China-USA Business Review, ISSN 1537-1514
September 2013, Vol. 12, No. 9, 833-844

Croatia and the SET-Plan: Intents and Results*

Ljerka Cerovic, Dario Maradin, Ivana Ilijasic Versic
University of Rijeka, Rijeka, Croatia

Energy efficiency and environment protection are the international concern. European Union, under its energy and climate policy, adopted goals of reducing greenhouse gas emissions by 20%, and increasing the proportion of European energy which comes from renewable sources up to 20% by 2020. Until 2007, the development of these technologies in the European Union (EU) was undertaken in a dispersed, fragmented, sometimes even competing way. The Strategic Energy Technology Plan (SET-Plan) is the pillar of the EU's energy and climate policy aiming at development of affordable, clean, efficient, and low emission energy technologies through coordinated research. Croatian accession to the EU required meeting the main challenges as the other member states, involving increase in energy efficiency and renewable energy used as some of the basic components of sustainable development. Funding projects in the area of ecology and energy preservation, odds and prospects for public bodies and Environmental Protection and Energy Efficiency Fund (FZOEU) involvement in financial support of the projects, additional sources of funding etc., are some of the numerous questions this paper is aiming to address in order to assess the Croatian absorption capacities for the SET-Plan as one of the most important EU strategies.

Keywords: European Union (EU) accession, SET-Plan, energy efficiency, challenges, Croatia, policies and programmes

Introduction

With the ongoing climate change, the need for tackling an effective low-carbon policy and efficient energy technologies becomes a prerogative. The European Union (EU) is addressing the challenge under its energy and climate policy (Commission of the European Communities, 2007) whose target is the transformation of the entire energy system, with far-reaching implications on how the energy is sourced and produced, transported and traded, and how it is used. Adopted goals underline the reduction of the greenhouse gas emissions by 20%, and increasing the proportion of European energy which comes from renewable sources to 20% by 2020. One way essential to the achievement of the goals set out under the energy and climate policy is the development of low carbon technologies, but it also ensures Europe's future competitiveness. The rationale behind this target is a market choice; low-carbon technologies should be affordable and competitive (Commission of the European Communities, 2009). Therefore, EU endorsed the European Strategic Energy Technology Plan (SET-Plan) as a means of accelerating the development and large scale deployment of low carbon technologies that builds upon

* This article is a result of the scientific project "Economic impacts of regulatory reforms in electricity sector No. 081-0361557-1455" financed by Croatian Ministry of Science, Education and Sports.
Ljerka Cerovic, Ph.D., Associate Professor, Faculty of Economics, University of Rijeka.
Dario Maradin, M.A., Research Assistant, Faculty of Economics, University of Rijeka.
Ivana Ilijasic Versic, M.A., Head of the Science Office, Faculty of Humanities and Social Sciences, University of Rijeka.
Correspondence concerning this article should be addressed to Ljerka Cerovic, University of Rijeka, Faculty of Economics, Ivana Filipovica 4, 51000 Rijeka, Croatia. E-mail: cerovic@efri.hr.

the current research and development (R&D) activities and scientific results in Europe. It proposes a new innovation model based on research, development, and demonstration planning and implementation within a large scale programmes (Edenhofer & Stern, 2009).

Republic of Croatia adapted legislative in accordance with the relevant directives of the EU; therefore energy efficiency is the key part of the strategic national documents such as strategy of energy development, master plan of the energy efficiency, energy efficiency national programme, and the first national action plan on energy efficiency. While special regulative and laws have been put in motion, many of the proposals are still in queue for adoption and conduct.

Weaknesses and Obstacles in Energy Innovation

Since the oil price shocks in the 1970s and 1980s, Europe had inexpensive and sufficient energy supplies. The availability of resources, no carbon constraints and the market have not only left Europe dependent on fossil fuels, but also tempered the interest for innovation and investment in new energy technologies. Shortly, there is no natural market demand or a short-term business benefit for such technologies (Joint Research Centre, 2007a). Public intervention to support energy innovation was necessary. The energy innovation process from conception to market also has its specific structural weaknesses; it is characterised by long lead times to mass market due to many different investments required and the technological and regulatory inertia typical for contemporary energy systems. New technologies are in overall more expensive than those they are replacing, and are usually not providing a better energy service.

Key Technology Challenges for the Next 10 Years

Achieving the 2020 targets requires the simple conditions; research has to lower costs and improve performance. Pro-active support measures have to create business opportunities, stimulate market development and address the non-technological barriers that discourage innovation and the market deployment of efficient and low carbon technologies. To achieve the further, 2050 vision, which aims to completion of decarbonisation, the new generation of technologies is needed. The major organisational and infrastructure changes have to be planned. Key EU technology challenges for the next 10 years to meet the 2020 targets (Joint Research Centre, 2007c):

- Make second generation bio-fuels competitive alternatives to fossil fuels, while respecting the sustainability of their production;
- Enable commercial use of technologies for CO_2 capture, transport and storage through demonstration at industrial scale, including whole system efficiency and advanced research;
- Double the power generation capacity of the largest wind turbines, with offshore wind as the lead application;
- Demonstrate commercial readiness of large-scale Photovoltaic (PV) and concentrated solar power;
- Enable a single, smart European electricity grid able to accommodate the massive integration of renewable and decentralised energy sources;
- Bring to mass market more efficient energy conversion and end-use devices and systems, in buildings, transport and industry, such as poly-generation and fuel cells;
- Maintain competitiveness in fission technologies, together with long-term waste management solutions.

Key EU Technology Challenges for the Next 10 Years to Meet the 2050 Vision

EU has the precise vision of the technology innovations that are to meet even further challenges of the distant future vision (European Commission, 2008):

- Bring the next generation of renewable energy technologies to market competitiveness;
- Achieve a breakthrough in the cost-efficiency of energy storage technologies;
- Develop the technologies and create the conditions to enable industry to commercialise hydrogen fuel cell vehicles;
- Complete the preparations for the demonstration of a new generation (Gen-IV) of fission reactors for increased sustainability;
- Complete the construction of the ITER fusion facility and ensure early industry participation in the preparation of demonstration actions;
- Elaborate alternative visions and transition strategies towards the development of the Trans-European energy networks and other systems necessary to support the low carbon economy of the future;
- Achieve breakthroughs in enabling research for energy efficiency: e.g., materials, nano-science, information and communication technologies, bio-science, and computation.

The European Strategic Energy Technology Plan (SET-Plan)

EU energy research budgets have declined since the 1980s and the energy technologies that have been developed have not been widely picked up, often due to cost and to lesser performance (Joint Research Centre, 2007d). The need to move to a post-carbon society and economy, and the commercial opportunities offered by the emissions trading scheme and other policies designed to improve energy security and fight climate change mean that the moment here is to make a more sustained and integrated effort to develop the EU's capacity for innovation in energy technologies. With the strategic energy technology plan, the European Commission proposes various ways in which the EU as a whole (institutions and member States) can work together and create the best conditions for industry and society in general to use research, development, and innovation to drive down the cost of existing energy technologies and to develop the next generation of technologies for the sustainable energy system of the future.

In order to do so, the SET-Plan is aiming at establishment of large scale programmes (such as the European Industrial Initiatives—EIIs) that bound industry, research community, the Member States and the Commission in risk-sharing and introducing the public-private partnerships aiming at the rapid development of key energy technologies at the European level. In short, EIIs are industry-led and aim to strengthen the industrial participation in energy research and demonstration, boost innovation, and accelerate deployment of low-carbon energy technologies.

SET-Plan Initiatives

The SET-Plan includes six priority technologies that have already been identified as the focal points of the first EIIs (Joint Research Centre, 2007b): wind, solar, electricity grids, bio-energy, carbon capture and storage, and sustainable nuclear fission. A further initiative on energy efficiency in cities (the Smart Cities Initiative) is also proposed. In parallel, the European Energy Research Alliance (EERA), which brings together key European research organisations, has been working since 2008 to align their individual R&D activities to the needs of the SET-Plan priorities and to establish a joint programming framework at the EU level.

The European industrial bio-energy initiative. The European industrial bio-energy initiative addresses the technical and economic barriers to the further development and accelerates commercial deployment of selected state-of-the-art bio-energy technologies. This is with a view to achieving greenhouse gas emission savings of 60% for bio-fuels and bio-liquids under the sustainability criteria of the EU Directive on renewable energy.

The European CO_2 capture, transport, and storage initiative. A large demonstration programme aiming at the construction and operation of up to 12 industrial-scale CCS projects by 2015. Each project will integrate and test the existing components of CCS, demonstrating the feasibility of the concept and generating knowledge that will help to reduce costs, orientate further R&D and increase public awareness about the benefits of the technology.

The European electricity grid initiative. The European industrial initiative on the electricity grid looks to develop, demonstrate, and validate, at scale, the technologies, system integration and processes to:

- Enable the transmission and distribution of up to 35% of electricity from dispersed and concentrated renewable sources by 2020 and make electricity production completely decarbonised by 2050;
- Further integrate national networks into a truly pan-European, market based network;
- Optimise the investments and operational costs involved in upgrading the European electricity networks to respond to the new challenges;
- Guarantee a high quality of electricity supply to all customers and engage them as active participants in energy efficiency;
- Anticipate new developments such as the electrification of transport.

The Fuel Cells and Hydrogen (FCH) joint technology initiative. This European industrial initiative is working to speed up the development of hydrogen-supply and fuel-cell technologies to enable the industry to take the large-scale commercialisation decisions necessary for mass market introduction in the timeframe 2015-2020.

The sustainable nuclear initiative. The European sustainable nuclear industrial initiative will demonstrate the long-term sustainability of nuclear energy. The initiative will design and construct demonstration reactors of a new generation of nuclear technology—so-called Generation IV—based on fast neutron reactors and closed fuel cycles. Compared with current nuclear plants, this advanced technology will make 50-100 times more efficient use of uranium resources, will generate less long-lived radioactive waste and will reduce proliferation risks. It will also have favourable safety characteristics by maximising inherent and passive safety features. The first demonstration reactors are expected to come into operation from 2020. The operational experience gained should then pave the way for the commercial deployment of this technology from 2040.

Energy efficiency—the smart cities initiative. The smart cities initiative aims to improve energy efficiency and to step up the deployment of renewable energy in large cities going even further than the levels foreseen in the EU energy and climate change policy. This initiative will support cities and regions that take pioneering measures to progress towards a radical reduction of greenhouse gas emissions through the sustainable use and production of energy. It will make the cities involved in the forefront of the development of the low-carbon economy. The initiative will be underpinned by concrete activities being prepared at the time of publication.

The solar Europe initiative. The European industrial initiative on solar energy focuses on PV and

concentrating solar power (CSP) technologies. The objective is to make these technologies more competitive and to facilitate their large-scale penetration in urban areas and green-field locations as well as their integration into the electricity grid.

The European wind initiative. The European wind initiative aims to make wind energy more competitive, to harness the potential of offshore resources and deep waters, and to facilitate grid integration of wind power.

Energy Efficiency in the Republic of Croatia: Current Position and Expectations

Economic burden brought by the increase in energy expenditure, price growth of the energy-generating products, and exhaustion of the fossil fuels, along with the rising awareness of sustainable use of natural resources and environment protection are some of the most important themes of contemporary time in Croatia and the world.

Although energy expenditure decreased after 1990 due to the deindustrialization, and energy intensity is not as high as in the other members of the EU, Croatia is facing the substantial problems aroused from the increasing energy needs and almost 50% dependence on energy import.

Given the circumstances, the question imposed is how to promote sustainable development, and secure added value creation and responsible trade marked by the environment care. Energy efficiency (EnE) is being widely considered as the basic assumption for the sustainable energy development. Therefore the EnE has to be the key role in general national energy politics.

Incentives for Development of Energy Efficient Projects in the Republic of Croatia

Energy expenditure increase and the first energy crises created the need for the energy projects development which was to result in energy expenditure decrease and, given the rational time line, secure the return on investment. Regardless of high return on investment rate, adoption of energy efficient technology was and still is low due to the insufficient knowledge on advantages that such technology can produce information asymmetry and other market failures. In every way, the EnE is the less expensive option compared to ecological and other benefits it offers (i.e., decrease in energy production and use, and consequently reducing greenhouse gas emissions).

Market potential for EnE projects in Croatia is huge and still rising. Reasons are overarching; from the need to protect environment and secure the energy supply, to stimulating the economic recovery and growth, as well as fulfilment of related international obligations:

(1) Environment protection and energy supply safety.

EnE is the most efficient and cost effective way of accomplishing the goals of sustainable development, bearing in mind that EnE projects have the strongest impact on promotion of the energy triad (Regionalni centar zaštite okoliša, 2010), emphasizing the decrease of energy needs, increase of renewable energy sources use (RES), and finally, the use of fossil fuels in cleaner production. Mentioned triad has an impact on the decrease of energy depend on the state, namely, supplying safety, decrease in negative environment effects (first of all reductions of the greenhouse gas emissions), and consequently slowing the process of climate change and the rising awareness of sustainable energy use on every level.

(2) Economic recovery and growth.

EnE projects have direct impact on competitiveness' increase in national economies:

- Through reduction of energy costs (implies the overall reduction in energy expenditure which results in

lesser need for energy production, reduced prices of industrial products, services and transport and life expenses). Energy costs in Croatia are substantial and amount up to 20% GDP, mostly comprising of the building sector (40% of energy). Furthermore, Croatia is spending 12% more of the primary energy by the GDP unit than the EU-27 average, and even 20% more than the EU-15 average, therefore, the Croatian potential for improvement of the EnE is huge (Domac-Šćulac, 2009);

- Through job creation (EnE projects market is large and it can absorb a huge number of employees of different profiles and by that significantly decrease the unemployment rate). The greatest potential is in the building sector where it is expected that the application of energy efficiency measures on 20% of the overall amount of the residential units in Croatia during the next 10 years will result in an increase of the total investments for 2.8 billion USD, creation of 7,000 direct "green" job posts per year and at least that amount of non-directly created job posts (UNDP, 2010);
- Through support for social programmes (primarily in the framework of the educational media campaigns on EnE).

(3) EU accession process and fulfilment of international obligations.

Agreement on energy charter was signed by Croatia in 1994, and ratified in 1997. In 1996 Croatia ratified the UN Framework Climate Change Convention (UNFCCC), while in 1998 the Protocol on Energy Efficiency and Related Environment Aspects (PEEREA) is ratified. By this Croatia overtook the obligation to adopt the strategy of EnE and related strategic goals, to create the related legislative frameworks, to define the concrete programme for the promotion of efficient energy use, and the programme for reduction of negative effects of energy sector on environment. Croatia, as EU accession country, adopted the agreement on energy community and in 2007 signed and ratified the Kyoto protocol, along with the UNFCCC, by which it overtook the obligation of reducing the greenhouse gas emission by 5% during the 2008-2012 period.

Constant environment protection care, the increase of the EnE and RES is one of the key components of sustainable development and use of natural resources in Croatia, as well as important factor in EU accession process. In the pre-accession period Croatia overtook the obligations formulated in the package of measures known as the EU Directive "20-20-20 until 2020" aiming at the following (Balabušić, 2009):

- Reduce greenhouse gas emission by 20% without endangering the economic growth, competitiveness, and quality of life of its citizens;
- Reduce energy usage by 20%;
- Increase the portion of RES by 20% by using the energy of wind, sun, water, bio-mass, bio-fuel, and geothermal energy.

Strategy of energy development of the Republic of Croatia in the domain of EnE and RES until 2020 is in accordance with the goals and time line of the EU strategic documents required for the adoption of EU Directives in Croatian national legislative.

Strategic, Legislative, and Institutional Framework for Energy Efficiency in the Republic of Croatia

Key factor for EnE project realization is defining its strategic, legislative, and institutional framework.

(1) Strategic framework.

EnE as a necessary and acceptable way of completing the energy needs is the important part of the key Croatian national documents, i.e., Strategy of Energy Development, Master Plan on Energy Efficiency, National Energy Efficiency Programme, and The First National Energy Efficiency Action Plan.

Strategy of Energy Development in the Republic of Croatia until 2020. Strategy is adopted by the Croatian government in the end of the 2009. It foresees the investment of about 15 billion euro in energy until 2020, as well as portion of that sector in the increase of the Croatian GDP with about 1%-2% per year (Ministry of Economy, Labour and Entrepreneurship, 2008).

Strategy, apart from that, also foresees the building of two thermal power plants powered by gas, and two powered by imported stone coal, as well as the hydroelectric power plant. It is also planned to build the Liquefied Petroleum Gas (LPG) terminal, networking of the Croatian and Hungarian gas systems, investments in underground gas storages, finalizing the modernization of refineries, securing the oil reserves until 2012, etc.. These plans are based on the assessment that energy usage increase in Croatia will amount up to 3.1% per year until 2020, electric energy by 4.3%, and gas fuel energy by 4.7% per year (Ministry of Economy, Labour and Entrepreneurship, 2008).

Master plan of Energy Efficiency in the Republic of Croatia. Aiming at the creation of the detailed expert background for the adoption of the overall strategy for efficient energy usage in Croatia, UN Development Programme (UNDP) and Croatian Ministry of Economy, Labour and Entrepreneurship (MINGORP) launched the project of drafting the Master Plan of Energy Efficiency in the Republic of Croatia. The project started in April, and ended in October 2007. The Croatian government adopted the Master Plan as the national programme which is completely compatible with the EC Directive 2006/32/EC on energy efficiency and services. Master Plan defines the goals of improvement of EnE, as well as the mechanisms and measures for their conduct.

Master Plan offered the background for the two further important strategic documents; Energy Efficiency Programme 2008-2016, and the First National Energy Efficiency Action Plan of the Republic of Croatia 2008-2010 which enabled Croatia to have clear and defined politics on EnE.

National Energy Efficiency Programme of the Republic of Croatia 2008-2016. Programme adopted by the Croatian government is technically and professionally drafted according to the EC template for related Directives on EnE, which defines the goal of energy savings until 2016, usage of the defined methodology, conduct measures and stakeholders, but it does not include the financial projections. Croatian national interest includes conduct of EnE measures and decrease of immediate energy expenditure by 9% in the period from 2008 to 2016, according to the EC Directive 2006/32/EC (Mladineo, 2009).

The First National Energy Efficiency Action Plan of the Republic of Croatia 2008-2010. During the EU accession process, Croatia is bound to translate the requirements of the Directive to the national legislative and draft the First National Energy Efficiency Action Plan for the period from 2008 to 2010. Again, it is the Croatian government programme which meets requirements set by the EC Directive 2006/32/EC. Division of national goal by the sectors is based on the portion of each sector in immediate energy usage, potential for improvement of energy efficiency, and possible level of intervention by the EnE politics in the sector. The division by the sectors, given the goal of 9% or 19.77 PJ[1] energy savings until 2016, is as follows: households 34% or 6.72 PJ, transport 30% or 5.93 PJ, services 19% or 3.76 PJ, and industry 17% or 3.36 PJ (Raguzin, 2010).

(2) Legislative framework.

The development of the EnE depends on legislation, directives, action plans and guidelines, different tax

[1] Energy unit PJ (petajoule) is the equivalent for about 30 million of kWh.

appropriations and reimbursements set by the governments, etc.. In legislative framework it is important to highlight the Energy Law (NN 68/2001, 177/2004, 76/2007, and 152/2008) and Law on Efficient Energy Usage in Immediate Use (NN 152/2008). Energy Law defines measure and safe and reliable energy supply and its efficient production and usage; its articles define the conduct of energy politics and planning of the energy development, practice of energy services on the market or as public services, as well as the basic issues of energy services practice with respect to the environment protection measures. Law on Efficient Energy Usage in Immediate Use has overtaken the acquis, namely, the requirements of the EC Directive 2006/32/EC with respect to the Croatian interests. It defines the area of efficient energy usage in immediate use, adoption of programmes, and plans for EnE improvement and their conduct, and particularly the practice of energy services, obligations of public sector, and large consumers regarding the energy management, consumer rights in EnE measures' conduct, development of EnE projects market, etc..

(3) Institutional framework.

The role of certain public bodies and institutions in strategy, plan, and programme of the EnE in Croatia is different. EnE policies lie within the responsibility of two Croatian ministries: MINGORP is for the energy issues and the Ministry of Environmental Protection, Physical Planning and Construction (MZOPUG) are for the environment protection issues. Guidelines conduct of labelling the EnE household supplies lies within the responsibility of the State Inspector's office, while the responsibility for the establishment and conduct of minimal regulations on EnE and eco-design is divided by the both ministries. The Climate Change policy, in which the EnE is one of the key buffering factors, is the responsibility of the Ministry of Environmental Protection, Physical Planning and Construction. Ministry of the Sea, Transport and Infrastructure (MMPI) is responsible for the EnE issues within the transport sector. On execution level, the key role in financing, drafting, development and implementation of the EnE, RES, and environment protection projects has the Environmental Protection and Energy Efficiency Fund (FZOEU), namely, it enables the financial and institutional support to the EnE development in Croatia. Other public institutions actively participate in the EnE implementation, i.e., Energy Institute Hrvoje Požar, leader of all national EnE programmes since 1997, and the only public body with the right to make the energy balance sheet of the Republic of Croatia. Initiatives and counselling in the EnE domain are also provided by different academic institutions. In part of the business sector, some of the largest state companies are also very active in the EnE related issues (HEP, ESCO, Croatian Institute for Construction, Croatian Cleaner Production Centre, etc.). The rising engagement of the Non-governmental organizations (NGOs) in the promotion of environment protection and EnE has to be mentioned. Nevertheless the key bodies for implementation of the EnE policies in Croatia are the FZOEU and the MINGORP.

Funding of Energy Efficiency in the Republic of Croatia

Key factor for the realization of the EnE projects and meeting the requirements of the EU Directives is availability of funding sources. As mentioned before, strategy of energy development of the Republic of Croatia foresees the investment in energy of about 15 billion Euros until 2020; therefore, it is crucial to secure the financial support for investments in EnE in public and private sector. Possible sources of funds in Croatia involve state budget, dedicated funds (FZOEU), incentives, grants and other international assistance programmes, loan programme of the Croatian Bank for Reconstruction and Development (HBOR), commercial funding programmes, EU funding programmes (FP7, IPA, IEE, etc.), public-private partnerships, etc. (UNDP Croatia, 2008a).

Nevertheless, the most important incentives for the EnE projects come from the FZOEU. It is the structured out-of-the-state-budget fund which covers funding of the three basic types of practices: environment protection, EnE, and the usage of RES. Established in 2003 by the Law on Environment Protection and Energy Efficiency Fund (NN 107/2003), based on the Environment Protection Law (NN 82/94, 128/99) and Energy Law (NN 68/2001, 177/2004), and by the joint efforts of the responsible ministries (MINGORP and MZOPUG). Fund's area of work is expanded in 2006, by the Waste Law and in 2008, by the Law on Efficient Energy Usage in the Immediate Use, which enabled the Fund to gradually download the functions and responsibilities of the energy efficiency executive agency.

The priorities of the Fund in enforcing the Law on Efficient Energy Usage in the Immediate Use are drafting and conduct of the sector programmes on efficient energy usage (industry, households, transport, public, and commercial service sector) and coordination of inter-sector policies implementation, procedures, monitoring and evaluation of energy savings system establishment, as well as establishment of the unique informational system for EnE savings monitoring.

Croatian Energy Projects Overview

Aiming at encouraging the EnE, the number of projects, programmes, and campaigns is launched in Croatia, i.e., "Promotion of energy efficiency in Croatia", "Systematic management of energy in towns and counties of the Republic of Croatia", and energy management project named "Getting own house in order", as well as numerous educational media campaigns, etc..

"Promotion of energy efficiency in Croatia" project (2005-2009). This energy efficiency project was launched in 2005 by the UNDP and the MINGORP in cooperation with the FZOEU and Global Environment Fund. The aim of the project was to raise the awareness of efficient energy usage, as well as stimulate the implementation of cost-effective and energy efficient technologies and measure through consultations, seminars, and workshops. Target groups of the project, representing more than 40% of total energy expenditure in Croatia, were the households, services, and public sector. FZOEU almost completely finances the campaign of this project with more than nine million of Croatian kuna (UNDP Croatia, 2005).

The huge success of the above mentioned energy efficient project resulted with Croatian government two new activities: project "Systematic management of energy in towns and counties of the Republic of Croatia" involving all objects owned by the towns and counties, and an energy management project named "Getting own house in order" which involves systematic energy management in the objects owned by the Croatian government. After a few years of a project's duration, 80 out of 127 cities, 19 out of 20 counties, and 13 out of 16 Croatian ministries, actively engaged in both projects with 8,000 evaluated public buildings (out of 10,000 total) which entered the systematic energy management system (UNDP Croatia, 2008b). Expected financial benefit from both projects was saving around 700 million kuna (Mladineo, 2009). FZOEU was financing both projects with more than 70 million kuna totals (UNDP Croatia, 2005).

"Systematic management of energy in towns and counties of the Republic of Croatia" (2007-2009). Main goals of the SGE project were the application of the continuous and systematic energy management, strategic planning of energy policy and sustainable management of energy resources on local and regional level, which were to increase the EnE and decrease energy expenditure, and therefore, the greenhouse gas emission in the atmosphere, encouraging the development of new services and entrepreneurship (UNDP Croatia, 2005).

"Getting own house in order" (2008-2012). Programme "Getting own house in order" involves state and

local government objects (schools, hospitals, sport facilities, buildings, etc.) owned by the state. Through implementation of this programme, Croatian government gave the good practice example and not suggesting the EnE to anyone else. By this, the expenditure on the basis of operational costs within the state budget is decreased, and saved money is allocated to other priority domains of public interest (Government of the Republic of Croatia, 2011).

Informational and educational media campaigns. Education and public informing on EnE issues are few of the key factors of promoting the EnE projects. Citizens' responsibility in EnE domain is not limited to the individual actions, but it extends on the decisions and activities of the broader community. Main obstacles for the EnE projects are, in fact, social obstacles represented by the lack of knowledge and information, and given the fact that the change of attitudes and habits is a long term process, marked with lack of interest and motivation, and underestimation of the "ordinary people" impact (Kavedžija, 2009).

Within the energy efficiency (EE) project, there are numerous citizens oriented informational and educational campaigns on energy efficient technologies in everyday life. There are continuous efforts aimed at promotional activities on EnE through different national media campaigns, and local activities, as well as presentations, public discussions, expert meetings, and congresses. Communication and public informing on a local level is conducted in cooperation with "the local EE info offices and EE corners" which provide the information on different EE products, technologies, and measures, therefore offering the choice of adequate systematic solution of EE increases in their homes. EE info-spots are opened on 72 places in Croatia (EE info offices, EE info galleries, EE panels, EE info corners, and EE info centres) in 30 cities and 10 counties, and are still opening. According to the opinion polls which are done within the project, public knowledge on "EE measures and products" and "EE products" usage is significantly increased. The number of citizens who believe that they can lower the energy use by the EE measures application has risen from 27.9% in 2007 to 45.1% in 2009 (UNDP Croatia, 2009).

Market Obstacles and Improvement Measures of Energy Efficiency in Croatia

The market accomplishment of the EnE is evaluated by the success of development and implementation of the EnE projects in the state's market economy. Unfortunately, transition countries' (including Croatia) EnE markets are labelled with the very low level of EE projects' implementation, as well as the imbalance in their supply and demand. Numerous obstacles are the reason for such EnE market state (Bukarica, 2008), and are manifested on both sides of supply and demand chain. One of the most important is the financial obstacles; they are created on the demand side resulting from the weak purchasing power of consumers and huge investment costs of such projects. Similarly, on the supply side there is still low interest for EE projects, burdened by many administrative, legal and other requirements that have to be met. Furthermore, there is insufficient general level of knowledge on multiple benefits of improved EnE, and consequently, insufficient activity on both sides of the market regarding the EE projects. Finally, there are also the lack of expert and technical knowledge and experience necessary for the realization of the EnE projects.

In eliminating the mentioned obstacles, it is possible to undertake different inter-sector and sector measures and therefore influence the EnE improvement. Inter-sector measures (compatible with the specific measures for each involved sector) of the decrease of energy usage by the end-users include: financial and fiscal support for the EnE projects, technological research and development, participation in Intelligent Energy Europe programme (IEE), empowerment of the EnE in education, public awareness, and inter-sector campaigns,

energy inspection programmes, EnE in buildings, labelling appliances and tools, and energy characteristics standards (Ministry of Economy, Labour and Entrepreneurship, 2008).

On the other hand, sector measures for stimulating the EnE are specific, given that different sectors demand different approaches and incentives for the EnE investments. Reasons for that span from specific interests, different stakeholder structure and inclination to investments, to different shares in total energy usage, etc..

Conclusions

One of the key priorities of the EU development policies and research is the energy efficiency. One track being pursued is the development of low carbon technologies, essential both to the achievement of the goals set out under the Energy and Climate Policy, but it also aims to ensure Europe's future competitiveness. The SET-Plan, as the main pillar of the EU's Energy and Climate Policy, proposed concrete actions to build the best conditions for industry and society in general, to use research, development, and innovation to decrease the cost of existing energy technologies, and to develop the next generation of technologies for the sustainable energy system of the future.

The Croatian energy policy is also pursuing the European energy trends, which is evidenced by the numerous projects, laws and regulations in that domain. Mentioned activities are marked, before all, with the Croatian adaptation to the Community legislative (acquis), namely, meeting the requirements of the EC Directives. Croatian potentials for the EnE improvement are substantial; energy intensiveness in Croatia is about 12% higher than the EU-27 average, and even 20% higher than the EU-15 average, which represents the burden to national economy as well as environment protection. Main obstacles to the EnE improvement are, apart from financial ones, the lack of general knowledge on efficient energy use benefits, lack of technical knowledge for EnE projects conduct, and finally, the lack of clearly formulated national strategy. It is necessary to create the integral approach in energy policies planning on national and local government levels, taking into account the possibilities and alternatives, defining the goals and priority domains, drafting the required measures, as well as securing the necessary financial means for execution of the set goals.

References

Balabušić, D. (2009). *RE and EE policy in Croatia*. Retrieved from http://fei.rec.org/presentations/3.2_Balabusic_RE_and_EE_Policy_in_Croatia.pdf

Bukarica, V. (2008). Adaptive approach to defining and evaluation of Energy Efficiency Policy instruments (Adaptivni pristup definiranju i evaluaciji instrumenata politike energetske učinkovitosti) (Qualifying Ph.D. thesis, Faculty of Electrical Engineering and Computing, Department of Energy and Power Systems, Zagreb).

Commission of the European Communities. (2007). *Communication from the commission to the European council and the European parliament: An Energy Policy for Europe*. Retrieved from http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0001:FIN:EN:PDF

Commission of the European Communities. (2009). *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on Investing in the Development of Low Carbon Technologies (SET-Plan)*. A Technology Roadmap, Brussels, SEC 1295.

Domac-Šćulac, M. (2009). *Energy efficiency and renewable resources projects' financing in Croatia* (*Financiranje projekata energetske učinkovitosti i obnovljivih izvora energije u Hrvatskoj*). Retrieved from http://www.promo.com.ba/clanice/GlobalEXpo/MPS/files/energija/Govori2009/Marija-Sculac-Domac.pdf

Edenhofer, O., & Stern, N. (2009). Towards a global green recovery, recommendations for immediate G20 Action. Proceedings from *G20 London Summit*. The German Foreign Office.

European Commission. (2008). *EU SET-plan: Driving a revolution in Europe's energy systems*. Retrieved from http://ec.europa.eu/research/energy/pdf/set-plan_en.pdf

Government of the Republic of Croatia. (2011). *House in order programme*. Retrieved from http://www.ee.undp.hr/hio

Joint Research Centre. (2007a). *Why Europe needs a strategic energy technology plan?* Retrieved from http://ec.europa.eu/dgs/jrc/downloads/jrc_press_energy_memo_en.pdf

Joint Research Centre. (2007b). *Questions and answers on the European strategic energy technology plan (SET-Plan) and its financing*. Retrieved from http://europa.eu/rapid/press-release_MEMO-07-494_en.htm?locale=en

Joint Research Centre. (2007c). *Towards a low carbon future: European strategic energy technology plan.* Retrieved from http://ec.europa.eu/energy/technology/set_plan/set_plan_en.htm

Joint Research Centre. (2007d). *Support to the European strategic energy technology plan*. Retrieved from http://ec.europa.eu/dgs/jrc/index.cfm?id=4390

Kavedžija, I. (2009). Energy and responsibility—Educational model for democratic citizenship and renewable sources of energy (Energija i odgovornost—Model obrazovanja za demokratsko građanstvo i obnovljivi izvori energije). *Journal for Environmental Thought and Sociological Research, 18*(1), 46-57.

Ministry of Economy, Labour and Entrepreneurship. (2008). *National programme of energy efficiency 2008-2016* (*Nacionalni program energetske učinkovitosti 2008-2016*). Retrieved from http://www.mingorp.hr/UserDocsImages/Nacionalni%20program%20energetske%20u%C4%8Dinkovitosti%202008%20-%202010.pdf

Mladineo, V. (2009). *Environmental protection and energy efficiency fund investments in programmes and projects of using renewable energy sources and increasing energy efficiency* (*Ulaganja Fonda za zaštitu okoliša i energetsku učinkovitost u programe i projekte korištenja obnovljivih izvora energije i povećanja energetske učinkovitosti*). Retrieved from http://www.eihp.hr/hrvatski/projekti/support_ers/pdf/P4%20-20Support_ERS%20%20Fond.PDF

Raguzin, I. (2010). *Strategic and legislative framework of renewable energy sources in Croatia* (*Strateški i zakonodavni okvir za obnovljive izvore energije u Hrvatskoj*). Retrieved from http://www.konferencija-zuke2010.com/pdf/III%20dio/12-15%20IGOR%20RAGUZIN.pdf

Regional Centre for Environment Protection (Regionalni centar zaštite okoliša). (2010). Retrieved from http://www.rec-croatia.hr/materijal/EE_REC-projekti_fact_sheet.pdf

UNDP Croatia. (2005). *Fostering of energy efficiency in Croatia* (*Poticanje energetske efikasnosti u Hrvatskoj*). Retrieved from http://www.energetska-efikasnost.undp.hr

UNDP Croatia. (2008a). *Human development report: A climate for change: Climate change and its impacts on society and economy in Croatia*. Retrieved from http://www.issuu.com/undp_in_europe_cis/docs/croatia_climate_for_change

UNDP Croatia. (2008b). *Removing barriers to energy efficiency*. Retrieved from http://www.undp.hr/show.jsp?page=57802

UNDP Croatia. (2008c). *Energy efficiency project osijek* (*Projekt energetske učinkovitosti Osijek*). Retrieved from http://www.ee.undp.hr/index.php?option=com_content&view=article&id=178&Itemid=113

UNDP Croatia. (2009). *Removing barriers to energy efficiency*. Retrieved from http://www.undp.hr/show.jsp?page=57802

UNDP. (2010). *Green jobs in Croatia* (*Zeleni poslovi u Hrvatskoj*). Retrieved from http://www.undp.hr/upload/file/238/119007/FILENAME/Zeleni_poslovi_u_Hrvatskoj_-_Energetika.pdf