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im. Stanisława Staszica w Pile
ul. Podchorążych 10
64-920 Piła
tel. (067) 352 26 11
http://pes.pwsz.pila.pl
pne@pwsz.pila.pl

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Dragica STOJANOVIC*
Bojan DJORDJEVIC**

Carbon Market Development and Energy Efficiency in the Republic of Serbia

Introduction

Climate change has been recognised as a serious environmental problem which can violate the functioning of human civilisation. Energy consumption is an important component of the global climate change to reduce carbon dioxide (CO_2) emissions and ensure sustainable growth in the energy sector coincides with a looming new investment cycle in power generation in most OECD countries. In non-OECD countries, many power generation facilities are quite young, but more will be built in the coming years to meet growing energy demands. There is a window of opportunity to establish the policy framework to enable transformational change in the energy sector, including facilitating technological innovation and the creation of new markets and industries, to reduce the sector's carbon-intensity, and improve energy efficiency [OECD, 2011]. In accordance with the foregoing, the energy industry has a two-fold responsibility with respect to climate change. On the one hand, it needs to be prepared for facing new risks due to the negative effects that climate change has on its business. On the other hand, it can significantly help the low-carbon economy to develop by providing related products and services (e.g. services for emissions trading and financing for renewable energy technologies) [UNEP FI, 2015].

Many discussions can be found in the literature on the interaction between emissions trading (ETS) and RES-E support schemes. Brathwaite et al. (2010) and Ziegler et al. (2009) point out that: „the development of clean technologies promises substantial reduction in emissions because corporate investment in renewable energy technologies can lead to reduced profits, competitive disadvantages, lower stock values, and decreased firm values". Bunse et al. (2011) point out that: „investment in energy efficiency projects by organisations requires the determination of the level of operational barri-

* John Naisbitt University, New Belgrade
** John Naisbitt University, New Belgrade

ers and transparency including better working methods for energy efficiency investment decisions. Consequently, organisations may need to calculate the payback period when determining their investments in energy efficiency projects". However, Jaffe et al. (2005) point out that: „most innovation and diffusion of new technology are characterised by market failures due to incomplete information".

In other words, attempting to raise investment capital for renewable energy technologies with incomplete investment analysis information may cause investors to be promised uncertain returns [Jaffe et al., 2005]. Incidentally, industrial energy efficiency is a multifaceted issue entailing technical, economic and organisational challenges [Chai & Yeo, 2012]. Consequently, investment in energy efficiency projects by organisations requires determination of the level of operational barriers and transparency, including better working methods for energy efficiency investment decisions. Bearing in mind the above facts, organisations may need to calculate the payback period when determining their investments in energy efficiency projects [Bunse et al., 2011]. Incidentally, industrial energy efficiency is a multifaceted issue entailing technical, economic and organizational challenges [Chai & Yeo, 2012].

This paper therefore seeks to provide a review of current carbon emissions reduction practices in Serbia through renewable energy sources (RES). The paper is structured as follows: the first part analyses the potential RES in Serbia. On the basis of available data from CEE Bankwatch Network, the next part provides the projection of building new energy facilities as well as economic benefit for Serbia from international cooperation. Considering that the most modern instrument of environmental policy in developed market economies is trade in pollution permits, in the final part we give the key points of carbon market development in Serbia as well as certain conclusions.

Methodology

The methodology adopted in this paper is the summary of the existing practice for CO_2 emissions reduction in the Western Balkans countries energy sectors. Based on the analysis of greenhouse gas (GHG) emissions in Serbia, it can be concluded that the existing energy system is unsustainable. This paper points to this fact, i.e. to excessive reliance on fossil fuels, but also to progress through investment in the RES. The paper adopts the approach of the analysis of documented content by using relevant data from the CEE Bankwatch Network report – Climate change: Time for the energy community to take action. Relying on secondary sources, the data shown can give significant recommendations for energy sector transformation as a basic input of economic activities of every country including Serbia.

Renewable energy sources in the Republic of Serbia

Renewable energy sources are those that are found in nature and can fully or partially be naturally replenished. The most important renewable energy sources are: wind power, solar energy, bio-energy and hydropower. The issue of renewable energy sources is very current in all developed countries. There are numerous advantages to using such sources: for instance they are more environmentally friendly than conventional sources, particularly with regard to air emissions, and emissions from renewable energy sources are much more short-lived that those from fossil-fuel plants. Namely, combustion of fossil fuels releases large quantities of CO_2 which increases the greenhouse effect. Many directives and policies have been enacted in the EU aiming at supporting renewable energy sources. The EU's goal for 2020 is to meet the so called „20–20" targets. The key objectives of these targets are a 20% increase in the use of renewable sources and a 20% decrease in the emission of greenhouse gases. In order to reach these objectives, EU countries are introducing various economic instruments to stimulate investing in renewable energy sources, such as feed-in tariffs, quota systems and a green bonus. Since November 2009, the Serbian Government has adopted several regulations under Directive 2009/28/EC, including establishing a system of „incentive tariffs" within which the Serbian Government will subsidise the cost of renewable electricity.

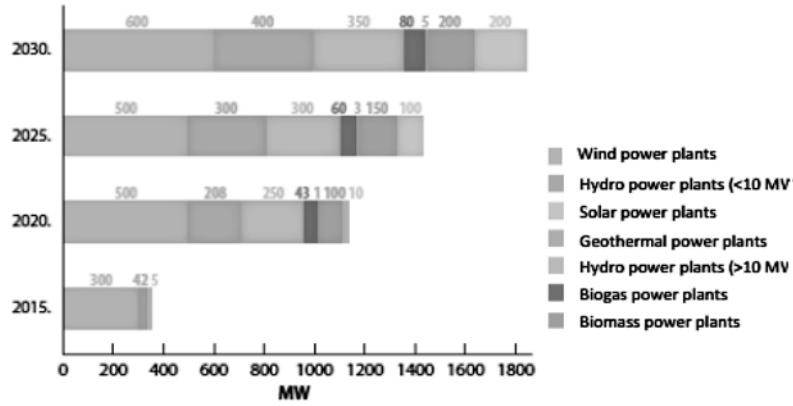
Renewable energy sources are the focal point of Serbia's energy independence in the future. This is supported by the fact that the total potential of energy from renewable sources can meet a quarter of Serbia's annual demand; add to that the enormous potential for energy savings across all sectors, and the general impression is that Serbia has good renewable energy sources: some estimates of wind power indicate 10.000 MW, while the potential for small hydropower plants is estimated at no less than 500 MW. Although renewable energy sources are particularly important for Serbia because of its accession to the EU, the use of renewable sources in production of electricity has not yet reached greater proportions, which is unacceptable given the huge potential for their use (the overall technical potential of energy from renewable sources is around 160 PJ per year). Namely, the large potential for use of solar energy is evident from the fact that the number of sunny hours in Serbia exceeds 2000, while the solar energy emitted in one year on $1m^2$ of roof of one house equals the energy generated from the combustion of 130 litres of oil. Areas with a large number of sunny hours and annual ratio of actual radiation and overall possibility cover approximately 50% of Serbia's territory. Finally, it is important to note that the energy potential of solar radiation in Serbia is one third (about 40%) higher than in Central Europe, making it very attractive to investors [Nikolic & Vlatkovic, 2015].

RES and new production of electricity

The environmental imperative to reduce CO_2, emissions in the energy sector coincides with a looming new investment cycle in power generation in most OECD countries. In the emerging market economies, many power generation facilities are quite new, but many more will be built in the coming years to meet growing energy demand. As power plants and other infrastructure tend to have long operating lives, we must avoid „lock-in" of CO_2 emissions by ensuring the latest clean technologies are used. We have a narrow margin. If we do not manage to slow current rates of emissions growth, we will hit the ceiling by 2017, meaning that to keep the global increase in temperature to 2 degrees Celsius; all new infrastructure will have to be zero-emission.A large-scale transformation of the global energy sector is possible, although it will require significant investment. Global emissions could be halved by 2050, using existing and emerging technologies, at an additional cumulative investment of 46 trillion US dollars, a further increase of 17% on top of baseline investments. It is vital for governments to create an enabling policy framework to catalyse private-sector investments in the transition to a low carbon energy sector. By acting now, long-term costs can be reduced. Every US dollar that is not spent on investment in the energy sector before 2020 will require an additional 4.3 US dollars to be spent after 2020 to compensate for increased greenhouse gas emissions by building zero-carbon plants and infrastructure by 2035 [OECD, 2011].Taking this into account, the negative impact of the energy sector on the environment, primarily on the air quality, can be partially compensated using the RES, but for the most part can be compensated by implementation of measures for protecting the environment at energy production installations. For investors, the potential economic performance of energy projects is carbon price of 5 Euros, which is similar to today's EU-ETS price as well as the price of 30 Euros, which is expected in 2025 [Change partnership, 2015].

The fact that Serbia has no obligation to introduce compensation for carbon emissions led to a plan to increase the capacity of electricity generation from coal. However, in the process of accession to the EU, Serbia's power sector will be faced with mandatory and financially burdensome costs of CO_2 emissions. Projected changes in the structure of energy sources for electricity production (significant share of RES and natural gas), the withdrawal of old and inefficient plants, commissioning of new, more efficient lignite-fired power and reduction of losses in distribution and transfer will lead to significantly lower specific GHG emissions from these sectors. According to the Energy Community, Serbia has a binding target to achieve electricity production from the RES of 27% by 2020. In order to achieve the adopted national targets, facilities producing electricity from wind, biomass and solar energy are planned to be build (Figure 1) [Republic of Serbia, Ministry of Mining and Energy, (2016)].

Figure 1. Electricity production using RES



Source: Energy Strategy of the Republic of Serbia until 2025 with projections to 2030.

Over a ten-year period, we have been comparing the total costs of new fossil fuel capacity against total costs of meeting that same capacity through wind or solar energy (see Table 1). As can be seen, wind is the cheapest way to cover electricity from new installations [Djordjevic et al., 2015].

Table 1. Cost comparison between fossil fuels and RES of new capacity for the first 10 years of operation

Country (Encom)	Total cost of new fossil fuel capacity in 2030 (€)	Wind cost at current prices (€)	Difference (%)	Solar cost at current prices (€)
Serbia	10,144,609,000	7,561,631,605	75%	12,851,420,455
Albania	125,290,000	213,625,245	171%	31,0415,094
Bosnia and Herzegovina	4,012,743,000	3,371,367,417	84%	6,436,914,894
Macedonia	1,588,215,000	1,541,010,274	97%	2,364,856,776
Montenegro	1,401,492,000	1,008,600,000	72%	1,890,000,000

Source: Djordjevic et al., 2015.

Taking into account the intended obligation of paying compensation for carbon emissions for new capacity using coal and gas in the future, it is estimated to be 25% cheaper to build new capacity using wind than new capacity using fossil fuels. On the one hand, the estimated costs of building new plants using fossil fuels add up with the costs of carbon emissions for the first ten years of operation (2020–2030). On the other hand, although many facilities have been installed to obtain the same amount of energy, the equivalent wind power would cost 7.5 billion euros [Centre for Ecology and Sustainable Development (STEP), 2015].

The data in the preceding tables show the challenges faced by the member states of the Energy Community with regard to electricity production and investment in the short and medium term. In addition to the ongoing energy projects, it becomes necessary to consider other renewable energy sources,such as biogas, cogeneration biomass and geothermal energy.

Key points of CO_2 market development in Serbia

Keeping in mind the global effects of climate change, as well as the growing number of ecological catastrophes all around the world, the Kyoto protocol question becomes more and more significant. The necessity of implementing this document is quite obvious. Serbia signed the Kyoto protocol on January 17th 2008. Even though Serbia's position is mainly defined by the causes and consequences of transition to EU membership, certain experiences of some countries might be important in understanding global tendencies and defining one's position. This particularly refers to tendencies related to negotiations on future activities of the international community regarding climate change and taking on commitments which are (not) in accordance with economic and social abilities [Todić & Grbić, 2014].

Considering former analyses and projections, key points of emission market growth would be the following [Djordjevic et al. 2015]:

1. **A price signal on current greenhouse gas emissions:** Total coal and gas generated electricity emissions, in 2012, were 25,806,330 tonnes of CO_2. At a carbon price of 5 Euros this would cost the electricity generators 129,031,650 Euros. With a carbon price of 30 Euros this would cost 774,189,900 Euros;
2. **Planned new fossil fuel capacity:** Serbia is planning to build an extra 2.85 GW of coal-fired capacity, with construction costs estimated at 6.7 billion Euros, to which a carbon cost of 419 million Euros per year should be added;
3. **Implementation of the Industrial Emissions Directive:** Plant modernisation and/or replacement in line with the directive's provisions would require an investment of 2.7 billion Euros, by 2018;
4. **Renewable energy:** Serbia has great potential to develop renewable energy and further investments should be channelled into this area, with a view to its future membership of the EU. Displacing planned new coal with renewable energy to generate a similar amount of electricity would save up to 2.5 billion Euros (if replaced by wind), and
5. **Energy efficiency:** With almost half of its energy imported and increasing electricity demand, Serbia must swiftly address the efficiency issues related to its energy system through better coordination of policies and actions, significant financial support and coordination between public

and private investments. Its current electricity losses mount to over 215 million Euros per year.

Using carbon markets to improve the energy efficiency of a country may have some positive implications such as [Stojanovic & Popovic, 2016]:

- ❏ attracting new technologies;
- ❏ encouraging economic innovation;
- ❏ improving the competitiveness of the economy and
- ❏ fostering long-term economic growth.

Pursuant to the above mentioned, investing in projects using renewable energy is very important for several reasons:

- ❏ renewable energy sources have a very important role in reducing CO_2 emissions into the atmosphere and reducing emissions is the goal of EU policy;
- ❏ increasing the share of renewable energy increases the sustainability of the system (reducing dependence on imports of raw material and electricity);
- ❏ it is expected that the renewable energy sources will become economically competitive with conventional energy sources.

Bearing in mind the global effects of climate change on the health of the population in the Serbia, as well as the increasing number of environmental disasters around the world, the issue of the Kyoto Protocol, investing in projects using renewable energy is becoming increasingly important.

Conclusion

Increasing energy efficiency by using international carbon market in one country can result in: attracting new technologies, encouraging innovation in the economy, improving competitiveness and encouraging long-term economic growth. Admittedly, investments in renewable energy require a great deal of financial commitment which may not be attainable by some companies. In the global carbon market, Serbia can turn its energy inefficiency into a competitive advantage. However, improving the efficiency of energy consumption is not just presuming the application of certain technical solutions. In fact, any technology, no matter how effective, loses that feature if not used in the most efficient manner. If Serbia wishes to become a full member of the EU it is necessary to adopt rules for protecting the environment and reducing climate change effects.

When it comes to power generation in Serbia, investment projects in this area are primarily directed at funding the capacity building for the use of RES such as wind, solar and hydropower. Investing in projects using RES is primarily a matter for people's conscience and their will to change long-established habits and adopt energy-efficient solutions. For that reason, it is necessary to consider consumer habits first and direct them toward more conscientious choices before making recommendations for improving the energy efficiency

of a country. Accordingly, decisions about their application will be made on the basis of their cost-effectiveness, which will increase energy as well as economic efficiency.

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Rozwój rynku węglowego i wydajności energetycznej w Republice Serbskiej

Streszczenie

Dostawa energii stanowi jedną z głównych kwestii zrównoważonego rozwoju w skali globalnej i wiąże się ze wzrostem wydajności energetycznej, modernizacją zakładów oraz wykorzystaniem odnawialnych źródeł energii. Praca ta zawiera porównanie kosztów elektryczności pozyskanej poprzez wykorzystanie aktualnych komercyjnych technologii oraz technologii, które będą dostępne w następnej dekadzie. Celem pracy jest wskazanie, że inwestycje w technologię niskoemisyjną to inwestycje przynoszące zyski a także, że zredukowana emisja CO_2 w kraju prowadzi do jej redukcji na poziomie światowym. Praca kładzie szczególny nacisk na ceny emisji CO_2 na rynku węglowym, co może zachęcać do realizacji projektów opartych na znacznym wykorzystaniu odnawialnych źródeł energii (RES) w Republice Serbskiej.

Słowa kluczowe: rynek węglowy, cena węgla, wydajność energetyczna, odnawialne źródła energii

Carbon Market Development and Energy Efficiency in the Republic of Serbia

Abstract

Energy supply represents one of the main issues of sustainable development on a global scale, and its solution is in energy efficiency increase, plants modernization and use of renewable energy resources. The paper provides the comparison between the cost of electricity from current commerical technologies and the technologies expected to be commercially available in the next decade. The aim of the paper is to point out that investment in low emission technology is profitable investment, and that reduced CO_2 emissions in a country lead to their reduction on the global level. Special emphasis in the paper is on CO_2 emissions prices on the carbon market which can encourage project realization focused on larger exploitation of renewable energy sources (RES) in the Republic of Serbia.

Key words: carbon market, carbon price, energy efficiency, renewable energy sources

JEL: Q4, Q5, F53, D4

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