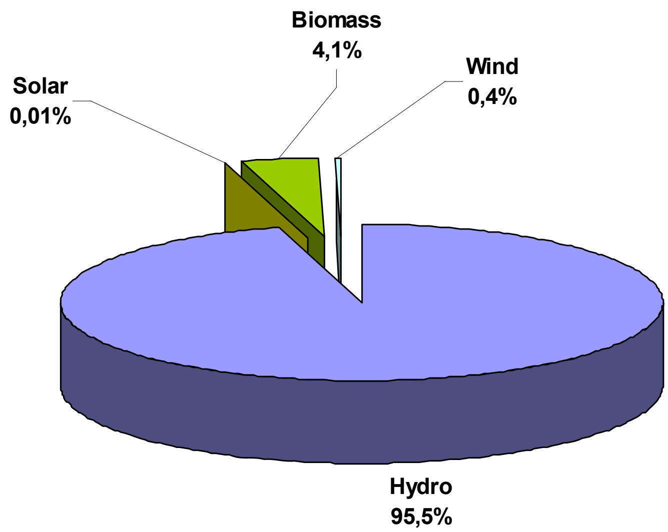
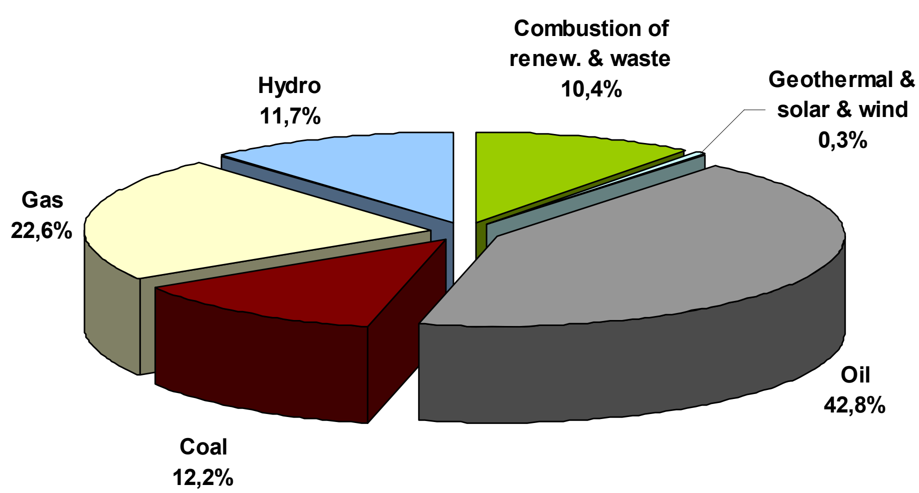


Figure 11.2: Primary Energy Supply by source (Eurostat 2001)



Renewable sources of energy currently constitute 27% of Austria's energy consumption (e.g. hydropower, biomass, solar and wind energy, etc.). The level of exploitation of Renewable Energy Sources varies significantly among the different sources.

The most important renewable sources of energy are hydropower with a share of 13,4% of the total energy supply and biomass with about 13%. Overall, hydropower accounts for about 70% of domestic power production. In summer, all of Austria´s electricity can theoretically be supplied by hydropower whereas biomass sources like fuel wood, wood chips, bark, sawdust, straw or biogas make up nearly half of the total consumption of renewable energies throughout the year.

Austria is a relative newcomer in the production of energy from wind. Wind power is considered a practicable supplementary form of alternative energy production as two thirds of the wind circulation in Austria occurs during winter when water availability is at its lowest and power demand is at its highest. It is particularly during this time that wind power stations could replace thermal power stations, thus helping to reduce electricity imports. Yet, before further developing Austria's wind power potential, it must be considered that Austria is a landlocked country and wind speeds are lower than in coastal regions. Wind incidence makes power output subject to considerable fluctuation.

Geothermal energy and energy from waste, the latter not considered as renewable energy source deserving promotion according to the ElWOG, are increasing as sources of energy. In respect of solar thermal installations, Austria, quite surprisingly, ranks in the second place after Greece.

As regards small hydropower, about 1.690 small plants are connected to the grid of regional utilities, representing approximately 9% of the total national hydropower capacity. Another 4.000 to 5.000 small stations exist, which are not connected to the public grid. Austria's small-scale hydropower stations are characterized by their decentralized location, the investment of private capital and the objective of satisfying the immediate energy needs of private or industrial users. According to estimates of the Austrian Association for the Promotion of Small Power Stations, 40 to 45% of the potential for small hydropower plants has been exploited to date, leaving approximately 4.000 GWh per year still to be developed. Since 1997, investment grants of 25% have been available for the reactivation of defunct stations and the extension of operating ones, and in some cases also for the construction of new installations with a capacity of up to 500 kW. The idea is to stimulate efforts for further reducing CO_2 emissions.

11.3 Regulatory Framework

The Austrian energy policy is based on the principles of environmental compatibility and promotion of Renewable Energy Sources. Environmental concerns have played a dominant role in Austrian energy policy-making for at least two decades. As a result, Austria has recently succeeded in substantially reducing SO_X and NO_X emissions. The level of CO_2 per capita is also quite low compared with IEA averages. Within Kyoto Protocol and EU burden sharing agreement, Austria has taken on an obligation to reduce its greenhouse emissions for 13%. Reduction should be achieved from 1990 level until first Kyoto commitment period from 2008 to 2012. The scenarios to achieve this target are quite different. On the one hand, a higher taxation on gas and electricity was introduced in June 2000 (doubling the former tax levels) and on the other hand, regulatory instruments such as purchase obligations of network operators regarding alternative energies, "labelling" of energy supplied to end-consumers, feed-in tariffs for renewable energies as well as research and incentive programs for renewable energies have been introduced.

Although the Austrian government has allocated grants amounting to ATS 240 million to support the development of Renewable Energy Sources in the past 3 years, additional incentives are considered necessary to make it economically attractive to install and operate Renewable Energy Sources.

Even though the use of renewable energy, in fact, has doubled over the past 20 years, renewable energy technologies still face certain difficulties in “taking off” in marketing terms. Under the prevailing economic conditions, a serious obstacle for the greater use of certain renewable sources has been the cost associated with their exploitation. The use of renewable energy, in many cases, is hampered by higher capital costs than those relating to conventional fuel or gas cycles. Another significant obstacle, as with most innovative technologies, is the lack of confidence from investors, governments and users, the lack of knowledge about the technical and economic potential and a general resistance to change and new ideas.

To counteract these obstacles and facilitate the development of new energy technologies, the Austrian policy lies upon some major supporting mechanisms for renewable energy use:

- feed-in tariffs
- tax incentives
- investment subsidies.

11.3.1 Green Electricity Act

In July 2002, the National Council and Federal Council passed the new Green Electricity Act (Ökostromgesetz, Official Journal BGBl I 2002/244). The main content of the EU Directive from October 2001 (Directive 2001/77/EC) has therefore been implemented and the proportion of energy generated from Renewable Energy Sources increased. The Green Electricity Act governs the aid for renewable power and combined heat and power generation throughout the country. Through this act, fees for green power, which varied from state to state, ware replaced with a uniform scheme of feed-in tariffs for new renewable installations. Consequently the total cost of aid for green energy following nation-wide attainment of the objective set is much lower than it would have been for attaining the objective individually in each federal state (the government will support these plants with a maximum € 275m/yr, down from € 400m/yr). This is because the areas with renewable energy potential can now be used wherever they are located (wind power in Eastern Austria, hydroelectric power in Western Austria). The supply tariffs for the green plant operators are the same throughout Austria. The distribution system operators are obliged to buy all renewable electricity offered by independent power producers and to pay feed-in tariffs.

The objectives laid down in the Green Electricity Act are namely to generate a proportion of 9% from small-scale hydroelectric plants and 4% from other eco plants by providing aid in the form of supply tariffs until the year 2008 so that the overall objective of 78,1% of electricity from renewable sources can be reached (the rest being generated from large scale hydro).

11.3.1.1 Feed-in tariffs

Under the ElWOG (1998; Elektrizitätswirtschafts- und organisationsgesetz) the system of feed-in tariffs worked as follows: the distribution system operators were obliged to buy renewable electricity offered by independent power producers and to pay minimum feed-in tariffs, which were defined by the governments of the nine Provinces. Each regional government set its own feed-in tariffs, quota and conditions for appliance. This resulted in a complicated and intransparent system, which was replaced in 2002 with the Green Electricity Act ('Ökostromgesetz'). From January 2003, the Federal Government sets feed-in tariffs for new installations. The Ökostromgesetz sets uniform feed-in tariffs per technology for installations approved between 01.01.2003 and 31.12.2004 and put into operation before 30.6.2006. For installations approved before 31.12.2002 the feed-in tariffs of the provinces are still valid. In Table 1 information on the feed-in tariffs by technologies categories is presented. Although the feed-in tariffs are relatively high, the continuity could be problem due to the short operational period of the instrument. The minimum period over which support is given is 10 years. Ministerial decree sets the period for 13 year /4/.

Table 11.1: Feed-in tariffs (Source: de Vos, 2004)

Source	€c/kWh
Biomass	10-16,5
Small-scale hydro	3,15-6,25
Wind	7,8
Photovoltaics	47-60
Geothermal	7,0

11.3.1.2 Purchase Obligation of Electricity from Renewable Energy Sources

The Act obliges electricity distributors to obtain a certain portion of electricity from Renewable Energy Sources (with the exception of hydropower), i.e., from solid or fluid domestic biomass, biogas, landfill- or sewer-gas, geothermal energy and wind as well as solar energy. The amount of electricity to be acquired from such sources by distributors ranges from 1% in the period from 1 October 2001 to 30 September 2003. It was planned to increase share to 2% from 1 October 2003 to 30 September 2005, 3% from 1 October 2005 to 30 September 2007 and 4% from 1 October 2007, calculated from the aggregate amount of electricity consumed by the end users connected to the network of the distributor concerned.

This buying obligation of the distribution network operators was supervised by the regulator Elektrizitäts-Control GmbH. In case the proceeds resulting from the sale of this alternative energy do not meet the costs of the buying obligation, network operators are entitled to claim for the difference between these amounts. These additional expenditures are financed by a surcharge to the system use tariff which is determined by the governor of the respective federal province.

This quota and certificate system was ended on 1-1-2003.

11.3.1.3 Electricity "labeling"

In order to enable consumers to recognize the sources of electricity they buy, the supplier is obliged to identify such sources in its invoices issued to the end-user. Furthermore, labeling shall enable consumers to influence the future energy production and supply situation according to customer demand. In practice, the origin of the energy supplied to the end-users is evidenced by certificates issued from authorized certification institutes, conclusive statements of source by audited and published annual accounts (according to the mix of the supply and delivery portfolio of the respective electricity trader or supplier) or the actual and published UCTE country production mix. In case of electricity supply via an electricity exchange the relevant country production mix of the registered seat of the electricity exchange is decisive.

The quota and certificate system was ended on 1-1-2003.

Green certificate trading was introduced by the Energy Liberalization/Electricity Act 2000. Electricity suppliers based in Austria have to include 8% of electricity generated by domestic small-scale hydropower plants in the energy sold to final customers. Final customers purchasing electricity directly from foreign suppliers are required to prove that 8% of the electricity they consume is generated by domestic small-scale hydropower plants. "Small-scale hydropower certificates" are used as proof. Hydropower plants with a maximum capacity of up to 10 MW are designated by the provincial government, entitling their operators to issue such certificates. The designations are notified to Electrizitäts-Control GmbH. Small-scale hydropower certificates are in units of 100 kWh. They have to be authorized by the operator of the grid of the plant in question, who keeps a record of the small-scale hydropower certificates authenticated. The system is electronic and is monitored by Elektrizitäts-Control GmbH. Certificates can be banked for up to two years. In the event of non-compliance, an equalization levy is imposed upon electricity suppliers and final customers by the provinces.

It is interesting to note that energy stemming from large hydropower plants is not promoted under the Act, the reason being that, at present, approximately 70% of electricity produced in Austria already comes from hydropower plants.

The quota and certificate system was ended on 1-1-2003.

The electricity labeling in force are Renewable Energy Certificate System (RECS). The certificates are issued by E-control, compliance with the certification rules is monitored by Austrian Electrotechnical Association (ÖVE). About one million RECS certificates had been issued by the end of 2002.

11.3.2 Fiscal policy

Electricity tax law (Elektrizitätsabgabegesetz) is valid form 1996 and was modified in 2000 favors auto producers of electricity. Tax exemptions are available for those producers that produce electricity exclusively for their own use, if production does not exceed 5.000 kWh annually.

In addition, law enables Provinces to use 11,8% of the tax revenue for implementation of energy saving and environmental protection measures, including measures for the promotion of RE. The Provinces may substitute environmental expenditures from their own budgets, so they are not obliged to use these revenues additionally.

11.3.3 Environmental support program

On the basis of the Kyoto Protocol and the EU's internal Burden Sharing Agreement, Austria is obliged to reduce its greenhouse gas emissions by 13 percent compared to the level of 1990. In order to achieve this goal through appropriate measures in the period 2008-2012 the federal government and the provinces have agreed upon a joint climate strategy.

In the Kyoto base year of 1990, (or in 1995 for HFCs, PFCs and SF6) Austria emitted approximately 78 million tons of CO_2 equivalent of greenhouse gases according to the annual greenhouse gas emission inventory of the Federal Environment Agency. A 13 percent reduction in comparison to the base year leads to a reduction of around 10 million tones of CO_2 equivalent. For 2010 emissions of approximately 85 million tones of CO_2 equivalent are forecasted. The reduction necessary for meeting the Kyoto target thus amounts in the meantime to 17 million tones.

To achieve this target, the Federal government passed the Austrian Umweltförderungsgesetz (UFG - Environmental Support Act) started on August 21, 2003.

Its objective is to stimulate innovative technologies by investment subsidies. Because of guaranteed feed-in tariffs for ‘green electricity’ subsidies are given only for the heat producing part of a plant. Subsidies for electricity production will be only granted if a plant’s technology exceeds state-of-the-art. As the Community Guidelines for state aid for environmental protection would allow for higher subsidy rates than before, the national authorities for granting subsidies try to reach the maximum subsidy rate of 30% if possible. The subsidy rate is between 10% and 30%, depending on the type of investment.

11.3.4 Promotion of Biofuels

11.3.4.1 Exemption of tax for Biofuels

In accordance with Article 4(1)(7) of the Mineralölsteuergesetz (Mineral Oil Tax Law), fuels produced from biogenic substances are exempt from mineral oil tax. The blending of up to 2% bio diesel with diesel is also exempt from tax. There is also a tax reduction for the blending of up to 5% biogenic fuels with petrol.

11.3.4.2 Substitution requirement

The proposal for Article 6a, which was amended in the framework of the draft report on the revision of the Fuels Ordinance (the national consultation process runs until 20 August 2004), requires those who are subject to the substitution requirement to place on the market from 1 April 2005 a proportion of 2,5% biofuels or other renewable fuels calculated on the basis of the total energy content of the petrol and diesel placed on the market in the transport sector each year by those subject to mineral oil tax in Austria. This proportion should increase to 4,3% from 1 April 2007 and to 5,75% from 1 April 2008. Persons subject to the substitution requirement are any taxable persons in accordance with Article 22 of the Mineral Oil Tax Law, who are liable to tax for petrol or diesel in accordance with Article 2(1) and (2) of the Fuels Ordinance.

11.4 Case analysis

11.4.1 Biomass district heating

Austria has a decentralized population structure and a densely wooded landscape, and has been using wood as an energy resource for centuries and has an important role nowadays. Decentralized heat production from biomass is accepted and promoted by the local and regional authorities. The local council implements planning decisions at the local level. There can be initial opposition to district heating proposals. In some cases where this occurred, public authorities took the lead and established connections to public buildings to demonstrate the benefits. Austria has extensive forestry and other biomass resources that are used as energy resources. Between 1993 and 1998, it achieved significant increases in its level and rate of use of biomass for heat production in general and especially for district heating purposes.

Austria's large biomass resources play an important role in increasing the use of renewable energy. The government and, in particular, the regions provide active political support for biomass energy.

Significant number of new biomass district heating plants has been built in recent years, approx. 50 new installations per annum were registered. As many as 694 plants had become operational by the end of 2001 with a total capacity of 822 MW /6/.

Success factors:

a) Political: National and regional support to expand the use of biomass

b) Fiscal: Energy taxes favor renewable energy schemes

Austria introduced an energy tax on the use of gas (EUR 0,0435/m^3 (cubic metre) + 20% VAT) and electricity (EUR 0,003/kWh + 20% VAT) in 1996. The tax applies to small-scale as well as industrial users. Part of the tax revenue is made available to the Länder and to the communities for the implementation of energy saving and environmental protection measures, including measures to promote renewable energy.

c) Financial: Public grants and subsidies for biomass installations

Support is provided at both the national and regional level for biomass installations, particularly for district heating schemes. Eligible regions have also benefited from EU Structural Funding support targeted at renewable energy schemes including biomass.

The support includes:

- subsidies of 10–30 % of eligible costs through a national environmental support program;
- regional support plans that provide subsidies of up to one third of the costs;
- local and regional support targeted towards private households to subsidise the cost of connection to heating networks;
- special support programs by the farmers' association to encourage farmers to invest in biomass plants.

- **Administration: Long history of public support for and use of biomass as a fuel resource**

d) Technological development: Indigenous manufacturing expertise

New technological developments for biomass production processes are supported both within Austrian universities and in association with industry. There is already a well-established local industry that developed to meet the demand for new biomass district heating plants, including boiler and pipework manufacture, and installation services.

e) Information, education and training:

Long history of use of biomass as fuel, benefits to key local economic actors from biomass projects, promotion of benefits from biomass use by energy agencies. Biomass use is very well established and accepted in Austria, both at the local level for small scale applications and at the industrial level, due to the country's extensive wood-based industries. At the larger-scale and industrial level, farmers are supportive of new biomass projects because of the additional income that will be generated. Wood users such as sawmills also benefit because they have an additional market for their wood wastes. These actors, in particular the farmers, have been key in increasing public acceptance of biomass projects. At the local level, most regions carry out active dissemination activities to promote the economic and environmental benefits from using biomass as a fuel by individuals or communities. These activities are usually coordinated through regional or local energy agencies, which place strong emphasis on the importance of institution building and on activities in the information, communications and training sectors. The overall result of these activities is that the general public is well informed about the benefits and use of renewable sources.

11.5 Conclusion

In order to promote Renewable Energy Sources Austria combines various support schemes. Most important are: feed-in tariffs for renewable electricity production combined with tax policy and investment subsidies. Support is provided at national, regional and local level by legislation and various promotion programs. Instruments evolve over time, support schemes are improved to obtain better effects at lower costs.

Two lessons learned in Austria in the field of promotion of Renewable Energy Sources are very important. A successful mix of supporting instruments (investment subsidies, tax policy, technological development subsidies and education, promotion and training activities) lead to significant development of biomass heating systems.

The schemes for promotion of electricity production from Renewable Energy Sources evolved over time. Nation wide feed-in tariffs for electricity produced from RES introduced by Green Electricity Act are much more transparent and easy for implementation as nine regional schemes in force before January 2003. Nation wide scheme allows more cost effective use of resources.

11.6 References

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12 Legislation and update of the development of geothermal energy in Greece

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12.1 Introduction

Greece is rich in geothermal potential, with low enthalpy geothermal resources present in many locations at shallow depth and high enthalpy resources available in the islands of the Aegean volcanic arc. Geothermal development in Greece is rather limited and is growing with a rate of around 10% annually. It corresponds mainly to 35 ha of greenhouses and soil heating, as well as in 56 spa centres [1], [2] and [3].

a. Highlights for years 2001-2004.

The highlights for the years 2001-2004 include the ongoing projects of binary power generation and seawater desalination in Milos island and the district heating of public buildings with warm groundwater and heat pumps in Langadas, as well as the completed project for heating and cooling of the new Town Hall of Pylaia, Thessaloniki with geothermal heat pumps (see Tables 1 through 4 in the end of the report).

Current Status of Geothermal Energy Use (based on [1] and [2])

a. Electricity Generation

i. Installed capacity: none

b. Direct Use (see also Tables 1-4)

i. Installed thermal power:

	MWth
Ground coupled heat pumps	4
Space heating	1
Greenhouses and soil heating etc.	32
Seawater desalination & Drying	2
Bathing (spas)	36
Total	75

ii. Thermal energy used (include capacity factor). Load factors for geothermal applications in Greece are approximately 30% for heating applications and 15% for bathing. Overall thermal energy used is estimated at around 135.000 MWh.

iii. Category use (space heating, bathing, heat pumps, etc). Geothermal applications in Greece include heating of greenhouses, soil heating for asparagus cultivation, bathing mainly for curative purposes and secondary for recreation, space heating of a spa hotel and offices with floor heating systems, antifreeze protection in aquaculture, seawater desalination, drying of agricultural products, as well as groundwater or borehole heat exchangers coupled heat pumps for heating and cooling.

iv. New developments during 2001-2004: New developments during the last couple of years include approximately 5 ha of new geothermal greenhouses in Lesvos island, Nea Apollonia and Nigrita, operation of the old greenhouses in Nea Kessani, the antifrost protection of the fish farming ponds of Porto Lagos, the seawater desalination unit of Kimolos island, the tomato drying unit of Neo Erasmio near Porto Lagos, as well as a few ground coupled heat pumps systems for heating and cooling. They include the mining engineering building in the National Technical University of Athens campus, the new Town Hall of Pylaia in Thessaloniki, the European Centre for Public Low in Legraina near Athens and the new office building of CRES in Pikermi near Athens. Several projects have been under development including soil heating, district heating with groundwater source heat pumps (Langadas) and seawater desalination (Milos – coordinated by GSD).

v. Rates and trends in development. Non-spa direct heat applications of geothermal energy increase with a rate of 8 to 10% annually. New trends in development include deeper production wells (500-800m) tapping resources around 60 to 80ºC, and cascade utilisation.

vi. Energy savings. Geothermal utilisation in Greece results in at least 135.000 MWh annual energy savings [1].

12.2 Market Development and Stimulation

a. Support Initiatives and Market Stimulation Incentives

- Provision of financial support to geothermal investments from national programs.
- Electricity produced by Renewable Energy Sources is purchased in priority at a fixed high price by the power transmission system operator, calculated on the basis of the supply tariffs for medium voltage clients of the Public Power Co. and the corresponding charges for using the power grid are reduced.
- Tax exemptions are foreseen for domestic use of Renewable Energy Sources.

b. Development Cost Trends (well drilling, etc.)

- Borehole Heat Exchangers construction: 50-90 € per meter depth (single U-tube, including connection to heat pumps).
- Well drilling: 80 € per meter depth for shallow wells (100 m) up to 470 € per meter depth for deep wells (800 m).

12.3 Development Constraints (e.g. low cost of petroleum, environmental issues, etc)

The main development constraints in Greece are the virtually high capital costs involved with geothermal energy investments, the necessity for tailor made systems for each application and the direct competition from natural gas, in Northern and Central Greece.

12.4 Current Geothermal Legislation in Greece

The current Greek Geothermal Law 3175 (ΦΕΚ Α' 207/29.08.2003) briefly foresees the following:

- Geothermal or ground energy over 25^{o}C belongs to the state and is managed by the Ministry of Development.
- Geothermal energy under 25^{o}C – Geothermal Heat Pump, special Article 11, simple license for each user from the Prefecture, no annual "fee".
- For Geothermal energy over 25^{o}C geothermal producer/distributor licenses required and are granted only after strict public bidding process with no exception (best offer for the public receives the grant for "geothermal field license").
- Geothermal energy user defined as a separate entity from the geothermal energy producer/distributor.
- Any license issued for 15 years, with possibility of extension for further 15 years.
- Required Bank guarantee issuance for the whole license granting period depending on the predicted entire geothermal potential of the field.
- Annual "fee", depending on actual energy consumed at 5-10% of price of natural gas, determined by the Ministry of Development annually.
- For the cases of Geothermal Energy over 90^{o}C the geothermal license requested and issued from Ministry of Development
- However, for Geothermal Energy over 100^{o}C for main geothermal areas have already been "awarded" to PPC as the sole beneficiary for energy content and its utilization.
- For the cases of Geothermal Energy between 25 and 90 ^{o}C the geothermal license requested and issued from Regional Government where Geothermal field is located.

Extremely difficult not easy to apply Law, except for ARTICLE 11 for Geothermal Heat pumps – where numerous licenses and applications for licenses are already underway and many applications are foreseen.

No real development of geothermal is anticipated especially considering (9), unless another new law or a modification of this one foresees at least liberating from PPC the geothermal fields of over 100^{o}C (these are given to PPC and have an estimated potential of at least 300 MWe – Milos, Kimolos, Nisyros and Lesvos, these have been granted to PPC since 1985, no further development or exploitation has been done yet).

12.5 Financial Data

a. Trends in Geothermal Investment

- Ground coupled heat pumps: Capital costs vary from 500-1200 € per installed $kW_{(th)}$ for units utilising groundwater or surface water, to 900-1600 € per installed $kW_{(th)}$ for units coupled with borehole heat exchangers.
- Direct heating: Geothermal direct heating is very competitive to fossil fuels with corresponding costs amounting to 250-1500 € per installed $kW_{(th)}$.

b. Trends in the Cost of Energy

- Ground coupled heat pumps: Energy costs include mainly electricity costs and amount at 0,022-0,033 € per delivered $kWh_{(th)}$.
- Direct heating: Geothermal energy costs have been estimated at 0,0067-0,038 € per delivered $kWh_{(th)}$.

12.6 Research Activities

a. Focus areas

- Utilisation of 60-120ºC low enthalpy resources (nevertheless presently impossible due to restrictions of over 100°C)
- Ground coupled heat pumps (including combinations of open loop and closed loop configurations)

b. Government Funded (including the European Commission)

- Seawater desalination and binary power production in Milos island
- Heating and cooling with ground coupled heat pumps
- Exploration of deeper (500-800m depth) low enthalpy resources, in geothermal fields of North Greece

Table 12.2: utilization of geothermal energy in Greece as of the 31st December 2004 (excluding heat pumps and balneological use) (after fytikas et al., 2005 and karytsas et al., 2004)

		Maximum	**Utilization**			**Annual tilization**		
Locality	Type	Flow Rate	Temperature (°C)		Capacity	Ave.Flow	Energy	Capacity
		(kg/s)	Inlet	Outlet	(MWt)	(kg/s)	(TJ/yr)	Factor
Nigrita	G	19.5	59	38	1.83	6.67	17.60	0.94
Nigrita	G	10.9	41	28	0.76	4.90	6.40	0.35
Nigrita	G	8.3	60	30	1.04	3.10	12.27	0.37
Nigrita	G	14.0	45	30	0.88	4.70	9.42	0.34
Nigrita*	O	4.8	60	30	0.40	1.54	4.06	0.32

		Maximum	**Utilization**			**Annual tilization**		
Sidirokastro	G	25.8	60	35	2.70	8.52	25.09	0.30
Sidirokastro	G	13.9	37	20	0.64	5.29	7.68	0.38
Lagadas	G	5.6	36	20	0.37	1.96	4.14	0.35
Lagadas	G	5.3	37	25	0.42	2.75	4.35	0.33
N.Apollonia	G	7.0	40	32	0.41	2.55	4.71	0.36
N.Apollonia	G	13.9	42	28	0.61	4.60	8.86	0.35
N.Apollonia	G	16.7	46	22	1.68	6.35	20.10	0.38
N.Apollonia	G	11.0	45	30	0.60	3.70	7.32	0.34
Nimfopetra	G	19.4	42	25	1.38	6.68	14.96	0.34
Eleochorio	G	5.6	30	20	0.23	1.74	2.30	0.31
N.Erasmio	C	22.2	60	25	3.25	5.33	24.61	0.24
N.Erasmio	A	9.7	58	52	0.24	1.94	1.54	0.20
N.Erasmio	F	40.0	42	5	5.69	10.40	40.04	0.26
N.Erasmio	H	0.8	42	32	0.03	0.25	0.33	0.31
N.Kessani	G	5.6	60	30	0.70	2.07	8.19	0.37
Thermes Xanhi	H	0.6	51	49	0.01	0.30	0.08	0.37
Aristino	G	5.6	62	30	0.75	1.97	8.31	0.35
Trainoupoli	H	16.0	52	35	1.14	5.00	12.56	0.35
Polychnitos	G	16.7	80	30	0.14	5.70	33.82	0.34
Geras	G	5.6	38	25	0.30	1.90	3.28	0.34
Milos	G	4.2	46	24	0.39	1.02	2.96	0.24
Porto Lagos	F	40	27	5	3.18	10.10	25.31	0.25
Kimolos**	O	22.2	62	42	1.56	8.88	23.45	0.40
TOTAL		**377.1**			**34.73**		**346.30**	

*Cultivation of spirulina **Water Desalination

Table 12.3: ground-source heat pumps installed from 2001 to 2004 (after fytikas *et al.*, 2005 and karytsas *et al.*, 2004)

Locality	**Ground or water temperature (°C)**	**Typical Heat Pump Rating or Capacity (kW)**	**Number of units**	**Type**	**COP**	**Heating Equivalent Full Load (MJ/Year)**	**Thermal Energy Used (TJ/Year)**
Pilea Thes/niki	Ground	305	3	V	4	2500	2.1
Skopelos	Ground	15.4	5	H	4	1500	0.1
Himathia	Ground	43	4	H	3.8	1800	0.2
Thessaloniki	Ground	68	4	H	3.8	1700	0.3
Katerini	Ground	20	1	H	4.2	1800	0.1
NTU Athens	G-W	526	2	V	2.9	2500	0.1
TOTAL		**977.4**	**19**				**5.8**

Table 12.4: summary table of geothermal direct heat utilization as of 31 december 2004 (after fytikas *et al.,* 2005 and karytsas *et al.,* 2004)

Use	**Installed Capacity (MWt)**	**Annual Energy Use (TJ/yr)**	**Capacity Factor**
Individual Space Heating[4] District Heating[4] Air Conditioning (Cooling)	1.20	14.3	0.35
Greenhouse Heating	22.18	231.2	0.33
Fish Farming	8.87	72	0.25
Agricultural Drying[5]	0.24	1.5	0.20
Bathing and swimming[7]	36.00	161.6	0.16
Spirulina Cultivation	0.40	4.1	0.32
Water desalination	1.86	23.4	0.40
Subtotal	70.75	528.1	
Geothermal Heat Pumps	4.00	39.1	0.31
TOTAL	**74.75**	**567.2**	**0.25**

[4] Other than heat pumps

[5] Includes drying or dehydration of grains, fruits and vegetables

[6] Excludes agricultural drying and dehydration

[7] Includes balneology

Table 12.5: wells drilled for use of geothermal resources in Greece from 2000 to 2004 (excluding wells for heat pump) (after fytikas *et al.,* 2005 and karytsas *et al.,* 2004)

Purpose	**Wellhead Temperature**	**Number of Wells Drilled (Direct use)**	**Total Depth (km)**
Exploration	(TOTAL)*, **	10	3.9
Production	>150°C*	NONE	NONE
	150-100°C*	NONE	NONE
	<100°C**	40	9.65
Reinjection	(TOTAL)**	5	0.9
TOTAL		**55**	**14.45**

* According to Greek Legislation the PPC is responsible for all known geothermal fields over 100°C

** Private SME enterprises proceeded exploration, production and reinjection for geothermal fields under 100°C, with a total expenditure of over 5.000.000 EURO in years 2000-2005

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[2] Karytsas, *et al.* (2004) “Exploitation of geothermal energy in Greece and European Union” Bulletin of the Geological Society of Greece vol. XXXVI, 2004 Proceedings of the 10th International Congress, Thessaloniki, April 2004

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13 Experiences of Albania in regulatory framework to support Renewable Energy Sources penetration

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Abstract: This document presents the experiences of Albania in regulatory framework to support Renewable Energy Sources penetration in the country.

13.1 RES installations

The electricity sector in Albania is dominated by the state owned utility, Korporata Elektroenergjitke Shqiptare (KESH), which serves approximately 700,000 customers, and is responsible for generation, transmission and distribution. Total installed generation capacity in Albania is 1659 MW, including 1446 MW hydro and 213 MW thermal[21]. Albania has major hydropower potential of which only 35% is so far being exploited. Power supply is heavily dependent upon generation from large hydroelectric plants on the Drin River, with three units totalling 1,250 MW. KESH also owns 83 small hydro units of 1-2 MW each and one major thermal plant with an available capacity of about 90 MW (Ministry of Industry & Energy, 2002). The 83 small hydro plants are in the process of being privatised. The first thermal power plants installed in Albania in the early and mid 1950s at Tirana (coal), Maliq (coal), Kucova (heavy fuel oil), Vlora (heavy fuel oil) and Cerrik (heavy fuel oil) had capacities smaller than 10 MW.

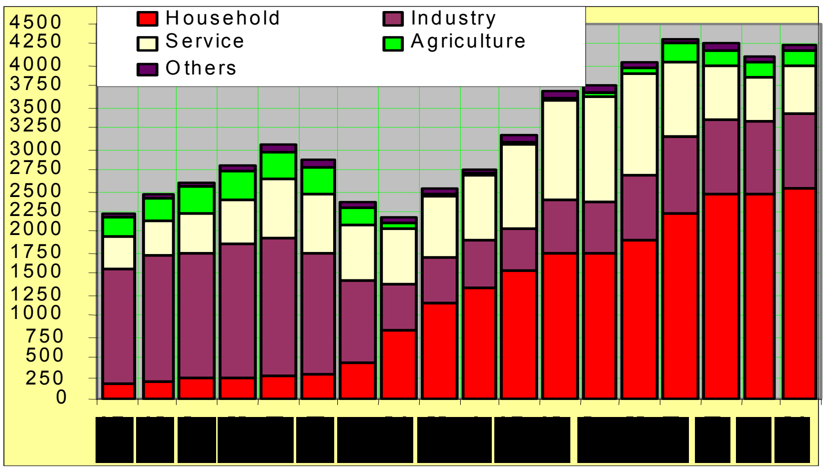
The Albanian Power System relies practically only on hydropower plants (99 %) and therefore it is totally dependent on hydrological conditions that means that it is vulnerable and unreliable. It is important to point out that Drin River Cascade production system can supply the installed yearly capacity only if the cascade accumulation basins are refilled fully six times per year. During the last two seasons, water inflow was the lowest ever recorded, so refilling of the basins has been far below the requirements.

Since 1997 Albania has experienced serious power supply problems, caused mainly by voltage fluctuations, and network faults. However, frequent and extended supply interruptions began in 2000, when abnormally high demand, together with reduced hydroelectricity production caused by reduced river flows, precipitated a substantial supply deficit. Albania imported 1,750 GWh of energy in 2001 (up from 1,000 GWh in 2000), however load shedding was equal to 14% of total electricity

[21] Ministry of Industry & Energy

demand[22]. In 2002 the power system fulfilled only 70-80% of the total demand during the peak winter period, causing further load shedding to customers[23]. Due to the ongoing unreliability of supply, auto-generation now accounts for 15% of total consumption for small industries and commercial enterprises. Albania's capacity to import electricity is also constrained by a transmission system that is in need of rehabilitation and upgrades to expand its capacity. Almost the entire population has access to electricity supply, although problems with blackouts are frequent. In some rural areas electric power is off on average for 9 hours per day[24].

Electricity consumption in Albania by economic sector (GWh)[25]



Domestic growth has been attributed to booming sales of domestic appliances, low tariffs and the increasing use of electricity as a heat source in preference to wood (EU Energy Efficiency Centre). Data from EU-EEC has shown that approximately 50% the increase in household electricity consumption is attributable to "non-thermal" uses, i.e. appliances such as washing machines, refrigerators, TVs and air conditioners, as opposed to heating, cooking and hot water.

Albania does not have a district heating system, nor a natural gas distribution network. Therefore for the majority of households, the main sources of energy are electricity and wood. Due to the regularity of blackouts in winter, households use alternative means of heating during winter, most commonly wood. The substitution of electricity with other sources of energy, both renewable and non-renewable is a major component of the Government's action plan for the energy sector. This plan focuses on promoting alternative fuels as a key strategy for achieving the objective of

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[22] Ministry of Energy, 2002

[23] Government of Albania, 2002

[24] World Bank 2001

[25] Source: Ministry of Industry & Energy (2003)

lowering electricity demand in the household sector. In particular the substitution of electricity for space heating and cooking with LPG is to be supported in the following ways:

- Removal of customs and excise taxes for LPG, as well as the establishment of a ceiling price for a period of 2-3 years
- Increasing the role of Government in controlling oil by-products and LPG, in order to increase their quality.
- Launch public awareness campaigns to present the advantages of LPG use as an alternative energy source for space heating and cooking purposes.

The Government will also promote the use of solar panel technology for domestic hot water use, which has successfully penetrated in Greece and Turkey. Funding for public services will come from the state budget, whilst householders will be required to make their own investments. The Government's intended role is to create the necessary economic and institutional conditions that will encourage growth of this sector. The Alliance to Save Energy counterpart organization in Albania is the EU funded Energy Efficiency Centre (EU-EEC), which is promoting rational use of energy and adoption of renewable energy technologies. The EU-EEC's focus is firmly on reducing electricity consumption at all levels as well as promoting renewable technologies such as solar power.

The second strategic option to ease the affordability burden in Albania concerns energy efficiency. It is clear there is considerable scope for improving household energy efficiency as a way of lowering current levels of wasteful consumption and thus affordability problems. The Government should be pro-active in promoting energy efficiency by recognizing this as the most cost-effective strategy for reducing electricity consumption. Even small scale home improvement measures can have a significant impact upon consumption levels and as a one off investment will provide energy efficiency benefits which will pay back the cost many times over in the longer term. It is therefore recommended that the Government provide funding for energy efficiency measures for the poorest households, to help reduce consumption levels.

The private operation of Small Hydropower Plants (SHPPs) in Albania was initiated in 1999 with the promulgation of a law permitting the privatization of state assets in the electricity sector. The privatization of the SHPPs, which were operated by KESH, was initiated and undertaken by the Ministry of Economy and Privatization/Albanian Agency for Privatization, followed by the Ministry of Industry and Energy. The contractual arrangements for the private operation are: ROT - rehabilitate, operate and transfer; ROO - rehabilitate, own and operate; BOT - build, operate and transfer; BOO - build, own and operate. The potential of identified medium & small sized HPPs in Albania is estimated to be about 180 MW at 127 identified sites. The HPPs under private operation are three medium sized HPPs of a total capacity of 14.0 MW (given in concession).

With regard to the 83 SHPPs, which were previously operated by KESH, the situation is:

- 29 SHPPs - given in concession,
- SHPPs - privatized,
- 22 SHPPs - planned for future privatization,
- SHPPs - considered out of use, but there are expressions of interests for their private operation.

Ex-Albanian Institute for Energy (it was under KESH) prepared an assessment of 41 new sites for medium sized hydropower plants. It was reported that for about 10 new concession projects or sales, contracts were signed.

13.2 Legal framework for RES installations

Albania is a Party to the UN Convention on Climate Change (UNFCCC) as of January 1995, and as of December 2004 Albania's Parliament adopted the draft law on ratification of the Kyoto Protocol. There are three mechanisms proposed by the Kyoto Protocol: (i) Joint Implementation; (ii) Emission Trading; (iii) Clean Development Mechanism (CDM). Of these three mechanisms, given the status Albania has it is eligible for the CDM only. This mechanism enables developed countries that are Parties to the Protocol, to reduce shares of their emission targets at lower cost through funding of projects that transfer new technologies to the non - Annex I Countries (like Albania). In turn, these projects besides the transfer of new and clean technologies will promote the sustainable development in non - Annex I Countries. Ratification of the Kyoto Protocol from Albania will serve mainly to promote the sustainable development through the promotion and diffusion of the new and clean technologies, protection of the environment at national and global level by accepting that the global nature of the climate changes requires a wide cooperation among countries according to their common but differentiated responsibilities and in the line of their socio-economic circumstances. This ratification would not bring any financial implications to Albania due to the status that our country enjoys (non - Annex I), which does not bring any emissions reduction target. By the other side, the ratification enables Albania that through CDM mechanism attract new investments / projects in the field of energy, transport, environment, forests, etc., by facilitating the implementation of the sectorial action plans that derives from respective strategies. This is the case of the National Energy Strategy, which reflects very well environmental concerns, particularly climate change related concerns such as greenhouse gas emission reduction. This strategy has highly stressed the need of ratification of the Kyoto Protocol by Albania.

According to the inventory funded by the Global Environment Facility (GEF), from the Albania's territory have been released about 7 million ton CO_2 equivalent GHG emissions or 1.9 ton per capita. These emissions values are relatively low compared to other countries and are justified with the fact that around 95 % of the electric power is generated by Hydro Power Plants. Although Albania's contribution to the global warming is at low levels, referring to the scenarios of emissions developed under the FNC, it is expected that the emissions level for 2004 to be 8,4 million ton CO_2 equivalent, while for 2015 the emissions level to be at least 5 times higher compared to 1994. The CDM can contribute to that point. For example, if a developed country funds a project under the CDM in Albania, this country will obtain credits called Certified Emission Reduction (CERs) according to the rules set by the Executive Board of the CDM. These credits will be accounted in the basis of the emissions reduced in Albania through this project. Albania is not eligible for such credits as long as it will be non - Annex I Country of UNFCCC. But, Albania benefits the project, which helps it to be developed in a sustainable manner.

The progress has been achieved in implementation of the Action Plan to improve power sector performance, the implementation of the sector reforms included in the National Strategy of Energy adopted by the Government in June 2003, and the Power Sector Policy Statement adopted by the Government in June 2003 April 2002

The Government is proceeding with implementation of its commitments under the Athens MOU in terms of:

- primary and secondary legislation,
- electricity market implementation,
- energy efficiency and environmental legislation, and
- investment projects needed for market opening.

The Albanian Electricity Regulatory Entity is setting attractive selling/purchase tariffs, and the new price for 2004/2005 is 4.3 Lek/kWh (0.034 Euro/kWh). These tariffs are valid for one year. The commercial relations between KESH and the private operators were initiated only recently and only few power purchase contracts were signed up to now. The contracts have duration of one year.

With respect to GHG measures proposed even in the Action Plan of the First National Communication, the two of 4 GEF Operational Programs under the focal area of Climate Change are:

- The second operational program "Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs" has the objective to remove the barriers to the use of commercial or near-commercial renewable energy technologies. The projects of such category include the usage of solar panels for hot water preparation/space heating, usage of photovoltaic cells for electricity generation, usage of biomass/solid wastes for energy purposes, methane gas production from landfills technologies, usage of wind power, usage of small HPPs for electricity generation, usage of geothermal energy, etc.
- The third operational program "Reducing the Long-Term Costs of Low Greenhouse Gas - Emitting Energy Technologies" has the objective to accelerate technological development and increase the market share of low gas-emitting technologies that have not yet become commercial least-cost alternatives, but which show promise of becoming so in the future. The projects of such category include photovoltaics for grid-connected bulk power and distributed power, advanced biomass power through biomass gasification and gas turbines, solar thermal-electric technologies in high insolation regions, wind power for large scale grid connected applications, etc.

13.3 Best practices

Within the framework of the economic cooperation between EBRD and Albanian Government, a Loan Agreement was signed between KESH and EBRD on November 22nd, 1994 and approved by the Council of Ministers. EBRD has provided the financing for Drin River Cascade Rehabilitation Project in collaboration with Austrian Government, Swiss Government and Japan Bank for International Cooperation (JBIC).

The management of the whole project is assured by a Project Management Unit conducted by KESH who is assisted and advised in this task by the Consultant - Colenco Power Engineering Ltd./ Switzerland, approved by EBRD. The Drin River Cascade Rehabilitation Project concerns four of the country's hydropower stations (two on Drin River, two on Mat River), representing over half of the total installed capacity.

The Government of Albania, through the Ministry of Industry and Energy, has started the negotiations with the consortium of GE Wind Energy GmbH and General Electric International, Inc. These wind turbines are "GE Wind Energy" type and the total installed generation capacity will be about 220 MW. The agreement for purchasing the energy will be signed between the local operator and KESH. The agreement will incorporate an element for the price regulation that will be based on a reference price per kWh, which will be defined by the Energy Regulatory Authority.

The total planed investments in 2005 and 2006 are about 1,336 million Lek or about 15.66 million Euro. Considering an own participation of about 30%, these investments plans would require a loan financing of 11.0 million Euro. In any case, without access to loan financing, these investments will not be realized.

13.4 Lessons learned

The Energy Sector is one of the most important components of the infrastructure in Albania and electricity remains the main energetic resource to fulfill the growing demand of industrial consumers, service sector and population. The high rate growth of electricity consumption in all economic sectors, especially the tremendous growth of consumption of this energy source in the residential sector, in addition to the lack of new generating capacities in the last 15 years, have put in serious difficulties our Power System to provide normal electricity supply to consumers, leading it to limits of a crisis during the last two years. The high electricity consumption especially for electric space heating, has diverted a valuable resource away from commercial and industrial uses that would otherwise create jobs and contribute to economic growth. In addition of difficulties to supply electricity to customers, KESH has been in financial distress and would be unable to meet operating expenses in the absence of the Government subsidy.

13.5 Main barriers to the development of RES

The importance of the SHPPs option for the Government is underlined by the fact that a positive environment, as described below, is created:

- Flexible privatization process: The privatization is handled in a flexible way, this means that a number of legal and regulatory issues have still to be clarified in the future.
- One-window approach: The applicants have only one contact within the Ministry of Industry and Energy; the dossiers and requests are then handed over to other Ministries.
- Promotion: The import of required equipment is exempt from import taxes.
- Price setting: The Albanian Electricity Regulatory Entity is setting attractive selling tariffs.
- Payment discipline of KESH: There were no complaints with regard to the cooperation with KESH. KESH has paid the new private operators.

The interviewed operators characterized lending attitude of the Albanian banks as follows:

- The banks require very high collaterals.

- Banks approached by the SHPPs operators refused to become involved in this new sector, which is considered as too innovative and not yet sufficiently developed.
- Electricity prices are fixed only for one year. There are no long-term price guarantees.
- The concession contracts cannot be used as collateral.

14 Experiences of Bulgaria in regulatory framework to support Renewable Energy Sources penetration

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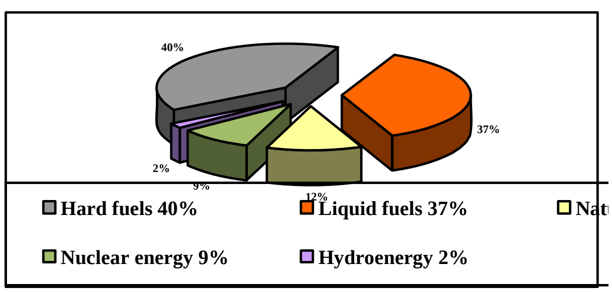
Abstract: This document presents the experiences of Bulgaria in regulatory framework to support Renewable Energy Sources penetration in the country.

14.1 RES installations

Bulgaria is heavily dependent on energy as it imports more than 70% of its primary energy sources. The only significant domestic energy source is low-quality lignite coal with high content of sulphur. Bulgaria is mainly reliant on energy sources from Russia: oil, natural gas, high-quality coal and nuclear fuel. This structure of the energy balance causes concern in terms of the security of energy supply.

Bulgaria's primary energy balance is well structured in terms of diversity of the energy sources used, but at the same time there is heavy reliance on import:

The primary energy balance structure (70% import)



The security of energy supply does not imply the maximum use of local resources or minimum import, but decreasing the risks in the production and supply through diversification of energy sources by type and location and taking into consideration the long-term regional and global trends on the energy sources market.

Efforts to ensure security of supply can be successful only if they are accompanied by an energy-saving policy. And while on the supply side Bulgaria's room for maneuver is limited, the potential for energy saving is quite high. Efficient instruments will be introduced to utilize this potential. This will have a beneficial effect not only on the security of energy supply, but also on Bulgaria’s foreign trade balance in which the import of energy sources amounts to 27%.

The PROMISE project, funded by the European Commission under the ALTENER program, is a 2-year project concluded at the end of 2003. It focuses on the opportunities to integrate Renewable Energy Sources (RES) and rational use of energy (RUE) technologies and equipment managed by local authorities through improved procurement processes.

The objective is to remove barriers for the utilization of RES and RUE in municipalities by elaborating tools and advice to local authority’s staff and by identifying concrete solutions to integrate RES/RUE in public procurement processes. One main aspect to achieve this aim is the implementation of pilot projects to follow the applied tendering and selection procedures of equipment and services in the municipalities and to provide local actors with appropriate information, as well as a set of tools designed to assist them in decision-making and the management of contracts.

PROMISE has the following main objectives:

- to find ways of reducing energy costs for municipalities and thus reducing the negative environmental impacts of energy consumption;
- to develop approaches and tools for local municipality staff to integrate Renewable Energy Sources (RES) and the Rational Use of Energy (RUE) into public procurement processes;
- to train local staff and carry out pilot projects that demonstrate procurement of RES and RUE.

14.2 Legal framework for RES installations

The National Strategy for Energy Sector and Energy Efficiency Development till 2010, adopted by the Council of Ministers and endorsed in principle by the National Assembly in 1999,

- sets long-term universal objectives reflecting the needs of the country for secure energy supply, energy efficiency, environmental protection and nuclear safety

The Government of Bulgaria in its Program for Governance has declared the establishment of a competitive energy market as a top priority for the energy sector.

Through the establishment of the State Energy Regulation Commission (SERC) in 1999 the National Energy Efficiency Review is in a process of preparation with the support of the World Bank. The Review will serve as a basis for drawing up:

- an Action Plan for Energy Efficiency and
- an Action Plan for Renewable Energy Sources.

The goal is to achieve a lasting tendency towards the improvement of the energy intensity indicators by means of a proactive policy for rational use of energy and energy sources.

14.2.1 The main goals of the draft of the Energy Act

- to create legal regulation of the activities in the energy sector in connection with the change in the model of the electricity and natural gas market, providing conditions for creation and development of the competition and the attraction of investment in the energy sector.

- to create prerequisites for high-quality and reliable satisfaction of the needs of society for electric power and thermal energy and natural gas;
- to provide conditions for sustainable development of the generation of electric power and thermal energy from Renewable Energy Sources in the interest of protection of the environment
- to encourage the combined generation of electric power and thermal energy;
- to reduce the regulatory regimes in the energy sector;
- to optimize the legal norms with a bearing on the powers of the government authorities in relation to enforcing administrative penalties and penalty payments and developing in detail the administrative and penal provisions in connection with violations of the licensing terms and conditions;
- to develop in more detail the provisions associated with the real rights in favor of the energy enterprises.

14.2.1.1 Electricity generation by Renewable Energy Sources

The electricity from Renewable Energy Sources produced by the producer by means of a power plant with a total installed capacity up to 10 MW, as well as the electricity produced by the combined method, with the exception of the amounts covered by contracts concluded with eligible consumers, shall be purchased mandatory by the public supplier and/or public procurement agents, who hold electricity supply licenses.

The Minister of Energy and Energy Resources:

- Develops and submits for adoption by the Council of Ministers of national indicative targets for encouragement of the consumption of electricity, generated from Renewable Energy Sources and draws up reports of the accomplishment of those targets;
- Determines mandatory minimum quantities for generation of electricity from Renewable Energy Sources and for combined generation of electricity;

For the purposes of regulating the activities of generation, transmission and distribution of electricity, of transmission and distribution of natural gas, of trade in electricity and natural gas, of generation and transmission of thermal energy, the Commission:

- issues certificate to producers of electricity for the origin of the electricity, generated form Renewable Energy Sources and in co-generation of electricity and thermal energy;
- issues green certificates to producers of electricity, using Renewable Energy Sources and generating electricity and thermal energy in a combined manner;

The Commission determines preferential prices for sale of electricity, generated from Renewable Energy Sources, which are indicated in Article 157, paragraph2 and from co-generation by plants with combined generation of electric and thermal energy, as shown in Article 160, paragraph2.

The Minister of Energy and Energy Resources exercises advance, current and follow-up control over:

- compliance with the obligation of each electricity producer for generation of electricity from Renewable Energy Sources and combined generation of thermal energy and electricity in accordance with the mandatory quotas, determined by the Minister of Energy and Energy Resources in accordance with Article 159, paragraph2 and under Article 161, paragraph2.

Heat energy generation shall be carried out in:

- plants for combined production of heat energy and electric power;
- heat generation plants;
- installations utilizing waste heat energy and renewable sources of energy.

14.2.1.2 Promoting power generation from Renewable Energy Sources and combined generation

Section I Electric power generation using Renewable Energy Sources:

- The National indicative targets for_demand of electric power generated from Renewable Energy Sources are set as a percentage of the gross annual electric power demand in the country for the following ten years by the Council of ministers of the Republic of Bulgaria at the proposal of the Minister of Energy and Energy Resources

For the purpose of achieving the national indicative targets the electric power generation from Renewable Energy Sources shall be promoted while:

- taking into account the principles of electric power market;
- taking into account the characteristics of the different Renewable Energy Sources and electric power generation technologies;
- ensuring an effect least equivalent to preferential treatment of electricity producers with a view to their income per unit of generated electricity in case of changes in the development mechanism.

The public supplier and/or public providers who are granted an electricity supply license shall buy out the entire volume of electric power generated in a plant using Renewable Energy Sources with the exception of the volumes for which the producer has entered into contracts pursuant to Chapter Nine, Section VII or with which he participates in the balancing market.

The public supplier and/or public suppliers shall be obliged to buy out the electric power generated in a plant with total installed capacity up to 10 MW using Renewable Energy Sources at preferential prices pursuant to Article 34, Paragraph 3.

The transmission company and the distribution companies shall be obliged to connect by priority a power plant generating electricity from Renewable Energy Sources with total installed capacity up to 10 MW to the transmission network and the distribution network respectively.

The costs of connecting the power plant to the respective network up to the property boundary of the electrical switchgears shall be covered by the producer.

The expansion and reconstruction of the transmission and/or distribution networks involved in connecting the power plant pursuant to Paragraph 1, shall be the responsibility of the transmission and respective distributor company.

For the purpose of carrying out expansion and reconstruction of the networks under the preceding Paragraph, the transmission and/or respective distributor company shall have the right to apply for financial support from the “Energy Efficiency” Fund.

The mandatory buying out of electric power pursuant to Article 157 shall be applied until the time of setting up a system for issuing and trade in green certificates.

The Minister of Energy and Energy Resources specifies the minimal mandatory quotas for electric power generation from renewable sources as a per cent of the total annual generation by each producer for a ten-year period as of the date of introduction of the system for issuing and trade with green certificates.

Each producer shall be considered to have fulfilled his obligation under Paragraph 2 upon submission, to the Minister of Energy and Energy Resources, of green certificate(s) indicating the volume of electric power from Renewable Energy Sources comprising its obligation; such certificate(s) shall be:

- issued by the producer and/or;
- bought from another electric power producer, as the sale/purchase transaction shall be considered effective on condition that it was entered into the register pursuant to Article 23, Paragraph 1, item 4.

The terms and conditions for issuing of certificates of origin and trade with green certificates shall be settled in an ordinance issued by the Minister of Energy and Energy Resources.

Mandatory buying-out of electricity at preferential prices pursuant to Article. 157, Paragraph 1 shall be applied until the establishment of a system for issuing of and trade with green certificates.

The Minister of Energy and Energy Resources specifies the minimum volumes of electric power from combined generation for each producer as a percent of the total annual output by each producer for a period of ten years as of the date of introduction of the system for issuing of and trade with green certificates.

A penalty payment from 30 to 90 Leva per each MWh of outstanding obligation shall be imposed on any energy company which fails to observe the terms and conditions for fulfilling its obligation for generation of electricity from Renewable Energy Sources or and generation of electricity by combined heat/power generation method in compliance with the mandatory quotas as fixed by the Minister of Energy and Energy Resources pursuant to Article. 159, Paragraph 2 and Article 161, Paragraph 2.

In case of repeated violation the penalty payment shall be three times the maximum amount of the sanction under Paragraph 1.

14.3 Best practices

According to recent assessment made by Sofia Energy Agency some 280 m^3/h landfill gas now evolved to the atmosphere can be recovered and utilized in a gas engine with 500 kW electrical and 800 kW heat capacity. The period of exploitation of the power station will be extended after starting to use the second part of the landfill in 2006. Then the electrical capacity will be increased to 2,5 MW and emissions of 5 000 tons/yr CH_4 (110 000 tons CO_2 equivalent) will be avoided. Some preliminary calculations were made in order to define the investment (EUR 3 million) and O&M costs (EUR 200 000 annually) needed. The simple payback period was estimated to be 5 years. As a part of the investigation, some preliminary contacts with potential investors from Netherlands and Denmark were established. Possibilities to use mechanisms like Joint Implementation (Kyoto Protocol) or the scheme Built-Operate-Transfer (BOT) were discussed on municipal level.

14.4 Lessons learned

Energy intensity measured as an amount of primary energy sources per GDP unit (a ton of oil equivalent to US $ 1,000) is one of the key measures of energy efficiency and an important component of a nation's competitiveness. Bulgaria's place in Europe measured by this indicator can be seen in the following table and figure:

Energy intensity, in t.o.e./$1,000 of GDP

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Bulgaria	1.96	1.91	1.74	1.72	1.88	1.83	1.91	2.19	2.23	2.03	1.57
Czech R	0.97	0.91	0.94	0.86	0.83	0.78	0.73	0.75	0.74	0.72	0.74
Hungary	0.59	0.59	0.64	0.60	0.59	0.59	0.59	0.59	0.55	0.53	0.49
Poland	1.08	1.03	1.06	0.97	0.95	0.90	0.84	0.83	0.76	0.66	0.59
Romania	1.55	1.37	1.30	1.37	1.31	1.20	1.20	1.14	1.14	1.09	1.28
Slovakia	1.08	1.04	1.12	1.13	1.12	1.05	1.00	0.94	0.90	0.86	0.82
EU	0.19	0.19	0.19	0.18	0.19	0.18	0.19	0.18	0.17	0.16	0.15

For 2000 this indicator is 1.84 t.o.e./$ 1,000 of GDP. The contrast is evident. The market economies, as well as the transition economies in Central Europe have a significant edge in terms of energy intensity per production unit. The Bulgarian economy cannot be competitive until it continues to consume 10 times more energy than the economies in Western Europe and two to three times more than the Central European economies. Even more alarming is the fact that while in all other countries a sustainable downward trend can be observed, the Bulgarian economy continues hovering around the highest values reached by it.

The coal-fired Thermal Power Plants (TPPs) emit about 80% of the country's emissions of sulphur oxides and about 60% of the emissions of carbon dioxide.

In 1995 Bulgaria ratified the UN Framework Convention on Climate Changes. In accordance with the Kyoto Protocol signed under the Convention in December 1997, Bulgaria made the commitment to reduce anthropogenic emissions of greenhouse gases by 8% compared to the emissions of 1998.

In case of the Kyoto Protocol ratification, in conformity with the commitments arising from the Protocol, strategy provides for the provisions to undertake in electricity and heat generation:

- Preservation of the nuclear energy share in the overall energy balance of the country through construction of new nuclear capacities
- Increase in the share in the national balance of the electric and thermal power plants, using natural gas
- Priority construction of cogeneration plants
- Increase in the share of energy generated by Renewable Energy Sources in the national energy balance through implementation of a preferential policy for their development

14.5 Main barriers to the development of RES

Renewable energy sources (RES) represent another local source that can help reduce reliance on import, improve the security of energy supply, meet the commitments to protect the environment and contribute to employment generation. Moreover, much of the RES (biomass, small hydropower plants, geothermal energy, etc.) have a significant resource, technical and economic potential. Nevertheless, being used irregularly and insufficiently, their share in the total gross energy consumption is negligible. A serious obstacle to their development is the higher cost of initial investments. To overcome the existing barriers, an Action Plan will be drawn up that will include an integrated approach and instruments for the promotion of RES, as well as a campaign for their accelerated development.

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