ENERGY EFFICIENCY IN SERBIA
National energy efficiency program – strategy and priorities for the future

by

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Energy system in Serbia, in the whole energy chain, from exploitation of primary energy sources, transformations in electric power plants and district heating plants, energy (electric and heat) transmission and distribution to final users, and up to final energy consumption, is faced with a number of irrational and inefficient behavior and processes. In order to fight with such situation National Energy Efficiency Program, financed by the Ministry of Science and Environmental Protection has been founded in 2001.
Basic facts about status of energy sector in Serbia, with special emphasis on the energy efficiency and use of renewable energy sources have been given in the review paper published in the issue No. 2, 2006 of this journal.
In present paper new strategy and priorities of the National Energy Efficiency Program for the future period from 2006 to 2008, and beyond, is presented. This strategy and priorities are mainly based on the same concept and principles as previous, but new reality and new and more simulative economic and financial environment in energy sector made by the Energy low (accepted by Parliament in 2004) and Strategy of Development of Energy Sector in Republic Serbia up to 2015 (accepted by the Parliament in May 2005), have been taken into account. Also, responsibilities that are formulated in the Energy Community Treaty signed by the South-East European countries, and also coming from documents and directives of the European Community and Kyoto Protocol are included in new strategy.
Once again necessity of legislative framework and influence of regulations and standards, as well as of the governmental support, has been pointed out if increased energy efficiency and increased use of renewable energy sources are expected.

Key words: *energy, energy efficiency, renewable energy sources, energy policy, R&D&D projects in energy efficiency*

Introduction

Basic facts about status of energy sector in Serbia, with special emphasis on the energy efficiency (EE) and use of renewable energy sources (RES) have been given in review paper published in the issue No. 2, 2006 of this journal [1]. In this paper, also, National Energy Efficiency Program (NEEP), founded in 2001 and financed by the Ministry

of Science and Environmental Protection, has been described in details. Specially, Strategy and Priorities of the NEEP, and basic topics considered in the demonstration (D) and research development and demonstration (R&D&D) projects in the period 2002-2005 have been listed.

In the period from 2002 to 2005, there were announced 5 open invitations for submission of the project proposals for nine Development programs consisting NEEP and in total 140 projects and 25 studies have been selected for financing and realized in this period. In the mentioned projects and studies many valuable results have been obtained. This issue of the journal *Thermal Science* is conceived to present most interesting results obtained in the frame of NEEP in the period 2002-2005, by presenting results of 21 projects in 21 papers written by the leaders of the projects and researchers engaged in their realization.

Having in mind many changes and activates realised in the period 2002-2005, in present paper Strategy and Priorities of the NEEP in the future period 2006-2008 is described. In the past four years period, in spite of the results achieved in the projects and studies financed in the frame of the NEEP, activities of the Serbian Energy Efficiency Agency and the Ministry for Mining and Energy (Energy law and Strategy of energy development in Serbia up to the 2015 has been approved in the Parliament), changes in the fields of EE and use of RES are still at the beginning.

New opinions and actions regarding energy efficiency, energy saving, rational use of energy and use of RES can be noticed both in governmental administration, industry and local authorities as well as at citizens. Also, many scientific and research institutions, faculties, and researchers themselves, changed opinion regarding most interesting scientific and engineering topics, and re-oriented interest towards basic problems and technologies connected with energy efficiency and use of RES.

Those changes and activates were not sufficient to make apparent shift in energy efficiency in Serbia, and to show obviously that energy and natural resources of Serbia are used in rational, efficient, and environmentally acceptable and sound manner. Synergy of many governmental activities, activities of different responsible ministries and in different fields is necessary in order to support and initiate efficient and rational behavior in the whole chain from exploitation of energy resources, production of primary energy up to the final energy consumption in all industrial sectors, in municipal systems, in buildings, and by citizens. Also, synergy of different activities – scientific, research and development, technical and engineering activities, education, and advertising is inevitable. And the most important, legislation and standards have to be formulated to make friendly environment in which energy efficient and rational use of energy, natural resources and use of RES will be also economically valuable.

Based on the results of D and R&D&D projects, and especially based on the many feasibility studies realized in the frame of NEEP in the period 2002-2005, and having in mind tasks and problems, and also responsibilities connected with approaching to the European Union energy system and criteria, Board of Directors of the NEEP formulated new strategy and priorities for the next three years period 2006-2008. This strategy also takes into account requirements that have to be expected in much longer future pe-

riod, necessary for the increase of the energy efficiency and use of RES, in order to satisfy expected diminishing of the CO_2 emission according to the Kyoto Protocol.

Objectives, priorities and activities of the NEEP in the previous four year's period (2002-2005)

For comparison, Strategy and priorities of the NEEP formulated and accepted by the Board of Directors in the middle of the 2001, are presented again in this place (for details see [1]).

General objectives

Strategy and priority topics of the NEEP for the period 2002-2005 were formulated based on the analysis done in the Strategy of energy development in Serbia up to 2010 [2, 3]:

- increase of safety and continuous energy supply to consumers (industry, district heating, and individuals),
- reduction of dependence on imported energy and fuel, and reduced use of imported oil and gas,
- decrease of the specific energy consumption per unit of gross domestic product (GDP) and increase of competitiveness of domestic industry on the world market,
- more rational and more efficient use of domestic energy resources,
- more rational and more efficient use of energy in general and reducing of production costs in industry,
- reduction of the environmental impact of the power generation equipment,
- implementation of the European standards in energy efficiency and environmental protection,
- smaller impact of energy costs on the prices of industrial products, and
- more favorable ambient for small, medium, and large enterprises, and for development of economy in general.

Specific objectives and priorities

Realization of the NEEP projects has to achieve the following specific goals:

- increased, but rational use of domestic energy resources, local energy resources, and in particular, renewable energy sources,
- reduced use of the imported oil and gas in power and heat production in industry and in district heating,
- reduced use of electric energy for heating households,
- increased, efficient and economical use of waste biomass,
- increased use of alternative energy resources, as municipal and industrial wastes,

– higher efficiency of power production in utility power plants,
– higher efficiency of industrial and district heating plants,
– reduced technical and commercial losses in energy transmission and distribution,
– reduced heat and energy consumption in buildings,
– higher efficiency in end-use of energy in industry, municipal systems and households,
– research, development, demonstration, promotion, and implementation of efficient and clean energy technologies for heat and electric energy production in utilities, industry, district heating and municipal systems, and in households,
– increase of the energy efficiency of domestic appliances and energy labeling,
– decrease of fuel consumption and increase of energy efficiency in traffic, and
– control of environmental impact of power plants and equipment.

Activities in the frame of NEEP have been also devoted to the formulation of the proposals of new regulations, standards and laws in energy sector, and to the support of the authorized laboratories for energy audit, and control of the energy balances and energy efficiency. Specific objectives of all 9 development programs consisting NEEP are specified in [1].

Basic characteristics of the NEEP policy

More then 260 projects and 50 studies have been submitted, but only 140 projects and 25 studies are accepted for financing, showing strong criteria used in evaluation process. The aim was also to achieve results as soon as possible, so accent has been given to the short term demonstration projects, capable to give results in one year or in shorter period of time. In the number of 140 projects, 80 projects have been demonstration projects (one year projects) and only 60 R&D&D have been accepted for financing (three years projects). For studies, only 3 months have been given for realization.

Besides priority that has been given to the D projects, Board of Directors of the NEEP aimed to achieve the following objectives:
– to orient, and re-orient research activity in energy field (especially to support oriented fundamental research) towards those topics that contribute to the increase of energy efficiency, implementation of the new efficient and environmentally acceptable energy and production technologies, and to the implementation of use of RES and local energy sources,
– to benefit and use, as much as possible, the existing accumulated domestic knowledge achieved in the past, in order to obtain as soon as possible apparent results in the fields of energy efficiency and use of RES,
– to use as much as possible existing international knowledge, and to create new domestic knowledge in order to initiate domestic production, independently or by technical cooperation with the foreign industry, of the energy efficient processes, equipment and technologies,
– in the financed feasibility studies, to collect and concentrate data and knowledge for evaluation of the available energy potentials, energy efficiency potential in industry and municipal systems, buildings and households, energy potentials of the renewable

energy sources, in order to make data base for formulation of the strategies, priorities, and legislation in the energy sector, and for rational and efficient use of energy and energy resources, including renewable energy sources,
- priority was given to the short term (one year) demonstration projects, in which by construction of pilot or demonstration plants, using existing knowledge and designs (or preparing construction of pilot and demonstration plants) can be demonstrated in real conditions benefit that can be obtained by implementation of modern, energy efficient and environmentally acceptable technologies, equipment, methods or energy management.
- energy audits, implementation of modern measurement instruments and methods have been supported,
- to achieve high standards in project proposals and in making terms of reference for projects proposed for financing, as well as to formulate criteria for evaluation of the projects proposed for financing,
- to formulate clear and fix responsibilities and objectives of the projects, easy for control and evaluation,
- to establish realistic scope and size of D and especially R&D&D projects, minimal, but necessary, number of the researchers and engineers engaged in the project, and their real engagement time (working-hours), as well as amount of money for instruments and construction of experimental equipment, pilot and demonstration plants,
- to insist on the high engagement of the engineers from industrial companies in realization of the projects,
- to establish strict professional evaluation of the results of the projects, and professional and serious engagements of the project leaders and staff engaged in project realization, and
- to introduce objective oriented research, based on fundamental and applied research and knowledge but aimed to achievement of the results applicable in practice, followed by publishing results in professional and scientific journals.

Strategy and priorities of the NEEP in the next three year's period 2006-2008

Background

Board of Directors of the NEEP concluded that previously accepted strategy and priorities have been excellent basis for the activities in the frame of NEEP in past four year's period. All basic topics and objectives of this strategy have been approved in practice and helped in obtaining the valuable research and development and engineering results in many projects financed and finished in the period from 2002-2005. This strategy and priorities were accepted as a good basis for formulation of the strategy for next period. It was also concluded, that in the new strategy must be taken into account new reality and new and more stimulative economic and financial environment in energy sector

made by the Energy low (accepted by Parliament in 2004) [4], and Strategy of Development of Energy Sector in Republic Serbia up to 2015 (accepted by the Parliament in May 2005) [5]. Also, in the mean time, Energy Community Treaty has been signed by the South-East European countries, with the aim to make energy market for electricity and gas, and to accept all energy documents and directives of the European Community and Kyoto Protocol [6]. Responsibilities included in those documents, and especially in the Energy Community Treaty, and responsibilities that Serbia will accept in the process of association and joining with the European Community makes objectives in the fields of energy efficiency and use of renewable energy sources clearer and more obligated, and with very definite time table. All the mentioned facts and documents, posed new tasks in front of the NEEP, and must be taken into account in formulation of the Strategy and Priorities.

Fundamental assumptions

In new Strategy it was necessary, also, to avoid deficiencies noticed in past period, especially those connected with formulation of the project objectives, as well as in formulation of the terms of reference of the projects, and also in the process of project evaluation, acceptance and following up of its realization.

Some of the deficiencies are quoted below:

- Unsatisfactory cooperation and coordination of the Ministry of science and environmental protection (*i. e*. NEEP) and Ministry of Mining and Energy and Serbian Energy Efficiency Agency,
- Too small influence of the results achieved in the projects financed in the frame of the NEEP on energy efficiency and use of RES in general, and on changing standards, legislation and regulations in energy sector, necessary to make stimulative environment for rational behavior of companies and individuals in energy production and consumption.
- Lack of investment for implementation in practice of the project results, and especially for construction of the pilot and demonstration plants.
- Too many short term demonstration projects had negative influence on the continuity of the research process and achievement of the new knowledge, and education of the young research and engineering staff.
- Small amount of money given by the Ministry of Science and Environmental Protection for the projects and studies accepted to be financed in the frame of the NEEP, and for the projects in energy field in general, comparing with the financing of the fundamental research in natural and life sciences.

Besides avoiding of the mentioned deficiencies, important part of the activity in the frame of the NEEP in the future has to be affirmation and advertising of the valuable results obtained by realization of the projects and studies in the frame of the NEEP, and affirmation of the useful and positive actions and formulation of the more strict criteria in evaluation of the project proposals and project results. The most important are:

- further influence on the re-orientation of the research activity on priority topics, both in the fundamental research laying in the basis of the processes and technologies for energy transformations, and in applied research,
- to declare more narrow and more objective oriented topics in open invitations for project proposals, and introduction of the so called "top-down" approach for project formulation,
- more rigorous and detailed consideration of the realization of the projects and evaluation of the final results,
- more realistic estimation of the working hours necessary for realization of the projects, and estimation of the optimal number of the engaged researchers, and
- more strict and rigorous preparation and evaluation of the terms of reference of the projects submitted for financing in order to achieve real SMART concept of the projects accepted for financing, *i. e*. projects have to be Specific, Measurable, Achievable, Realistic, Timely.

General objectives

Taking into account fundamental assumptions accepted for future strategy of the NEEP, and fact that, due to the lack of money for the research and development activities in 90s, existing fundamental, applied and practical knowledge that could be used for fighting for increase of energy efficiency and use of RES, is practically exhausted in past four year's period, it was necessary to formulate new objectives. Also, challenges of the XXI century, especially for developing countries, and especially in energy field, will be very difficult to be faced. Main emphasis in the world and especially in Europe will be posed on the new energy sources, global warming and environmental protection in general [2, 3, 5, 6]. Rehabilitation and modernization of the energy sector in Serbia is the main task in the future period in order to achieve European standards. Implementation of the modern, energy efficient and environmentally acceptable technologies will be inevitable, increase of energy efficiency and increased use of renewable energy sources have to be in main concern of the strategy and priorities of the NEEP in near and, even more, in far future.

In formulating priorities and topics of the future open invitations for submission of the project proposals, Board of Directors of the NEEP, will follow following main lines and policy.

- Priority will be given to the long term research and development projects followed by demonstration in real conditions (R&D&D projects), which can encounter objective oriented fundamental research of the processes and phenomena necessary for development and implementation of the modern and new technologies, equipment and methods.
- All projects have to give concrete and easy recognized final results, as well as periodic (each year) results.

- In long term, R&D&D projects, oriented fundamental research has to be formulated in separate terms of reference, and will be evaluated according the specific criteria valid for evaluation of the fundamental scientific results.
- Each R&D&D project has to engage young research fellows, making their Ph. D. thesis.
- R&D&D project will be the basis for future applied research.
- Priority will be given to the projects offering development of the new technologies and equipment, making at the same time basis for solving problems that will be posed in long term future (up to the middle of the 21st century).
- Special attention will be paid to the projects with the objective to increase use of renewable energy sources, both due to the responsibilities of Serbia to fight with the global warming, and due to the lack in energy resources in Serbia.
- Instead of the short term expert studies financed in past period, priority will be given to the detailed and long term studies giving new data base for formulation of the energy strategy in Serbia, and as a basis of future decisions in energy sector in Serbia.
- In specific fields, short term demonstration projects, will be financed also, if the mass dissemination of the results can be foreseen in near future.
- Activities and objectives of the NEEP will be more closely coordinated with the activities of the Serbian Energy Efficiency Agency, especially in construction of pilot and demonstration plants, based on the results of the NEEP projects.
- Results of the feasibility studies, and data basis created in those studies, will be more regularly presented to the ministries in different sectors, especially to the Ministry of Mining and Energy, in order to stimulate formulation of new legislative and regulations in energy sector.
- Special attention will be paid to the projects dealing with the energy production and consumption on the level of local authorities, using local energy sources, industrial and municipal wastes and renewable energy sources.

Specific topics and projects accepted for financing in the period 2006-2008

Two Open invitations for submission of the projects for financing in the frame of NEEP have been announced – 6th and 7th Open invitations. Open invitations have been announced for all 9 specific Development programs consisting NEEP.

Specific topics were slightly changed comparing with those defined in the Strategy and Priorities of the NEEP for the period 2002-2005 [1], since those are topics in the field of EE and use of RES relevant and important in any time and conditions. Only slight priority has been given to the use of RES. Also, previous open invitations and projects submitted for financing in the period 2002-2005 have shown that priorities were adequately chosen.

More then 200 projects and studies have been submitted for both invitations, but only 89 projects (24 D + 65 R&D&D) and 21 studies have been accepted for financing. Distribution of the projects between the 9 Development programs is as follows:

– Energy efficiency in electric power production – 8 projects (3D+5R&D&D) and 2 studies,
– Energy efficiency in electric power transmission and distribution – 11 projects (6D+5R&D&D) and 6 studies,
– Energy efficiency in industry – 19 projects (2D+17R&D&D) and 2 studies,
– Energy efficiency in municipal systems – 12 projects (2D+10R&D&D) and 1 study,
– Energy efficiency in households – 6 projects (4D+2R&D&D) and 2 studies,
– Development of domestic ovens and boilers burning solid fuels – 7 projects (2D+5R&D&D),
– Use of alternative and renewable energy resources – 17 projects (1D+16R&D&D) and 4 studies,
– Energy efficiency in buildings – 4 projects (2D+2R&D&D) and 2 studies, and
– Energy efficiency in traffic engineering – 5 projects (2D+3R&D&D) and 2 studies.

Conclusions

Together with the projects accepted for financing in the previous open invitations in 2004 and 2005, presently more then 120 projects and 20 studies are still in the course of realization. NEEP engaged practically all the most experienced researchers from scientific institutes and faculties (about 300 researchers), and approximately the same number of engineers from industry.

It is believed that after acceptance of the Energy law, Strategy for Development of Energy Sector up to 2015, and National Strategy of Economic Development of Serbia up to 2012, followed by the corresponding legislative and regulations, favorable environment for rational use of energy sources, more efficient energy production and consumption and increased use of RES, will be created [6]. In such environment, results of the projects and studies financed in the frame of the NEEP will have more chance for dissemination. Governmental support for projects aimed to increase energy efficiency and to stimulate use of RES will be more evident when Fund for energy efficiency and use of RES, which is in preparation, will become active.

Under those conditions full influence and importance of the projects and studies realized in the frame of the NEEP since 2002 will be evident. Results achieved in the 20 projects financed in the past period, and presented in this issue will support this statement.

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