RENEWABLE ENERGY POLICY CONSIDERATIONS

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A ROADMAP FOR DEPLOYING RENEWEBLE ENERGY SOURCES IN SERBIA AND THE REGIONAL PERSPECTIVE

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Abstract

The energy policy aimed at securing a future for sustainable energy should be based on three key themes: improving fossil fuel technologies to have a lower environmental and social impact; applying renewable technologies on a wider scale; and introducing energy efficiency measures in the fields of energy conservation, distribution and consumption. Authors of this paper strive to point that renewable energy will continue to play important role in the transition towards a competitive, secure and sustainable energy systems in the future, especially having in mind that the global electricity demand is constantly increasing, as is its share in overall energy usage.

The challenges of the energy strategy, driven by climate changes and energy security, are reflected in creating an energy market with competitive prices, ensuring security of supply, reducing CO_2 emissions and saving energy. In this paper, key policy themes related to renewable energy utilization in the power sector are analyzed; as well as obstacles to their deployment and the main challenges facing decision makers. Negative impacts of electricity production from various sources on environment, climate and health are discussed, along with the support mechanisms and schemes, which are still necessary to make most renewable energy technologies competitive. The variability of electricity production from intermittent sources (wind, solar) has been also addressed, as well as the renewable energy cost and benefit analysis and the model of the Levelized Cost of Electricity, which enables a fair comparison of different electricity generating technologies.

The common message throughout this paper is that the utilization of renewable energy sources in Serbia and the region is far below the level projected and committed to by these countries as contracting parties in the Energy Community Secretariat. It is also clear that the lack of projects is not due to a lack of interest among investors and independent power producers (IPPs). On the contrary – the interest is there and money has started flowing into the sector, but a result is still lacking. This is due solely to a number of different barriers – economic, political and social – which hamper construction of most renewable energy projects, especially the larger example. In that respect, this paper suggests the guidelines on the key policy issues, aimed to enable wider utilization of renewable energy sources.

Finally, it is clear that the issue of renewable energy utilization, associated with climate change mitigation and the promotion of green economy, is too important to be left solely to experts. It requires consensus among the widest group of stakeholders, because our decisions about climate and renewable energy policy represent our existential choices about the way of life, as well as about the prospects for the future generation.

Table of Contents

Introduction: Energy as the Key Problem of the Future

The world is turning towards renewable energy. That's a fact, whether we like it or not. In this sense, humanity has completed a full cycle. The first energy we started using came from renewable sources. For heat we relied on the Sun and biomass (wood, straw), and for transportation mankind used horses and wind (sailboats). The Industrial Revolution brought us the steam engine and the mid-1700s saw the emergence of the first modern coal-powered steam engines. In the 17th and 18th centuries, coal was also used for heating buildings. Electricity and oil came with the Post-Industrial Revolution (19th and early 20th centuries). The world saw its first electrical generator in 1880 and a year later, in 1881, the world's first hydroelectric plant went on-line in Wisconsin, USA. By the late 1800s, a new form of fuel was catching on: petroleum. By the 1900s, oil - processed into gasoline_ was powering internal combustion engines. Then came the "electricity era", which saw power lines extend between cities, bringing electricity to rural areas across Europe and much of the world. As cars became an available commodity, demand for gasoline steadily increased. Energy consumption grew quickly, doubling every 10 years.[1] As the cost of producing energy was then declining steadily, efficient energy use was not a concern. After World War II, the energy sector's new focus was on harnessing nuclear power to produce steam and electricity. The first nuclear reactor for producing electricity started operating in December 1951 in Idaho, USA. Then, in the 1970s, the US support for Israel in the Arab-Israeli War led the oil-producing Arab nations halting the supply of oil to the United States and other Western nations. Oil prices tripled overnight and then rose again by 150% in a matter of weeks[2]. A series of serious blows hit the nuclear power industry with the Three Mile Island nuclear disaster of 1979 and then, in 1986, the Chernobyl disaster. Energy prices were no longer "too small to matter" and energy no longer seemed to be in abundance. The world began slowly turning to renewables once again – as energy sources that contribute to saving the planet, reduce the environmental damage caused by extensive use of fossil fuels and represent a reliable alternative for future generations when fossil fuel reserves become depleted or too expensive to extract from the ground. One of the biggest challenges facing humanity is providing the planet with safe, clean and sustainable supplies of energy.

Two key problems exist when it comes to fossil fuels. They were best summed up by Nikola Tesla, our most celebrated scientist and one of the world's leading innovators, when he said: "Energy is the key problem of the future – the question of life or death. Contemporary energy sources are not reliable and pollute our planet. We might survive that pollution, but the day will come when these sources will be depleted"[3].

The world's current energy systems have largely been built on fossil fuels and now depend on them overwhelmingly: they are concentrated, making them easy to store and distribute. Fossil fuels (coal, natural gas, and oil) accounted for 80% of global primary energy consumption in 2014 and the International Energy Agency (IEA) predicts that, by 2017, coal will have replaced oil as the dominant primary energy source worldwide.

Coal has remained the fastest-growing fossil fuel at the global level, with incredible growth in the consumption of coal China and India. China now accounts for a dominant 47.5%

[1] Bernard Pipkin, Dee Trent, Richard Lazlett, Paul Bierman, "Geology and Environment", 2014, 2011 Brooks/Cole, Cengage Learning, p. 504
[2] WTRG Economics "Oil Price History and Analysis", http://www.wtrg.com/prices.htm
[3] http://hr.wikiquote.org/wiki/Nikola_Tesla, original quote reads: "Energija, to je ključni problem budućnosti – pitanje života ili smrti. Sadašnji izvori energije su nepouzdani i truju naš planet. Možda preživimo to trovanje, ali doći će dan kada će ti izvori energije presušiti."

Renewable technologies will bring an end to the fossil fuel era before we deplete fossil fuel reserves – just as the Stone Age ceased to exist not because we ran out of stones, but rather because the Bronze Age technology became superior.

of the world's production of coal, followed by the United States (13.4%) and India (6%).[4] Existing global coal and lignite reserves are sufficient for the next 137 years, at current rates of production.[5] However, most of these reserves are in North America, China, CIS (Commonwealth of Independent States) countries, i.e. members of the former Soviet Union, Australia and New Zealand. The EU's share of global energy reserves and resources accounts for only about 3%. On the other hand, the EU is the world's third largest coal-consuming region, after China and North America, and the world's second largest importer of coal, behind China. As such, although fossil fuel reserves are ultimately finite, there are no concerns that the planet will run out of them in the short-to-medium term. We could, however, argue that new renewable technologies will bring an end to the fossil fuel era before fossil fuel reserves are depleted – just as the Stone Age ended not because we run out of stones, but rather because the technology of the new Bronze Age became superior[6].

When it comes to oil, after a period of almost five years of oil price stability (around $100 per barrel since 2010), oil prices fell dramatically – from $115 per barrel in June 2014 to the current level of $50 per barrel. However, low oil prices are not expected to have a substantial negative impact on investment in renewables. In other words, clean energy growth won't be slowed down by cheap oil. As proof of this statement, we can note that global investments in renewables grew by 17% in 2014, which equates to total investment of $270 billion worldwide, compared to $232 billion in 2013[7].

The reason for this is the fact that renewables and oil do not compete in the same field. Renewable energy is utilized predominantly in the power generation sector, with the aim of producing large quantities of low carbon electricity. On the other hand, oil is primarily used in motor vehicles and for heating/cooling purposes (e.g. in the United States, only 1% of electricity was generated from oil in 2014). Of course, as we use more electric cars, transportation could rely more on renewable energy, but this would require widespread use of electric cars in order to have a genuine impact. Natural gas, however, as the fastest growing source of energy, actually does compete with renewable energy. Natural gas-fired power plants in the U.S. today provide more than a quarter of the nation's electricity. If the low price of oil causes suppliers to limit their production, we can even expect an increase in natural gas prices, which would in turn make renewable energy even more cost effective.

The second problem relates to the impact of fossil fuels on the environment and society. From the moment of their exploitation and extraction from the ground, as well as during the course of their distribution, fossil fuels represent an environmental and health hazard, while their combustion generates large quantities of carbon dioxide, a greenhouse gas responsible for global warming and climate change. In the foreword for the publication "Coal Industry Across Europe", whih was published in 2013 by the European Association for Coal and Lignite (EURACOAL), Phillip Lowe, Director-General for Energy at the European Commission, stated "The facts are undeniable: 87% of the EU's CO_2 emissions come from energy production or use, while energy industries still remain the dominant source". Furthermore, global CO_2 emissions continue to grow: emissions have increased by almost 50% since 1990, with the majority coming from developing countries[8].

[4] World Watch Institute, http://www.worldwatch.org/
[5] European Association for Coal and Lignite (EURACOAL), "Coal Industry Across Europe", 5th Edition, 2013
[6] Expression taken from Sheikh Ahmed Zaki Yamani, Saudi Arabian politician who was Minister of Oil and Mineral Resources from 1962 to 1986, and a minister in OPEC for 25 years.
[7] Report on Global Trends in Renewable Energy Investment, Frankfurt School - United Nations Environment Programme, in collaboration with Bloomberg New Energy Finance, April 2015
[8] The Millennium Development Goals Report 2014, UNDP

As much as 87% of the EU's CO_2 emissions come from energy production or use, with energy industries remaining the dominant source.

These considerations suggest that a policy aimed at securing a future for sustainable energy should be based on three key themes: introducing improved fossil fuel technologies that will have a lower environmental and social impact (i.e. *"cleaning-up" fossil fuel technologies);* applying renewable technologies on a wider scale (i.e. *changing the patterns of energy use*); and introducing energy efficiency measures in the fields of energy conservation, distribution and consumption.

In order to address these challenges, in March 2007 the EU's leaders set climate and energy targets that the Union should achieve by 2020, committing Europe to becoming a highly energy-efficient, low carbon economy. The so-called "20-20-20" targets – meaning a 20% reduction in the EU's greenhouse gas (GHG) emissions from 1990 levels; raising the share of EU energy consumption produced from renewable resources to 20%; as well as securing a 20% improvement in the EU's energy efficiency – were enacted as the 2009 climate and energy package. The overarching goal of the "20-20-20" targets is to combat climate change, increase the EU's energy security, strengthen its competitiveness and ensure efficient usage of energy. Under the Renewable Energy Directive, EU Member States have accepted binding national targets for raising the share of renewable energy in their energy consumption by 2020. These targets, which reflect Member States' different starting points and potential for increasing the production of renewables, range from 10% in Malta to 49% in Sweden. The national targets will enable the EU as a whole to achieve its 20% renewable energy target for 2020. The targets will also help cut GHG emissions and reduce the EU's dependence on imported energy.

The Energy Community stands as the first common institutional project undertaken by the non-EU countries of Southeast Europe.

Interestingly, following the wars of the 1990s, this region – primarily referred to in this paper as the countries of the former Yugoslavia –came together for the first time in the energy sector. On October 25th, 2005, a treaty was signed in Athens establishing the Energy Community. The signing of the treaty was approved by the European Parliament on May 29th, 2006, and it subsequently entered into force on July 1st, 2006. The conflicts between the countries of the former Yugoslavia led to the disintegration of a unified energy system that had stretched from the Adriatic to the Black and Aegean seas. The goal of the Energy Community was to re-establish cooperation between the separate entities that previously functioned as a single system and which still relied on each other to ensure the smooth functioning of their power supplies. However, according to the European Commission (COM(2011) 105 final), "the Energy Community is …founded on solidarity, mutual trust and peace. The very existence of the Energy Community, only ten years after the end of the Balkan conflicts, is a great success in its own right, considering that it represents the first joint institutional project undertaken by the non-EU countries of Southeast Europe".

In December 2009, the Ministerial Council of the Energy Community brought a decision approving the accessions of Moldova and Ukraine. With this decision, the geographical concept of the Western Balkans, with which the process was linked initially, lost its relevance. The key goal of the Energy Community Treaty today is the harmonizing of the energy policies of these non-EU countries with those of the EU, in other words, Energy Community serves to transfer the relevant EU energy *acquis communautaire*, help in the development of an adequate regulatory framework and liberalize the energy markets of the Contracting Parties in line with the *acquis*. An important part of that is implementation of the EU "20-20-20" targets by the Contracting Parties, signatories of the treaty on formation of the Energy Community, even though they are not part of the EU. Hence, the 10th Ministerial Council of the Energy Community, on October 18th, 2012, adopted Directive 2009/28/EC and determined national renewable energy targets until 2020[9] for the nine Contracting Parties (Table 1).

[9] Decision 2012/03/MC-EnC

Table 1: Energy Community renewable energy sources 2020 targets[10]

Contracting Party	Percentage of RES in gross final energy consumption, 2009	Target percentage of RES in gross final energy consumption, 2020
Albania	31.2%	38%
Bosnia and Herzegovina	34%	40%
Croatia	12.6%	20%
Macedonia	21.9%	28%
Moldova	11.9%	17%
Montenegro	26.3%	33%
Serbia	21.2%	27%
Ukraine	5.5%	11%
Kosovo* [11]	18.9%	25%

The Government of the Republic of Serbia adopted the Decision of the Ministerial Council of the Energy Community on the promotion of the use of renewable energy by means of transposition of the EU Directive 2009/28/EC on renewable energy. This decision sets a mandatory target for Serbia to increase the percentage of renewable energy in gross final energy consumption to 27% by 2020, from a starting point of 21.2% in 2009. Serbia's mandatory target for energy consumption from renewables by 2020 is lower than those of Albania, Bosnia and Herzegovina, Macedonia, and Montenegro. Accordingly, in 2013 the Serbian Government enacted the National Renewable Energy Action Plan - NREAP (Official Gazette 53/2013). The NREAP sets individual targets for each sector: 30% should be achieved in the heating/cooling sector (from a starting point of 25.6%); 36.6% in the electricity sector (from a starting point of 28.7%); and 10% in the transportation sector (starting from 0%). Translated into megawatts, in the power/electricity sector, as stated in NREAP, Serbia requires 1,092 MW of new capacities for production from renewables by 2020[12].

The EU seems to be on the right track to achieving the 2020 targets. This region, however, is seriously lagging behind.

To date, the EU as a whole seems to be on the right track to achieving the targets it has set for itself. According to available estimates, in the case of GHG emission reduction, the EU will reach 24% and thus exceed its target for 2020; in the case of increasing the final consumption of energy from renewables, it seems that the EU will achieve 21% and, again, exceed its target for 2020; finally, in the case of energy efficiency targets, estimates suggest that EU will fail to achieve this target, hitting only 17%[13]. Considering that only five years remain until 2020, the EU has already set its targets for 2030, which are even more ambitious and demanding than those set for 2020. The 2030 GHG reduction target is at least 40% compared to 1990; a target of at least 27% has been determined for renewable energy; while levels of energy efficiency, i.e. energy savings, have also been set at 27% by 2030.

This region, on the other hand, is seriously lagging behind, despite the fact that there is very high potential to be tapped by implementing the *acquis* related to climate and energy targets. According to the Annual Implementation Report for 2013/2014, as well as the new Annual Implementation Report for 2015 published by the Energy Community Secretariat on September 1st, 2015[14], there is reason

[10] Energy Community Directive 2009/28/EC

[11] *This designation is without prejudice to positions on status, and is in line with UNSC 1244 and the ICJ Opinion on the Kosovo* Declaration of Independence. This is used throughout the paper and means the same thing.

[12] It needs to be noted that this is based on estimated rate of total energy consumption in Serbia in 2020. If the consumption is higher than estimated by NREAP, i.e. if the country fails to deliver on its energy efficiency targets, than the target of 1,092 MW will be correspondingly higher.

[13] 2030 Framework for Climate & Energy #EU2030, http://www.energy-community.org/pls/portal/docs/3184029.PDF

[14] https://www.energy-community.org/portal/page/portal/ENC_HOME/DOCS/3356393/Energy_Community_Implementation_Report_2014_WEB.pdf; Annual Implementation Report 2015, Energy Community Secretariat, September 2015.

to believe that more than a few Contracting Parties will fail to meet the targets fully by the year 2020, including Serbia. In the area of renewable energy, the Energy Community Secretariat had to launch infringement procedures against a number of Contracting Parties for failing even to submit their National Renewable Energy Action Plans (NREAPs).

As for Serbia, even though the Government adopted its NREAP on time, as well as the new Energy Law, which has been implementing the 3rd Energy Package since its adoption in December 2014, in practice we have seen very modest investment activities, mainly in small hydro power plants (i.e. projects below 10 MW), followed by solar and biogas plants – with the total capacity of all projects eligible for the feed-in tariff (many of which are still under construction) in the range of 5% of the planned 1,092 MW. The general note about Serbia in the latest Implementation Report by Energy Community Secretariat is positive as we look back on another successful year of reforming the energy sector.[15] It is recognized that Serbia has transposed the Third Package into the new Energy Law even before the expiry of the deadline, aligning the provisions on authorisation and tendering for construction of new generation facilities with the *acquis*. At the same time, despite all the progress in upgrading the legal and regulatory framework and the assistance provided to the potential investors in renewable energy, very few renewable energy projects are currently under construction. It is concluded that Serbia is not on track to meet its 2020 targets, since the impact of the legislative framework on the actual deployment of renewable energy in the last years was minimal, resulting in only 23 MW of new renewable energy capacities put into operation, since the adoption of the Renewable Energy Directive 2009/28/EC in 2012[16].

Considering that the entire region has only five more years in which to fulfill mandatory renewable energy targets (2015 to 2020), a considerable shortfall exists between expectations and reality. It is obvious that, in a stark contrast to the EU, the region has not even started considering the 2030 targets. In other words, the significant renewable energy potential that exists in Serbia and the rest of the region remains unexploited.

There are a number of reasons for this very drastic delay and lack of investment activities in the renewable energy sector. They range from unnecessary regulatory barriers; infrastructure constraints; inadequate resource assessment; complex legal, social and political environments that make it extremely difficult to attract such large investments; a lack of regional cooperation; etc. What is certainly needed is an integrated policy framework for the period up to 2030, which would ensure regulatory certainty for investors and a coordinated regional approach.

[15] Annual Implementation Report 2015, Energy Community Secretariat, September 2015
[16] Annual Implementation Report 2015, Energy Community Secretariat, September 2015

Chapter 1

EU ENERGY TRENDS: POLICY DRIVEN BY CLIMATE CHANGE AND ENERGY SECURITY

1.1. EU policy framework for climate and energy

The EU has demonstrated the political will to make meaningful progress on the further deployment of renewable energy technologies, reducing greenhouse gas emissions and improving energy efficiency, with the ain of creating a low-carbon economy. The EU's 2030 Framework for Climate and Energy Policies aims to develop a "competitive and secure energy system that ensures affordable energy for all consumers, increases the security of the EU's energy supplies, reduces dependence on energy imports and creates new opportunities for growth and jobs" (European Commission, 2030 Framework for Climate and Energy Policies).

This framework is centered on three binding targets, which are mutually supportive and reinforcing: renewable energy targets, GHG[17] reduction targets and energy efficiency targets.

In 2011, the EU spent €406 billion on fossil fuel imports, which rose to €545 billion in 2012. The 27% renewable energy target for 2030 would result in fossil fuel import savings of €190 billion over a 20-year period (2011-2030); while achieving the 30% renewable energy target would save €450 billion in imported fossil fuel costs during the same period – which is €260 billion more for this 20-year period, or €13 billion annually…

The binding target to reduce EU domestic GHG emissions is set to *a minimum of 40% below the 1990 level by 2030.* This target puts the EU on a path to achieving 80% GHG reduction by 2050, while helping to ensure a sound Emissions Trading System (ETS)[18], which drives GHG emissions down in the long term. The new improved emissions trading scheme (ETS) is expected to be more decisive and effective in encouraging low-carbon investments with the lowest possible costs to society, This improved ETS represents the EU's main tool in achieving GHG emission reductions. It is important for carbon emissions to be linked to a specific cost, in order for the different generating technologies to be priced (and compared) according to their real cost to society. It is unfair that renewable energy technologies have to compete with fossil fuel technology, but in the absence of a system in which environmental costs are reflected in the electricity price for consumers, the playing field remains far from level. This topic will be addressed in greater detail in Chapter 4.

In order to achieve this general target of 40%, the sectors covered by the EU's ETS would have to reduce their emissions by 43% compared to the 2005 level, while other sectors would need to reduce emissions by 30% below the 2005 level. This binding target will be translated into specific goals for each Member State, and the European Council has outlined the main principles for achieving this goal.

Renewable energy continues to play important role in the transition towards a competitive, secure and sustainable energy system. However, support mechanisms and schemes (e.g. Feed in Tariffs) are still necessary to make most renewable energy technologies competitive. The EU has set a new binding renewable energy target for a minimum of 27% of final energy consumption in the EU by 2030. This target is aimed at improving Europe's energy security and reducing import dependence, helping to avoid a fossil fuel lock-in, boosting technological innovations and green

[17] Carbon dioxide (CO_2) is the most important anthropogenic greenhouse gas implicated in global warming. Other greenhouse gases include methane (CH_4), dinitrogen oxide (N_2O), halocarbons and ozone. These human-induced emissions are the principle cause of a process of climate change that has already led to a rise in the earth's mean surface temperature of around 0.6°C during the 20th century.

[18] The EU Emissions Trading System (ETS), an international system for trading greenhouse gas emission allowances, is developed to reduce industrial greenhouse gas emissions cost-effectively. It includes more than 11,000 power stations and industrial plants in 31 countries, as well as airlines, and covers around 45% of the EU's greenhouse gas emissions.

economy, and minimising the cost of de-carbonization. This sends the signal to investors that renewable energy is a priority, thereby reducing investment risk and the cost of capital. Utilizing renewable energy technologies leads to further cost reductions and, ultimately, to grid parity, which reduces the need for support mechanisms in the long run.

Finally, the target for energy saving and energy efficiency is set at 30% for 2030 and builds on the results already achieved in this field. Namely, energy usage in new buildings has been halved compared to the 1980 level; while the industry is about 19% less energy intensive than in 2001.

1.2. Power generation trends in Europe

Reducing carbon intensity in electricity generation technologies is today seen as a slow and lengthy process: despite significant implementing of renewable energy technologies in developed EU markets, the continuing use of coal in emerging economies is limiting the progress of further de-carbonizing power generation. Electricity is today largely generated from fossil fuels (70%), while 20% comes from renewable energy sources. Moreover, Europe's dependency on fossil fuels is increasing: in 2011, €406 billion was spent on importing fossil fuels[19], rising to €545 billion in 2012[20]. According to the Commission's impact assessment of the economic benefits of renewable energy targets, the renewable energy target of 27% by 2030 would result in fossil fuel import savings of €190 billion over the 20-year period (2011-2030); and the 30% renewable energy target would save €450 billion in imported fossil fuel costs during the same period – which is €260 billion more for the 20-year period, or €13 billion a year more[21]. Moreover, according to the Commission's report on the economic developments of energy in Europe, renewable energy led to savings of €30 billion in imported fuel costs during 2010 alone. If we compare this number to the total cost of support for renewable energy in Europe during the same year, which totaled €26 billion[22], it is evident that the cost of supporting renewable energy is offset by the avoiding of fossil fuel import costs.

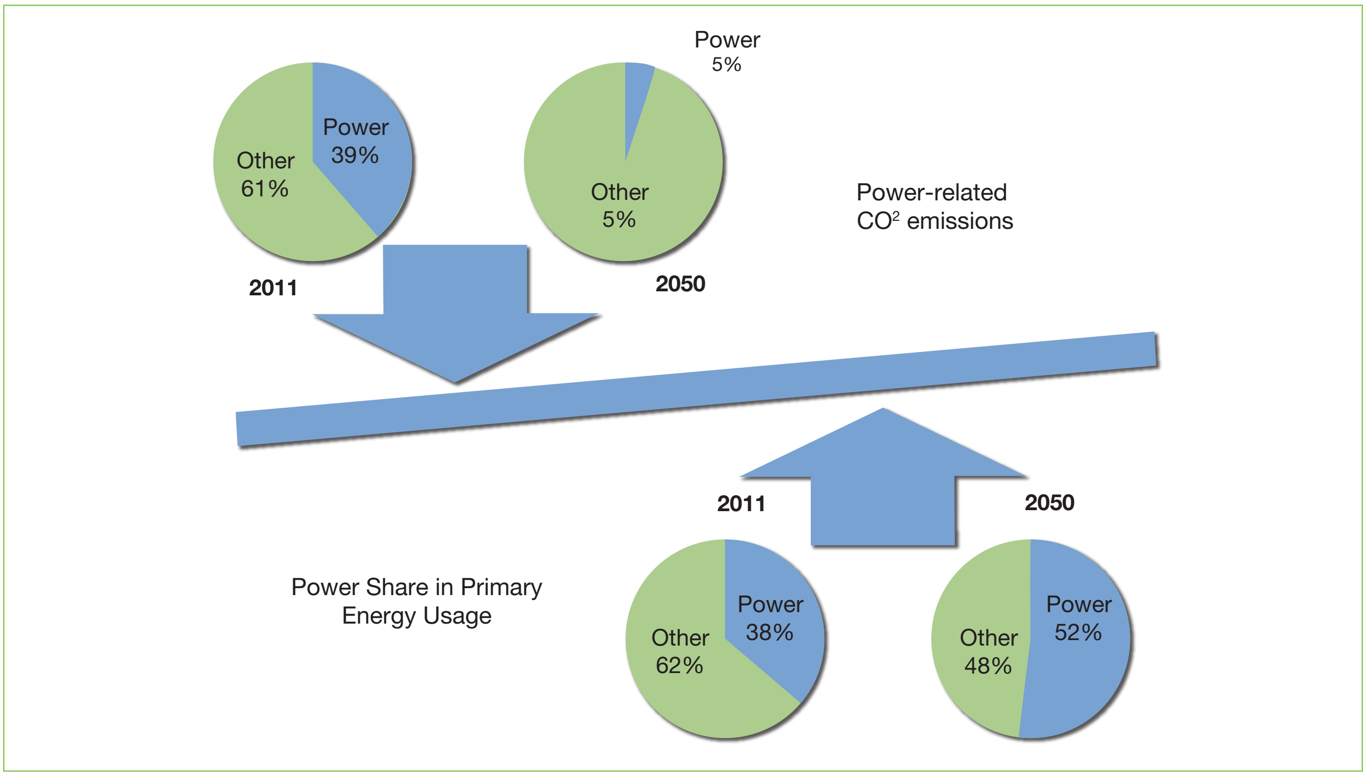
In the long term, it is predicted that the situation is likely to reverse: in 2050, 65% of electricity will be produced from renewables and 20% from fossil fuels[23]. According to Shell's scenario[24], renewables could be supplying possibly 50% of the world's energy by 2050. Furthermore, the Greenpeace Institute has suggested that we could have an energy system in 2100 based almost entirely on renewable energy, even assuming continued growth in energy use of 2% annually[25].

At the same time, global electricity demand is increasing constantly, as is its share in overall energy usage. In 2011, electricity accounted for 38% of the world's total primary energy use, with a share of 39% of power-related CO_2 emissions in total emissions from all sectors. According to the 2DS scenario developed by the IEA, 52% of total primary energy in 2050 would be used for electricity generation, with only a 5% share of power-related CO_2 emissions (Figure 1)[26]. These numbers suggest massive utilization of renewables during the next couple of decades, with variable renewable technologies having a dominant role, together with fuel switching from coal to gas power plants. Major emissions' benefits related to fuel switching for basic electricity generation are expected in the mid term – up to 2030; after 2030, further reductions in emissions

[19] Energy Challenges and Policy, European Commission contribution to the European Council, May 2013
[20] Energy Economic Developments in Europe, European Commission, January 2014
[21] European Commission Impact Assessment, SWD, 2014
[22] IEA World Energy Outlook, 2011
[23] International Energy Agency (IEA), Energy Technology Perspectives 2014
[24] Shell, The Evolution of the World's Energy System 1860-2060, Shell International, London, 1995
[25] Greenpeace, "Towards a Fossil Free Energy Future", Stockholm Institute report for Greenpeace International, London, 1993
[26] IEA, Energy Technology Perspectives 2014. The 2 degrees scenario (2DS) involves a model of an energy system consistent with an emissions trajectory that would give an 80% chance of limiting average global temperature increase to 2°C. It sets the target of cutting energy-related CO2 emissions by more than half in 2050 (compared to 2009) and ensuring that they continue to fall thereafter.

would primarily come from gas power plants with carbon capture and storage technologies (CCS). Key issues for replacing coal with natural gas, fuel switching and related investment decisions are linked to pricing, fuel supply constraints, environmental regulations and water constraints.

Figure 1: The role of electricity in primary energy usage and associated CO_2 emissions in 2011 and projections for 2050; under the 2DS scenario[27]



Increasing the production of electricity using renewable energy sources (wind and solar) introduces more variability of supply. This variability requires flexibility of the system, which can be secured by means of power generation that, when required, can be *quickly* turned on and off (i.e. gas-fired power plants); by using grid infrastructure in order to connect different markets; by demand side integration and usage of storage capacities (i.e. pump storage hydro power plants). Gas-fired power plants perform best when it comes to system flexibility and enabling higher integration of variable renewable electricity generation into power systems, but their utilization is often limited due to fuel supply constraints. Generating power at gas-fired power plants can be tailored to meet current needs and can easily monitor demand and supply changes on the grid. However, flexible operations increase the costs of operations and maintenance, thus the economics of flexible generation will depend on adequate regulation that rewards these services.

Gas-fired power plants are crucial for utilizing large-scale intermittent renewable energy sources, due to their flexible operation. The main hurdle, however, remains how to ensure a secure supply of gas.

Another trend is reflected in the increased need for storage capacity, which is expected to rise with the further integration into the grid of wind and solar power. Storage capacity is dominated by pump storage hydro power plants on the generation side, but there are other power storage technologies applicable in transmission and distribution, as well as in the end-user domain. Investments in power storage capacities are often driven by the deferral of investments in transmission and distribution infrastructure, but business models for investments in storage

[27] International Energy Agency (IEA), 2014

capacities are still not viable under current market and regulatory conditions – and will remain so until storage power capacity is not permitted to participate in ancillary service markets and receive adequate remuneration. As such, market design and regulation are keys for rewarding flexibility adequately– both in the case of gas-fired power plants and power capacity storages.

On the other hand, power storage technologies have numerous applications on the demand side – from batteries in electric cars to all households' appliances, where consumption management can be applied. There are huge opportunities to efficiently balance fluctuating electricity production from intermittent sources in the system using demand-side management, as opposed to constructing large storage capacity power units. This is a new, bottom-up approach, where consumption has to adjust to generation using consumption management (or demand-side management) with the aim of producing the desired changes in the power utility's load shape. The idea behind this is to manage loads in such a way as to engage electricity consumers (devices) during periods of cheap electricity (e.g. when there is maximum output from wind and solar power plants), moving the load along the time line, so that consumption ultimately begins monitoring and adjusting to production. The role of smart grids is to enable this consumer engagement and demand-side management – adapting consumption to fluctuations in electricity production from renewables.

Smart grids can be implemented at every level in the system, as they incorporate information and communications technologies into electricity generation, transmission and distribution, as well as consumption. Today's electricity grids already involve smart functionality features, though they are mostly used to balance supply and demand in the system. There are already established smart grid technologies, such as distribution automation (DA) and demand response (DR), which directly enable RES utilization and are cost-effective even without taking into account other benefits implied by the use of renewable energy. These technologies are already available to improve grid performance and enable system integration of renewable energy. For example - DR are used instead of new peaking plants or storage capacity – as they achieve the same benefits as, for example, gas-fired power plants, but do so at a lower cost.

Smart grids play an important role in the transition to a sustainable energy future by:
- **Facilitating integration of variable renewable energy;**
- **Supporting distributed generation;**
- **Creating new business models through enhanced information flows;**
- **Engaging consumers in demand-side management;**
- **Improving system control.**

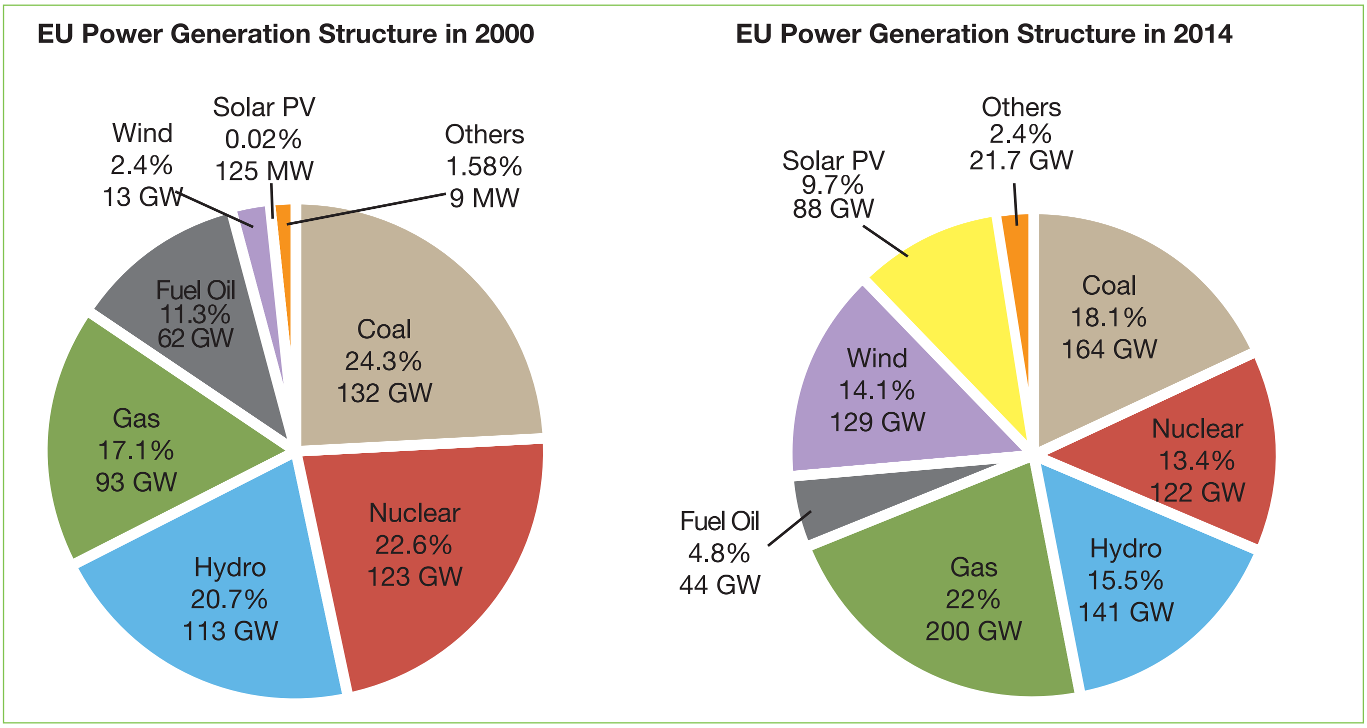
Advanced Metering Infrastructure (AMI) and Meter Data Management (MDM) are also beneficial for achieving higher renewable energy utilization levels. Smart intelligent meters with remote reading capabilities, coupled with inexpensive smart communication modules, represent a cost-effective smart grid technology by enabling consumers to engage when excess power is available (cheap electricity). For example, they can measure and track the output of a rooftop solar PV system and send data back to TSO (DSO). Other advanced smart grid technologies include smart inverters and renewable forecasting technologies, which contribute to the productivity and efficiency renewable power generation and are applied when the RES deployment level is high. Successful implementation of smart grid technologies requires an adequate policy and regulatory framework in order to address non-technical issues, primarily with regard to the distribution of costs and benefits across suppliers, consumers and grid operators.

Finally, to the surprise of many, recent projections suggest that solar power will possibly be the dominant energy source by 2050, as it comes close to wind, hydro and nuclear power in the IEA's 2DS scenario, and predictions are that over a quarter of global electricity could come from solar energy by 2050. According to IEA technology roadmaps and the hi-REN scenario, solar PV could account for 16% of the world's electricity generation by 2050, and solar thermal power from concentrated solar power plants (CSP) could add an additional 11% - combined, both could save over six billion tons of carbon dioxide emissions per year by 2050[28]. It is argued that even though the amount of solar energy to which the earth is exposed is extremely large (approximately 90,000 TW equivalent), due to land and geographical access limitations, only 1000 TW represents usable potential[29]. Even in that case, it still represents almost 80 times global energy production worldwide! In fact, the abundant potential of solar power was never questioned - it was the technology price that limited wide deployment of this source of energy. But the prices of solar PV systems fell rapidly and the price trend for PV will continue to make this technology more cost effective compared to fossil fuels and other conventional technologies. To illustrate this – there was a 22% year-on-year decrease in multi-crystalline silicon module prices in 2013. As the price of technology decreases and the level of deployment of PV systems increases, markets mature, and incentives will be reduced so costs converge towards those of the least-expensive systems. Solar PV technology has reached grid parity in Germany – the cost of solar PV generation is today lower than the retail price of electricity. Still, wholesale markets alone do not provide adequate remuneration for capital-intensive solar technologies, so financial incentives are still required in most markets in order for solar PV to compete with existing power generation options, until the cost gap with other newly-built generating technologies vanishes.

1.2.1. EU power generation mix

The share of renewable energy technologies in the overall new power generation capacities in the EU has been growing since the year 2000, as Europe moves away from fuel oil and coal, with both technologies continuing to be decommissioned more than they are installed. The highest growth since 2000 has been enjoyed by *wind power*, *gas* and *solar PV*, which has come at the expense of *fuel oil*, *coal* and *nuclear power*. The share of wind power in the total installed capacity has increased five-fold since 2000. Other renewable energy technologies (biomass, waste, hydro, geothermal, etc.) have increased their share in the overall generation mix too, albeit to a lesser extent. Figure 2 illustrates how the structure of electricity generation evolved from 2000 to 2014[30].

Figure 2: Change in the EU's electricity generation structure from 2000 to 2014[31]



[28] hi_REN is a variant of IEA's 2DS scenario for power sector, with same reduction targets as in 2DS scenario.
[29] Jackson, T. "Renewable Energy: Summary Paper for the Renewable Series", Energy Policy, Vol 20, 1992
[30] Wind in Power: 2014 European Statistics, European Wind Energy Association (EWEA), 2015
[31] It should be noted that only relative numbers in percentages are comparable; due to the fact that there has been a significant growth in energy consumption (and production) and that many facilities were decommissioned as opposed to newly built.

During 2014, 26.9 GW of new power generating capacity was installed in the EU, which is 9.4 GW less than in 2013. The negative impact of market, regulatory and political uncertainty across Europe during the last two years has resulted in a decreased level of investments in renewable energy technologies in some countries. For example, in large markets, such as those of Denmark, Spain and Italy, the rate of new wind power capacity decreased significantly - by 90%, 84% and 75% respectively. But during 2014, renewable energy sources accounted for 21.3 GW or 79.1% of the total new power capacity, and this was the seventh consecutive year when over 55% of all new power generating capacity was produced by renewable energy technologies.

The negative impact of market, regulatory and political uncertainty across Europe during the last two years has resulted in a decreased level of investments in renewable energy technologies in some countries. However, even then, renewable energy sources accounted for 79.1% of all new power capacity.

The leaders in the new installed renewable power capacity in 2014 were wind (11.8 GW or 43.7%) and solar PV (8 GW or 29.7%). The vast majority (59.5%) of all new wind capacity was installed in Germany and the UK. At the end of 2014 there were 128.8 GW of cumulative installed wind capacity in the EU (120.6 GW onshore and eight GW offshore), which could produce an average of 284 TWh annually – enough to cover 10.2% of the EU's electricity consumption (up from 8% the previous year).[32] Germany and Spain dominate the European wind market, with cumulative installed capacity at year's end 2014 of 39 GW and 23 GW, respectively.

Similarly, most of the new solar PV capacity was installed in Germany, Italy, the UK, France and Greece. Many European countries have already reached their national 2020 targets for solar PV. This is explained by swift deployment of PV systems, at a much faster rate than expected, but also the fact that most countries (except Germany and Spain) have set modest national targets for solar PV – thus markets have been underestimated in their national action plans. The cumulative solar PV capacity in EU at the end of 2013 was nearly 80 GW. In most EU countries today, solar PV and concentrated solar power plants (CSP) compete with peak generating units, contributing to reducing the mid-day peak demand. These two solar technologies have a complementary role: PV deployment has been much faster, due to significant technology cost reductions, and will continue to be faster until 2030. After 2030, when PV technology reaches a 5% to 15% share in annual electricity generation[33], large-scale deployment of STE will start - thanks to CSP plants' built-in thermal storage, which allows for the generation of electricity when demand peaks in late afternoon and after sunset, thereby complementing the PV generation from earlier in the day.

Interestingly, 3.3 GW of new coal capacity was installed in 2014 - but, at the same time, 7.2 GW of coal capacity was decommissioned, which represented more than double the capacity installed during same year. Even though gas power has been one of the fastest growing energy sources during the last decade, in 2014 some 2.3 GW of new gas power capacity was installed, with 2.9 GW of gas capacity being decommissioned. Fuel oil and nuclear power did not install any generating capacity in 2014, while an additional 1.1 GW of fuel oil capacity was decommissioned during same year. Technologies with modest utilization levels in 2014 include biomass (990 MW or 3.7%) and hydro (436 MW or 1.6%), while waste, geothermal and ocean power account for only 0.3% of all new installations.

[32] Wind in Power: 2014 European Statistics, European Wind Energy Association, 2015

[33] Deployment projections based on modelling in the "high-renewables" climate-friendly scenario, IEA's *Energy Technology Perspectives 2014*

Chapter 2

REGIONAL OUTLOOK: CAN THE REGION DELIVER ON ITS PROMISES?

2.1. Energy Strategy of the Energy Community

The Energy Strategy of the Energy Community is based on the same principles as the strategy of the European Union: it sets priorities and targets for the energy sector, as well as the actions to be taken in order to achieve them. As such, the members of the Energy Community face the same challenges in the energy sector as EU member states: creating an energy market with competitive prices, ensuring security of supply, reducing CO_2 emissions and making energy savings. The increased need for investments in new, low-carbon technologies for electricity generation, as well as modernisation of the energy systems, takes place during a time of economic crisis, with limited capital available to support these projects at a cost of capital consistent with project feasibility.

The Strategy sets a framework aimed at facilitating those investments and promoting energy security at both national and regional levels. To that end, it integrates national energy priorities into a regional context, placing an emphasis on investment opportunities for synergies between countries and the integration of regional electricity markets. It implies mutual cooperation and dialogue among neighbors in identifying joint projects of regional importance, as well as coordinating procedures for their implementation. This cooperation is still not sufficiently developed today – to name a few examples: there is a lack of integration of regional markets, a low level of cooperation between Transmission System Operators (TSOs) and balancing markets are not yet functioning.

The Energy Strategy sets three main objectives and related actions that are required to meet those objectives.

Outdated and inadequately maintained energy systems contribute to the high energy intensity in the region: in 2012 it was five times higher than the average energy intensity in the EU member states.

The first objective is to establish a competitive integrated energy market between the contracting parties and ultimately integrate in into the EU energy market. This objective requires the development of a common regulatory framework for energy markets, which enables energy trading across borders. This led to the defining of a range of actions and measures, mainly related to the removal of unnecessary barriers: barriers in interaction between Energy Community members and EU member states (which implies implementation of the Third Energy Package's internal energy legislation), as well as remaining legal barriers to energy trade (e.g. VAT harmonization between Energy Community members and EU member states). Furthermore, all parties are required to introduce a common capacity allocation mechanism, establish at least one power exchange that covers all countries of Southeast Europe and implement price based market coupling, in order to facilitate their integration into the EU energy market. Finally, they are required to adopt a set of regulations related to balancing the rules for market participants, including non-discriminatory and cost-reflective methodologies for calculating prices for imbalances.

The other two strategic objectives are aimed at making a direct impact on the utilization of renewable energy sources. The second objective relates to attracting investments in the energy sector. New investments are needed in order for countries to meet the increasing energy demand and improve the security of supply, to replace or modernize old power plants, improve grid

Nearly €40 billion would be needed by 2020 to diversify existing energy resources and replace old power plants in the region.

infrastructure, increase energy efficiency and the utilization of renewable energy sources. The Energy Community Secretariat estimates that nearly €40 billion would be needed by 2020 to diversify existing energy resources and replace old power plants in the region. At the same time, grid infrastructure requires massive upgrading and expansion in order to be able to support the increased security of supply, including an increase in interconnection capacity between the countries (as suggested by ENTSO-E[34] Ten-Year Development Plan). Outdated and inadequately maintained energy systems contribute to high energy intensity[35] in the region: in 2012 it was five times higher than the average energy intensity among EU member states[36]. Thus, one of the Energy Community's key goals remains to attract infrastructure investment into the region. To that end, a range of actions were proposed - from price regulation and network tariffs, to measures focused on the removal of regulatory barriers, including acceleration of permitting and licensing procedures for new investments, and their harmonization with EU regulations.

The third objective relates to a secure and sustainable energy supply for customers. Ideally, all customers should have uninterrupted delivery of energy at affordable prices, with environmental effects taken into account. This is one of the main principles of the Energy Community Treaty, but at the same time represents the major challenge for policymakers at national levels. Security of supply is closely related to investments in (new) generation facilities and implies energy diversity and flexibility – making the most important task for governments the provision of a safe, quality and reliable energy supply to customers and reducing the energy dependence of their countries. Low electricity prices cannot support the industry and new investments in the energy sector; yet low prices contribute substantially to the deterioration of the system, making those political decisions unsustainable in the long run. While a high carbon dioxide (CO_2) price would stimulate investments in renewables, a sufficient price level (which would reflect uncertain coal, gas and CO_2 prices) is unlikely to be reached in most of the region's countries, given their level of economic development.

The key measure introduced by the Energy Community was the incorporation of the EU Directive 2009/28/EC in the *acquis*, and setting target(s) for renewable energy at the national level(s), aimed at increasing the share of renewable energy in the gross final energy consumption of each Energy Community contracting party. Further actions include the adoption and implementation of National Renewable Energy Action Plans (NREAPs) and the harmonization of the respective regulation with that of the EU framework (e.g. allowing priority access to the grid for generators from renewable energy sources; introducing support schemes; simplifying and accelerating licensing procedures and grid connections). Countries within the Energy Community are also obliged to prepare national road maps for the implementation of the Large Combustion Plants Directive 2001/80/EC and the national maps for CO_2 emissions reduction and limitation, including setting indicative targets and concrete measures to achieve them. However, implementation of the Large Combustion Plants Directive has been delayed, as it requires substantial investments that are proving difficult for contracting parties to realize. The current state of implementation of Directives is not at a satisfactory level, as most of the Energy Community's contracting parties will fail to comply

The Energy Community Secretariat opened infringement procedures against the majority of contracting parties for not even submitting National Renewable Energy Action Plans.

[34] The European Network of Transmission System Operators for Electricity (ENTSO-E) is an association of Europe's TSOs for electricity, founded in response to the emergence of the internal electricity market within the European Union.
[35] Energy intensity correlates with the level of industrialization and economy of the country. It is calculated as gross energy consumption per gross domestic product, and it shows the amount of energy used to produce one unit of GDP.
[36] Energy Community Implementation Report, Energy Community Secretariat, 2014

fully and implement the *acquis* in due time. Thus, the Energy Community Secretariat has had to open infringement procedures against the majority of countries for not even submitting national renewable energy action plans (NREAPs).

The common issue for all countries in the region is that the existing price levels are not fully cost reflective and, thus, cannot support new investments in either generation capacity or grid infrastructure. If the price of electricity is government-regulated and kept at an artificially low level, it leads to a long-standing lack of investments and a low level of energy efficiency and competitiveness in the energy sector. In the long run this jeopardizes the balance between supply and demand, and imposes a major risk for the security of supply. Furthermore, renewable energy (i.e. low carbon) technologies remain more expensive and are more CAPEX intensive than conventional technologies (e.g. generation from fossil fuel). This makes it important to recognize that financing renewable energy generating technologies in a competitive framework requires high returns on capital invested and an adequate risk-return ratio. Policy options used by governments to foster low-carbon investments should therefore reflect particularities and the cost structure of different generating technologies.

2.2. Renewable energy status in the Energy Community contracting parties[37]

The countries of Southeast Europe have small and fragmented energy markets, mainly dependent on fossil fuels (except Albania). Domestic coal/lignite represent a significant share of the energy supply, especially in Serbia (53%), FYR Macedonia (47%), Kosovo* (65%), Montenegro (36%) and Bosnia and Herzegovina (33%). The vast majority of power plants were built in the 1960s and 1970s, based on old technology, and have been inadequately maintained over time. Hydropower is the most commonly used type of renewable energy, with more growth potential across the whole region. Renewable energy (including large HPPs) already plays a significant role in the final energy supply in some contracting parties: Montenegro (52%), Albania (43%), Serbia (29%), Bosnia and Herzegovina (24%) and FYR Macedonia (12%). The structure of the energy mix differs from one country to another: some countries have a balanced portfolio of energy sources, while others depend on only a few types of energy carriers. All countries in the region, except Bosnia and Herzegovina, are net electricity importers. The overall level of utilization of renewable energy sources in the region is low, but there is great potential for its further use in the future.

The power sector in ***Albania*** has been neglected over recent years and faces a difficult financial situation characterized by high losses, accumulated bad debts and low collection rates. Electricity production is dominated by hydro power plants (hydro power accounts for 20% of GDP), while the remainder comes from thermal generation. Still, electricity imports continue to account for a significant share of total electricity supply and will continue to do so in the coming period - until 2018 - after which it is foreseen that electricity will be mainly supplied from domestic generation plants.

In May 2013, the Albanian Parliament adopted a Renewable Energy Law dealing mostly with electricity from renewable sources, and only marginally with energy produced from renewable sources for heating. In accordance with this Law, the government must formally adopt the 38% target, including a 10% target for renewable energy in transport. However, in March 2014, the Parliament decided to postpone the implementation of crucial elements of the Renewable Energy Law until January 1st, 2015, including provisions related to the adoption of the National Renewable Action Plan (NREAP) and the adoption of support schemes. In February 2014, the Energy Community Secretariat launched an infringement procedure against Albania related to the failure to adopt its NREAP by June 30th, 2014, as required under Directive 2009/28/

[37] Excluding Ukraine and Moldova, as well as Serbia, which is covered in greater detail in Chapter 3.

EC. Other key issues that Albania needs to address in the coming period include transparency of TSO regarding access to grid and grid connection; implementation of the system for certifying electricity from renewable energy sources based on guarantees of origin; electricity market opening and attracting investments in renewable energy. The Vlora thermal power plant falls under the scope of the Large Combustion Plants Directive, but is currently non-operational, so Albania already meets the requirements of this Directive.

Electricity generation in ***Bosnia and Herzegovina*** is based on coal and hydro, with around 45% of total electricity consumption coming from hydro power. Total renewable energy capacities have increased by about 15 MW since 2012, with the majority of this coming from small hydro power plants. There is 1.5 MW installed in solar PV in the Federation and 0.5 MW in Republika Srpska, but no wind project has yet been commissioned. TSO has capped the wind capacity for operational security of the power system to a conservative 350 MW, but there are more wind projects pending approval for connection to the grid than the existing capacity cap. There are also plans to construct new gas-fired power plants, and Bosnia and Herzegovina is expected to remain a net electricity exporter in the foreseeable future. The share of coal in domestic electricity production is planned to be reduced from 50% in 2009 to 36% in 2021 and 34% in 2024 – which will be compensated for by the increased share of renewable energy, mainly from small hydro power plants.

However, Bosnia and Herzegovina is the worst performer in the group – due to its fragmented political and inert administrative structure, as well as a lack of cooperation that inhibits implementation of the *acquis*. The country's current regulatory framework for the promotion of renewable energy sources is split between the Federation and Republika Srpska and falls under the authority of the entities. No strategy or legislation dealing with renewable energy exists at the state level. With regard to the Large Combustion Plants Directive and the Industrial Emissions Directive, no progress has so far been made at the level of the Federation or entities. Two separate renewable energy laws were adopted by the two Parliaments of Republika Srpska and the Federation of Bosnia and Herzegovina in May 2013 and August 2013 respectively. In 2014, Renewable Energy Action Plans were adopted by both entities, but a State NREAP is missing and the binding targets for 2020 are not stipulated by any legal act. Therefore, Bosnia and Herzegovina did not comply with Directive 2009/28/EC and, in February 2014, the Energy Community Secretariat launched an infringement procedure.

In ***FYR Macedonia,*** domestic electricity generation is based on coal, oil and hydro power, and is supplemented by electricity imports. The total installed capacity of hydro power plants amounts to 33%, including both large and small hydro power plants, with a combined capacity of 649 MW. The total installed capacity of small HPPs is 46 MW. The level of electricity imports is forecast to decrease significantly (from 17% in 2009 to 1% in 2030); compensated for by an increase in the share of gas and renewables in the domestic power generation mix. The current level of deployment of intermittent renewable energy sources is higher than in other countries in the region (18 MW of solar PV and 37 MW of wind capacity).

However, the existing legal framework in FYR Macedonia still does not comply with that of the EU, while the country has yet to submit its NREAP to the Secretariat. This delay occurred because of the biomass consumption survey conducted by the national Statistical Office that should be included in national energy statistics. This placed the country in breach of Directive 2009/28/EC and, consequently, the Secretariat launched the infringement process in February 2014.

The power sector in ***Kosovo**** is characterized by extremely high dependence on domestic lignite, which accounted for 98% in electricity supply in 2009, forecast to decrease to 90% in 2020. The balance is covered by hydro power plants and other renewable energy sources (small hydro and small wind projects), while gas is not foreseen in electricity generation by 2030. Only one hydro power plant (HPP), which has a total capacity of 35 MW, is currently being constructed. During 2013, three authorizations were issued for HPPs with a total installed capacity of 33.5 MW and 13 preliminary authorizations were granted for renewable energy projects.

Kosovo* is currently a net electricity importer, but is expected to become a net exporter in 2018. The main issue for the utilization of renewable energy projects remains grid access, as there is a lack of reserve capacity to support electricity generation from intermittent sources, but also limited technical capacity and experience to operate the grid with intermittent generation. Due to grid constraints, two wind park projects (48 MW and 45 MW) have been delayed. It is crucial for Kosovo* to attract investments in the generation capacity, which provides flexibility for the system, allowing further renewable energy generation. Kosovo* may also consider adopting a new electricity market design, coupled with Albania, which would also allow integration of new renewable energy generation into the grid.

Kosovo* has adopted an NREAP and submitted it to the Energy Community Secretariat. Under Directive 2009/28/EC, Kosovo* committed to a binding target of 25% of energy from renewable sources in gross final energy consumption in 2020, compared to 18.9% in 2009. Going beyond its mandatory target in accordance with the Energy Community law, Kosovo* envisages meeting a voluntary target of 29.47% in 2020 according to its NREAP. The existing policy framework in Kosovo* is complete and its implementation is being monitored by the Secretariat. Further actions during the monitoring process include the removal of administrative barriers to licensing and permitting procedures for renewable energy.

Montenegro's domestic electricity generation is based on coal and hydro power. A total of 76% of the installed generating capacity is in large hydro power plants (635 MW). The major share of electricity generation from renewable energy sources is envisioned as coming from small HPPs. However, very little progress has been made in recent years and by year's end 2013, the Jezerstica HPP, on the river Bistrica, with installed power of 1 MW and estimated annual production of 3 GWh, was the only producer of renewable energy to have been connected to the grid during the last four years. More than 30 small hydropower plants that have been granted concession agreements are yet to be constructed. The construction of two wind farm projects, located in Krnovo (72 MW) and Mozura (46 MW), did not yet start. Montenegro is currently a net electricity importer, but is predicted to increase domestic electricity production to become net exporter in 2018, reaching 25% of exported electricity in 2030. Montenegro has one coal-fired plant falling under the scope of the Large Combustion Plants Directive, with an installed capacity of 219 MW.

The new Energy Development Strategy of Montenegro until 2030 (adopted in July 2014) envisages reaching the binding target for renewable energy, of 33%, in 2020. Moreover, it forecasts that Montenegro could have a share of renewable energy of nearly 46% of gross final energy consumption in 2020. And yet, even though the legislative framework in Montenegro is among the best in the region, it fails to comply with the *acquis* on renewable energy. Very little progress has been made in recent years, resulting in a poor record of installed capacity from renewable energy sources on the grid. Montenegro didn't adopt the NREAP and the binding renewable energy target required by Directive 2009/28/EC and, thus, the Secretariat launched an infringement action. It is today crucial for Montenegro to attract investments and gain investors' confidence. To that end, one of the key actions to be carried out is adoption of a bankable and *acquis*-compliant power purchase agreement model.

2.3. Regional cooperation

Regional cooperation is required and is envisioned in many different directions, but currently remains at the inception phase. One direction of regional cooperation follows the path of Energy Community processes, pushing for the integration of regional markets. It has not achieved significant success to date, as it requires the participation of all parties (e.g. Serbia and FYR Macedonia still didn't take part in any regionally coordinated capacity allocation scheme); and the level of cooperation between national TSOs is not satisfactory. Even though the process of establishing power exchanges is underway, tangible results are yet to come. The establishment of an integrated day-ahead market is a priority for the coming years, together with the opening of coordinated balancing markets, which is a pre-condition for market opening in general. Harmonized balancing regimes imply the practice of market-based procurement procedures and non-discriminatory imbalance settlement mechanisms. Two important projects for cross-border balancing have commenced: TSOs of the control block Slovenia / Bosnia and Herzegovina / Croatia concluded an agreement on the common procurement of balancing reserves; while negotiations have started on common procurement and the sharing of balancing reserves within the control block Serbia / Kosovo* / Montenegro / FYR Macedonia.

The key is in regional cooperation: through the harmonization process led by the Energy Community; and through bilateral cooperation between countries: sharing hydro potential on the river Drina; building an interconnection line between Montenegro, Serbia and Republika Srpska to enable the flow of (green) energy towards the EU.

Another direction of regional cooperation goes toward identifying and facilitating investments in projects of mutual interest for the region, mainly through bilateral cooperation between neighboring countries. The Energy Community adopted a list of Projects of Energy Community Interest (PECIs) at the Ministerial Council meeting in October 2013, which includes electricity generation and grid infrastructure projects (alongside gas and oil infrastructure projects). The list, based on national development plans and the strategies of each country within the Energy Community, translates into over 5,000 MW of new capacity to be installed and over 1,600 km of new transmission system lines, equating to a volume of investments of nearly €9 billion.

The vast majority of electricity generation projects are new hydro power plants (e.g. HPPs on the Upper and Middle Drina between Bosnia and Herzegovina and Serbia), as well as two gas-fired combined heat and power plants. The realization of large HPPs on the Drina is of particular importance, as it requires a bilateral agreement between the countries on the usage of joint hydro potential. This suggests the direction in which future development of electricity production in the region is heading. In an environment with limited funds and where investors' perception of the contracting parties' risk profile discourages significant inflows of capital, the funding option through public-private partnerships (PPP) has proven feasible for financing hydro power plants. However, the level of development of the listed projects is generally very low, with very few of them having achieved advanced development status and commenced construction works (e.g. HPP Dabar in Bosnia and Herzegovina, which has reached an investment decision but has not yet seen the start of construction).

Serbia is the only Contracting Party planning to use the cooperation mechanisms and transfer excessive renewable energy to an EU Member State within the framework of the Directive's cooperation mechanisms related to the joint projects between EU Member States and third countries. However, the fulfillment of the agreement between Italy and Serbia for the joint development of 10 small hydropower plants is questionable as the agreement has not been ratified yet by the Italian Government.

Of the listed electricity infrastructure investment projects, the construction of a 400 kV overhead line (OHL) between Albania (Tirana) and Kosovo* (Pristina) has started and is expected to be commissioned in 2016. The 400 kV OHL between Serbia (Pancevo) and Romania (Resica), which is critical for connecting the large wind power capacity in the region of South Banat to the grid, has also reached an investment decision, but construction works are yet to start. Other planned interconnection projects in the region are much less advanced and remain at the stage of feasibility studies with pending investment decisions. These include: 400 kV OHL between Albania (Elbasan) and FYR Macedonia (Bitola); 400 kV OHL between Montenegro (Pljevlja), Serbia (Bajina Basta) and Bosnia and Herzegovina (Visegrad); 400 kV HVDC cable between Italy (Bari) and Albania (Vlora); and 400 kV OHL between Croatia (Lika) and Bosnia and Herzegovina (Banja Luka). The high voltage line 400 kV between Montenegro, Serbia and Bosnia and Herzegovina is of specific importance, as it would enable transmission of a larger capacity of renewable energy toward Italy (forming a loop with the underground cable between Italy and Montenegro and enhancing the OHL grid in Montenegro).

Chapter 3

SERBIAN POWER SECTOR: URGENT NEED TO RETHINK THE ENERGY MIX

3.1. Electricity generation mix and current renewable energy utilization levels in Serbia

Electricity production in Serbia is dominated by TPPs. Total electricity production in 2014 was 31.96 TWh, compared to 37.43 TWh in 2013. Coal production in 2014 totaled 29 million tons, compared to 39 million tons in 2013 (two million tons more coal than was produced in 2012)[38]. TPPs accounted for 70.9% of the total electricity generated (26.54 TWh) in Serbia in 2013, as compared to 70.4% in the previous year (or 24.275 TWh)[39]. The average mean temperature in 2013 was 1.8 degrees Celsius higher than the 120-year average, with no extreme temperatures (low or high), which led to lower than expected energy consumption. These numbers were slightly better in 2014, when the share of TPPs in total electricity production was 64.2%, or 20.5 TWh.

Both 2013 and 2014 were also years with very favorable hydrology, which resulted in increased electricity generation at HPPs. In 2014, due to good hydrology, hydro power plants produced 11.445 TWh (35.8%), compared to 10.73 TWh (28.7%) in 2013 and 9.84 TWh (24.6%) in 2012[40]. Electricity production from hydro power units is very volatile, as it depends on rainfall and can vary substantially from one year to another.

Serbia nurtures widespread and deeply rooted opinion that electricity produced from fossil fuels, and most notably coal, is much cheaper than electricity produced from renewable energy sources. The production price of electricity is one of the key reasons why the country so adamantly refuses renewable energy and keeps delaying the implementation of projects which are in the pipeline.

Despite the aforementioned facts, extremely high production from TPPs was still recorded in 2013. Furthermore, the draft Energy Strategy of the Republic of Serbia from 2015 to 2025, with predictions until 2030[41], envisages new generating capacity from TPPs in the coming years.

In the renewable energy sector, a total of 36.184 GWh of electricity was generated in 2012 by privileged power producers (PPPs) and delivered to the public supplier, which accounts for 0.1% of the total aggregate electrical energy generated from thermal and hydro power units. In 2013 this number increased to 0.17%, or 65.1 GWh. At the end of 2014, the Ministry of Mining and Energy reported a total of 100 generating units from renewable sources in operation, with a total capacity of 53.2 MW. The vast majority of these producers are small hydro power units. As of June 17th, 2015, the Register of the privileged power producers showed a minor increase in the number of solar PV units and small hydro units, as summarized in Table 2.

Serbia currently has a total capacity of 58.5 MW in operation from renewable energy sources, which represents 0.82% of the overall installed production capacity in the Serbian power system – almost negligible compared to the target value, which the country wants, and needs, to achieve by five years from today. Of a total of 58.5 MW, 34.86 MW (60%) comes from small hydro power plants, 5.34 MW from solar PV on ground, 2.61 MW from solar PV on buildings, 4.86 MW from biogas plants, 10.33 MW from cogeneration plants and only 500

[38] EPS Annual Reports 2012, 2013, 2014
[39] EPS Annual Reports 2012, 2013, 2014
[40] EPS Annual Reports 2012, 2013, 2014
[41] The draft document was prepared by the Ministry of Mining and Energy of the Government of Serbia, but, at the time of writing this paper, hasn't yet been adopted by the Serbian Parliament (Source: www.mre.gov.rs)

kW from wind power. Interestingly, there are no biomass projects under the feed-in scheme in operation or in the phase of construction – contrary to the favorable position that biomass holds in the NREAP, with a 60% share of the total renewable energy potential in the country.

Table 2: Installed capacity (MW) of privileged power producers (PPPs) and preliminary privileged power producers (P-PPPs) in Serbia, as of June 17th 2015[42]

	PPPs		P-PPPs	
	No. of units	Installed capacity (MW)	No. of units	Installed capacity (MW)
Small HPPs	47	34.862	-	-
Solar PV on ground	8	5.34	9	0.66
Solar PV on buildings (up to 30 kW)	73	1.557	72	0.393
Solar PV on buildings (30 to 500 KW)	10	1.085	10	0.915
Wind	1	0.5	7	93.95
Biogas	5	4.862	-	-
Cogen	7	10.331	-	-
TOTAL	**151**	**58.537 MW**	**98**	**95.92 MW**

There are projects in the pipeline across all renewable energy sectors – be that with preliminary status, in the preparation or construction phase - that are expected to be operational in the near future (mainly solar PV on buildings). But their current total joint capacity equals as much as 2 MW, if we exclude the wind sector. Wind energy is the only renewable energy source where technology and regulation enable the development and construction of large-scale projects. Thus, it has the greatest influence on reaching the national target for renewable energy, as far as the electricity sector is concerned. But there are numerous hurdles in the way of actually constructing and putting into operation wind farms, which will be addressed in greater detail in Chapter 5. The expected wind power capacity of nearly 96 MW in projects with preliminary privileged power producer status is not realistic. In fact, four out of seven producers with the P-PPP status (from the previous table) are under dispute, bringing the capacity of 35.45 MW into question. Of the remaining three, two projects below 10 MW have secured financing. It is a major challenge for large wind projects to secure financing and start construction of their wind parks, due, above all, to regulatory barriers (see Chapter 5). However, during the period from June to September 2015, eight investors in wind parks have applied for a preliminary privileged producer's status with the total capacity of 768 MW. The excess capacity from the wind parks relative to the quota (the cap), set by the energy law, means that there will be no place for everybody, unless the cap is increased. Although the current status of these applications is still pending, it can be regarded as a positive trend in the industry, suggesting that the investors' confidence is slowly returning.

Solar PV projects are quickly filling the quota, which is relatively small for Serbia, reaching 6 MW for installations on the ground and 4 MW for roof-top installations. A number of projects currently under development exceed the quota for solar PV set by the Government. It is expected that there will be a gradual (minor) increase in the quota on an annual basis, the same way this issue is regulated in neighboring countries.

42 Registry of Privileged Producers of Electrical Energy, Ministry of Mining and Energy, as of 17th June 2015

Public utility company Electric Power Industry of Serbia (EPS) announced that two feasibility studies are under preparation, one for a 30 MW wind park and a second for a 5 MW solar PV plant, both in Kostolac. Even though these projects are not yet developed to the extent to which they have secured their place in the Registry of privileged power producers, it is nevertheless encouraging for the industry that the utility recognizes its potential.

3.1.1. The National Renewable Energy Action Plan (NREAP) in Serbia

As previously mentioned, NREAP was enacted in 2013 to set targets for the utilization of renewable energy sources until 2020, as well as to establish concrete measures for achieving them. Of the total available *technical potential* of renewable energy in Serbia, 35% is already being used – mainly in hydro potential and biomass. The structure of Serbia's renewable energy potential is shown in Table 3 – with biomass and hydro potential in the lead, with estimated respective potential of 60% and 30%.

Table 3: Structure (%) of renewable energy potential in Serbia[43]

Biomass	Used	19%
	Unused	41%
Solar		4%
Wind		2%
Geothermal		3%
Hydro	Used	16%
	Unused	14%
Biodegradable waste		1%

The percentage of renewable energy potential *already used* refers to electricity generated from large HPPs, as well as the use of biomass for household heating and, to some extent, in industry. According to data from the energy balance for 2009[44], the share of electricity from hydro potential amounted to 28.7% in the electricity sector, while the share of heat from biomass amounted to 27.5% in the heating and cooling sector[45].

The Serbian power sector is characterized by a considerable gap between expectations and reality.

The NREAP anticipates that Serbia could achieve the target set for 2020 from domestic sources, considering the unused potential of renewable energy, with the exception of the binding share of biofuels (10% in the transportation sector in 2020), where imports were envisioned in 2018. The indicative paths were developed for the share of energy from renewable sources for each sector separately – electricity, heating / cooling, transportation - based on data related to expected energy consumption in each sector, and the projects planned to be implemented/constructed during that period. All of these individual targets for sectors are supposed to enable the meeting of the cumulative target of 27% in gross final energy consumption by 2020, whereby heat from renewables would contribute with 12,3%; electricity from renewables with 12,1%; and biofuels with 2,6%[46]. These targets are not fixed for each individual sector (except for the 10% target in the transportation sector), and can be changed in the case of faster development in a certain sector compared to others.

[43] NREAP, Ministry of Energy, Development and Environmental Protection of the Republic of Serbia, 2013
[44] The year 2009 is taken as the base year for calculation of the binding share of renewable energy sources in 2020, as defined by the Energy Community Secretariat.
[45] NREAP, Ministry of Energy, Development and Environmental Protection of the Republic of Serbia, 2013
[46] NREAP, Ministry of Energy, Development and Environmental Protection of the Republic of Serbia, 2013

This paper focuses on the electricity sector: in order to achieve its targets, Serbia needs to install an additional (new) generation capacity from renewable energy sources of 1092 MW until 2020, as shown in Table 4. It is important to note that if the gross final energy consumption in 2020 is higher than estimated by NREAP, the target of 1092 MW will be correspondingly higher.

Table 4: Generation capacity (MW) from renewable energy sources from new plants – planned (2020) and achieved (2015)[47]

	Planned (2020)		Achieved (2015)	
	MW	%	MW	%
Hydro Power Plants (over 10 MW)	250	30.3	0	0
Small Hydro Power Plants (up to 10 MW)	188	16.2	34.9	59.6
Wind energy	500	27.4	0.5	0.85
Solar PV	10	0.4	7.9	13.5
Biomass – CHP plants	100	17.5	0	0
Biogas – CHP plants	30	6.2	4.9	8.37
Geothermal energy	1	0.2	0	0
Waste	3	0.5	0	0
Landfill gas/high efficient cogen	10	1.4	10.3	17.6
TOTAL planned/achieved capacity (MW)	**1092**	**100**	**58.5**	**100**

Comparing the results achieved with the targets planned for 2020 shows a considerable gap between expectations and the reality. It is highly unlikely that the country can catch up during the next five years and meet its obligations, but this gap could be narrowed significantly if hydro, and particularly large wind projects, are constructed and made operational.

Energy efficiency measures must be taken alongside renewable energy policy: Energy efficiency is a starting point from which renewable energy builds on.

It should be stressed that energy efficiency and energy saving measures have a big influence on estimations of ross final energy consumption and, thus, on the utilization levels of renewables, i.e. estimated investments in this field that are required to achieve the national target. The NREAP has developed two scenarios: the reference scenario (baseline) that does not take into account energy saving measures (but is based on an increase in gross final energy consumption in compliance with envisioned economic growth in the given period); and the scenario with applied energy efficiency and energy saving measures, which takes into account savings in primary energy in households and the public and commercial sectors, industry and transport. The indicative target of energy savings was defined as amounting to an average of 1% p.a., which equates to a minimum of 9% of the final energy consumption in the ninth year of implementation (2018); energy savings in the period from 2018 to 2020 were estimated at 1%, thus total energy savings in the period from 2010 to 2020 would amount to 10%[48].

However, even if we take into account the effect of energy efficiency and energy saving measures, and correct the numbers accordingly, the target is well beyond reach. Inadequate resource assessment of renewable energy potential may have initially resulted from the fact that energy-related statistics in the field of renewables have not yet been established in Serbia.

[47] NREAP, Ministry of Energy, Development and Environmental Protection, Republic of Serbia, 2013; Registry of privileged power producers, Ministry of Mining and Energy, 2015. The percentage of the planned capacity is based on the energy production, taking into account the capacity factor in hours p.a.

[48] Action Plan for Energy Efficiency (APEE) of the Republic of Serbia for the period 2010-2012

In 2009, as the base year, the majority of energy balances were encompassed (balance of electricity and heat, balance of coal, balance of natural gas, balance of oil and oil derivatives, balance of geothermal energy, balance of heating wood) - but there were no related statistics for renewables, except hydro-potential, wood biomass for exclusively heating purposes, and geothermal energy. Furthermore, Serbia's NREAP was prepared in compliance with the Energy Sector Development Strategy for Serbia until 2015, in the absence of the (new) Energy Strategy for the period from 2015 to 2025 (with predictions until 2030) – a document which is still awaiting adoption by the Serbian National Assembly. The Energy Sector Development Strategy until 2015, a document enacted in 2005, identified priority programs in accordance with strategic goals. The third priority program relates to the utilization of renewable energy sources, while the first two refer to the technological modernization of existing energy assets in all energy sectors (oil, gas, coal, thermal and hydro power plant and grid infrastructure); and the rational usage of energy sources and energy efficiency in the production, distribution and consumption of energy, respectively. The same strategy paper identifies opportunities in the renewable energy sector in two main directions: use of biomass technology for decentralized heat production and small hydro power (up to 10 MW) and wind power (up to 1 MW) for distributed generation of electrical energy. No larger capacity renewable energy projects were envisioned whatsoever.

Serbia's NREAP was prepared on the basis of estimates of energy production from renewable energy sources, which depends on a number of variable factors, such as forecasts of economic development of the country, development of the energy market, dependence between GDP and energy intensity, etc. Thus, it was expected that there would be deviations of data in the action plan with respect to that which has been achieved. What was not addressed when assessing the technical and commercial potential of particular renewable energy sources is a range of factors from infrastructure constraints, regulatory risks, land and permitting constraints, ease of collecting primary energy source in terms of distances and access to infrastructure, environmental constraints, and many more. As such, there is a need to constantly update and improve the NREAP. According to the Serbian Energy Law, the Ministry of Mining and Energy is in charge of monitoring the implementation of the NREAP and needs to submit an Implementation Report once every two years to the Government. Furthermore, regular updating of the NREAP is necessary for the preparation of corresponding progress reports, which are to be submitted to the Energy Community Secretariat.

Finally, even though NREAP was enacted in order to comply with EU Directive 2009/28/EC on renewable energy, and to contribute to the alignment of the national energy policy with that of the EU, and ultimately aimed to help Serbia fulfill its international obligations; it is equally important to recognize that large-scale utilization of renewable energy resources would bring Serbia sizeable benefits in terms of attracting investments to the sector. This topic is addressed in greater detail in Chapter 4.

3.2. Current status of the legislative framework for renewable energy in Serbia

The Energy Community Treaty represents a key document between Serbia and the EU in the area of energy. It covers the energy sector reforms that are necessary to complete the EU accession processes of the Contracting Parties. To that end, it aims to prepare energy market(s) for full application of European legislation through EU directives and, ultimately, their participation in a single European energy market.

Serbia, as a member of the Energy Community, is obliged to implement the *EU acquis on energy* into its appropriate legislation. Significant progress has been made in developing a regulatory framework in Serbia since the adoption of the first Energy Law in 2004. In 2011, the second Energy Law was adopted, in line with the Second EU Energy Package. To date, the Energy Community Secretariat has successfully managed negotiations between the electricity transmission system operators of Serbia and Kosovo*, with the resolving of problems paving the way for both parties to progress in the EU accession process.

At the level of technical cooperation, Serbia is already in Europe – it is a member of the ENTSO-E[49], an organization which consists of 41 electricity transmission system operators (TSOs) from 34 countries across Europe. This organization was established by the EU's Third Legislation Package for the Internal Energy Market in 2009, and was given a legal mandate to support the implementation of EU energy policy and achieve Europe's energy and climate policy objectives of affordability, sustainability and security of supply. ENTSO-E is the focal point for all technical, market and policy issues related to TSOs and the European network, interfacing with power system users, EU institutions, regulators and national governments.

Finally, the new Energy Law, adopted in December 2014, implemented the Third EU Energy Package of measures to a great extent. It is an umbrella law and it provides general rules that govern all energy sectors - setting goals of the energy policy; reliable, quality and secure supply of energy and energy carriers, goals for the use renewable energy sources, and conditions and incentives for the production of energy from renewable energy sources.

The 2014 Energy Law brought positive changes related to the following key areas:

- Project financing: introduction of a one-step Power-Purchase Agreement (PPA), which reduces uncertainty with regard to financing projects.

- Project construction:
    - The Law prolonged the construction completion period to three years (instead of two years) – thus reducing the construction risk;
    - The Law defined a *force majeure* clause during construction – again reducing construction risk.

- Grid connection: The Law clearly defined permitting and construction authority and obligations for connection infrastructure (overhead power lines and transformer stations) that can be financed and possibly built by private investors, but ultimately remains under the ownership and management of the national grid operator (TSO).

In addition to this, the Serbian National Assembly also adopted the new Law on Planning and Construction in December 2014, which serves to significantly streamline the construction permitting process and has a positive effect on investments in general, and renewable energy investments in particular.

However, there are still pending unresolved issues in the Energy Law that should be properly addressed in associated secondary legislation, such as – transferability of the PPA, step-in rights to lenders, protection against legislative amendments that could impavt negatively on project revenues, protection against acts and omissions of the authorities (political *force majeure*), deemed output, curtailment, and similar.

The support scheme for renewable energy sources is regulated by the Energy Law and prescribed by the Decree on Incentive Measures for Privileged Electricity Producers (Official Gazette of the RoS, No. 8/13). This Decree provides a detailed definition of privileged power producers, incentives for electricity production, and conditions for their achievement, as well as an incentive period, rights and obligations arising from these incentives for privileged power producers and other energy players. This Decree was adopted in January 2013 and is valid until

[49] European Network of Transmission System Operators

year's end 2015. Nevertheless, the adoption of the new Energy Law in December 2014 calls for the adoption of a new set of bylaws that are currently being developed by the Ministry of Mining and Energy and which could bring change to the incentive measures made available to privileged power producers.

The majority of other secondary regulation - governing licensing requirements, permitting procedure, privileged producers' status, supply and grid requirements - has been issued (and regularly updated), with exception of the Power Purchase Agreement for large projects (particularly wind), which is still pending. Specifically, three versions of this document have been adopted in less than two years, but investors and lenders are still awaiting a reliable version. At the time of writing this paper, the public debate is ongoing with respect to the set of new by-laws, which are relevant for renewable energy sources, namely: Decree on incentive measures for the Production of Electricity from Renewable Energy Sources; Decree on conditions and procedure for acquiring the status of privileged power producer, preliminary privileged power producer and of the producer of electrical energy from renewable energy sources; and Decree on the standard models of power purchase agreement.

The new by-law on incentive measures introduces the term of capacity factor for different generation technologies – i.e. the maximum annual effective hours of operation, which is used to calculate the maximum annual generated electrical energy eligible for the feed-in tariff, whereas for the excess electricity production above this level, the off-take price is calculated at 35% of the feed-in tariff. Furthermore, the same by-law proposes revised feed-in tariffs for hydro power plants, geothermal energy, biogas and solar PV. The treshold for biogas is suggested to be increased: biogas plants of installed capacity above 5 MW would receive a new feed-in tariff of 15 euro cents per kWh (as compared to 12,31 euro cents per kWh that we have today for biogas plants above 1 MW). Geothermal energy is also envisaged to get an increased tariff: the level of the off-take price is currently determined by the installed capacity, which would not be the case anymore. Thus the new feed-in tariff for all geothermal plants regardless their installed capacity would equal 8,2 euro cents per kWh (currently is 6,92 euro cents per kWh for plants above 5 MW). Finally, and in accordance with the trends in the solar industry, the feed-in tariffs for solar PV installations would be dramatically decreased – e.g. for solar PV on the ground the feed-in tariff is envisaged to fall from the current level of 16,25 euro cents per kWh to 9 euro cents per kWh!

The main issues of concern to be resolved in the Decree on PPA are payment guarantees (form, amount, currency, duration); termination provisions (termination events, compensation for losses); *Force Majeure* events; dispute resolution (choice of forum); assignment provisions; a change in protection under the law; the sale of electricity during the commissioning period; and step-in rights. A great many of those are the *provisions regarding typical project financing requirements* – e.g. there is no allowance or assignment by way of security in favor of the lender; such assigning should not require the prior consent of the purchaser (EPS) or the Ministry. Discussions aimed at resolving these issues are ongoing between the Ministry of Mining and Energy, representatives of international financial institutions (EBRD, IFC and OPIC), and members of the Serbian Wind Energy Association (SEWEA).

Table 5: Summary of regulation related to renewable energy in Serbia

Energy Law	Official Gazette of the RoS, No57/11, 80/11, 93/12, 124/12, 145/14
Energy Strategy of the Republic of Serbia until 2015	Official Gazette of the RoS, No. 44/05
Energy Strategy Implementation Program of the Republic of Serbia until 2015 for the period 2007-2012	Official Gazette of the RoS, No. 99/09
Law on efficient use of energy	Official Gazette of the RoS, No 25/13

Decree on conditions and procedure for acquiring the status of privileged power producer	Official Gazette of the RoS, No. 72/09, 8/13, 20/14
Decree on incentive measures for the Production of Electricity from Renewable Energy Sources and Combined Heat and Power Production	Official Gazette of the RoS, No. 99/09, 8/13
Decree on the method of calculation and allocation of funds collected for the purpose of incentive remunerations for privileged power producers	Official Gazette of the RoS, No. 8/13
Rulebook on energy permits	Official Gazette of the RoS, No. 15/15
Rulebook on conditions for issuing energy permits	Official Gazette of the RoS, No. 60/13
Rulebook on guarantees of origin for electrical energy produced from renewable energy sources	Official Gazette of the RoS, No. 24/14
Law on ratification of the Kyoto Protocol	Official Gazette of the RoS, No. 88/07 and 38/09
National Strategy of Sustainable Development	Official Gazette of the RoS, No. 57/08
Action plan for the implementation of the national strategy of sustainable development for the period from 2011 to 2017	Official Gazette of the RoS, No. 62/11
Strategy of sustainable use of natural resources and assets	Official Gazette of the RoS, No. 33/12
National Program of Environmental Protection	Official Gazette of the RoS, No. 12/10
Law on Environmental Impact Assessment	Official Gazette of the RoS, No.135/04 and 88/10
Law on Strategic Environmental Impact Assessment	Official Gazette of the RoS, No.135/04 and 88/10
Law on Waste Management	Official Gazette of the RoS, No. 36/09 and 88/10
Rulebook on categories, testing and classification of waste	Official Gazette of the RoS, No. 56/10
Rulebook on conditions and manner of collection, transport, storing and treatment of waste used as secondary raw material or for producing energy	Official Gazette of the RoS, No. 98/10
Rulebook on conditions, manner and procedure of management of waste oils	Official Gazette of the RoS, No. 71/10
Law on Protection of Air	Official Gazette of the RoS, No. 36/09
Decree on limit values of emissions of polluting matters into the air	Official Gazette of the RoS, No. 71/10
Law on private-public partnership and concessions	Official Gazette of the RoS, No. 88/11
Action plan for biomass 2010-2012	Official Gazette of the RoS, No. 56/10
Action plan for energy efficiency for the period 2010-2012	Official Gazette of the RoS, No. 8/13
Second action plan for energy efficiency for the period 2013-2015	Official Gazette of the RoS, No. 98/13
National Action Plan for renewable energy (NREAP)	Official Gazette of the RoS, No. 53/13

It continues to be important for regulations to be improved constantly, in line with the experience and good practices applied in the EU or elsewhere. The preparation of new laws and bylaws should include assessments of the possibilities of further rationalizing procedures for obtaining licenses, permits and approvals, as these procedures are often drawn-out, confusing and sometimes contradictory. The experience of investors in this field in Serbia is of great importance.

Chapter 4

BROWN VS. GREEN: RENEWABLE ENERGY COST AND BENEFIT ANALYSIS

4.1. Comparison of external costs from renewable sources and fossil fuels

Economic analysis has a major impact on the decisions taken by policymakers and governments regarding carbon reductions and the utilization of renewable energy, aimed at combating climate change. Conventional economics is usually biased in favor of the status quo, ensuring that excessive expenditure on expensive renewable energy technologies is avoided, and which views environmental problems in the form of "externalities" – i.e. unpriced damages imposed by one party on another. But it much more than economic theory that is at stake. The sustainable environmental policy should focus on preventing worst-case scenarios rather than calculating average or expected values, as the cost-benefit analysis suggests. Furthermore, the benefits of environmental protection are often devalued in cost-benefit calculations. In this chapter we seek to incorporate externalities into the calculations and provide the foundation for a fair comparison of different technologies. As we will see, many of the new technologies that harness renewables are, or will soon be, economically competitive with fossil fuels.

Serbia nurtures a widespread and deeply-rooted opinion that electricity produced from fossil fuels, and most notably coal, is much cheaper than electricity produced from renewables. The production price of electricity is one of the key reasons why the country refuses so adamantly to switch to renewable energy, and why it continues delaying the implementation of projects currently in the pipeline. Two mistakes are commonly made when comparing different electricity production technologies. First, the new (renewable) generating technologies are compared with old (existing) generating technologies (e.g. lignite-fired power plants), which is completely wrong in a methodological sense. Second, the external costs of electricity generation have not yet been taken into account in the calculations of technology costs. Both of these issues will be addressed in greater detail in this chapter.

These are the key topics that should be in the focus of public education and awareness campaigns. They will also be explained in further detail in the chapter on barriers to the market entry of renewables (Chapter 5).

4.1.1. External costs of electricity generation from lignite

In the next few paragraphs we will analyze the external costs of electricity produced from coal, as the conventional fuel with the greatest presence and most widespread utilization in Serbia and the region. Coal, and especially lignite, as the type of coal burned in the region, runs the highest external costs of electricity production as a result of its devastating environmental impact. We therefore did not analyze the external costs of electricity produced from large hydro power plants, which is certainly incomparable with that of coal, but is still present due to the impact of large hydro on river ecosystems and local societies. Finally, nowhere in this paper do we consider an external cost from nuclear power, which require much deeper analysis and should be treated with caution and, as such, is a topic in its own right. Also, while analyzing external costs of production and calculating the levelized cost of energy (LCOE), no consideration was given to the costs of decommissioning old thermal power plants (and nuclear where applicable) and opencast mines. Typically, LCOE calculation also doesn't include costs to the wider system, such as balancing and reserve costs. All of these costs vary from one country to another and are determined by a country's generation mix and power system, the state of plants and the national strategic objectives and dynamics with regard to decommissioning old power plants. These types of costs can be added as necessary, depending on the purpose of the calculation, in most cases to assist policymakers in decision making processes.

Over the last 30 years, the EU has started systematically analyzing so-called marginal, i.e. external, costs of electricity production in order to include this factor when deciding on energy pricing and future energy mix. In the early 1990s, a series of "External Costs of Energy" projects (ExternE) developed "ExternE-Methodology" as an approach to calculating external environmental costs called Impact-Pathway-Approach. As explained on the ExternE website: "Impact pathway assessment is a bottom-up approach in which environmental benefits and costs are estimated by following the pathway from source emissions via quality changes of air, soil and water to physical impacts, before being expressed in monetary benefits and costs"[50].

In Serbia, however, no relevant institution has to date ever produced, at least publicly, official analysis of the real price of electricity from coal, which would include external costs. Therefore, the price in the traditional calculations that form the basis of Serbia's energy mix (which often quotes 2.4 euro cents per kWh as the final cost of electricity currently produced in Serbia from TPPs) does not include serious and extremely dangerous costs resulting from burning, excavation, transport, displacement, and water, air and land pollution.

CEKOR: "Serbia already suffers major damage that has been caused by acidifications to agricultural land (soil erosion and lower agricultural productivity), greater risk of forest fires and lower forestry growth. ... The Health and Environment Alliance (HEAL) shows the losses of 2,000 human lives and €1.8 - €4.9 billion in health costs caused by the use of coal in the Serbian energy sector."

Fortunately, the section of the Serbian NGO sector that is focused on promoting the country's sustainable development has produced a plethora of analytical papers and reports from which one can draw relevant information. Some of the most comprehensive and informative studies were carried out by the European Movement in Serbia (EMinS) and the Center for Ecology and Sustainable Development (CEKOR).

Two outstanding studies[51] provide excellent insight into the real price of production from coal in Serbia. According to these studies, the most important external costs of coal-based electricity production are acidifications of agricultural and forest communities, as this has the strongest negative impact on the Serbian economy. CEKOR notes that Serbia has already sustained major damage caused by acidifications of agricultural land (soil erosion and lower agricultural productivity), a greater risk of forest fires and lower forestry growth. In their study, CEKOR cites data from an internationally recognized study completed by the Health and Environment Alliance (HEAL), which shows losses of 2,000 human lives and €1.8 - €4.9 billion in health costs caused directly by the use of coal in the Serbian energy sector. According to the ExternE methodology, the external costs of producing electricity from coal (lignite) at Serbia's TPPs operated by EPS amounts to more than 13 euro cents per kWh. In other words, if we take into consideration these external costs to the economy, the health sector and agriculture, the real price of electricity produced from coal in Serbia is approximately 18.5 euro cents per kWh. The external costs of electricity generation vary depending on the mix of fuels used for production and the efficiency and age of the power plant in question. Thus, given the age and technology in Serbia's dated TPPs, the calculated external costs are higher than the European average – which varies from 5.7 to 10 euro cents per kWh[52].

[50] Taken directly from ExternE website: http://www.externe.info/externe_d7/?q=node/46

[51] European Movement in Serbia, "Serbian EU Accession – Importance of Material Conditions in the Energy Sector", Belgrade, September 2013; and Center for Ecology and Sustainable Development, "Notes about Real Cost of Electricity in Serbia – Contribution to the Discussion on the Energy Strategy of the Republic of Serbia 2015-2025", Subotica / Novi Sad, December 2013

[52] EU ExternE study, European Commission, "Externalities of Energy", DG12, L-2920 Luxembourg, 2001; Gipe, P. (1995); Ferguson, R. (1990) Newcastle University, UK

External costs, counted through many different parameters, such as Potential Years of Life Lost (PYLL), Years of Life Lost (YOLL), additional costs to the healthcare system, losses incurred by the agricultural sector, water pollution and similar, represent only part of the additional costs of a coal-dependent energy sector. Another increasingly important cost is the cost of CO_2 emissions into the atmosphere, as well as the costs incurred to make environmental improvements at old TPPs, which is linked directly to the implementation of the Large Combustion Plants Directive.

Of the total of 65 TPPs based in different countries/contracting parties of the Energy Community (excluding Ukraine and Moldova), about 84% will have to install desulphurization filters, 50% will have to install filters for dust particles, and 33% will have to change combustion parameters to reduce nitrogen oxide[53]. In some cases, for extremely outdated power plants this revitalization process will simply be too expensive and they will have to be decommissioned completely and replaced by new ones. In order to meet its targets in this respect, estimates are that Serbia will need to reconstruct or completely replace about 4,000 MW of currently installed capacities for electricity production, and almost the entire central heating infrastructure. EPS has already embarked upon this process and invested considerable resources, mainly with the support of international funds. One of the most notable Serbian partners in this respect is the Government of Japan, which - through a Loan Agreement between EPS and Japan International Cooperation Agency (JICA) – has invested approximately €250 million in the flue gas desulphurization (FGD) plant at TPP "Nikola Tesla A". To date, this agreement represents the largest investment in the field of environmental protection in Serbia. In order to fully implement the Large Combustion Plant Directive and align with EU standards, EPS estimates that additional investment of €1.2 billion will be needed for filtering systems, transportation of ash and dust, water purification systems and similar[54]. This important topic will be elaborated in greater detail in Chapter 6.

This is obviously a major undertaking that will require considerable resources from the republic budget, and a carefully designed strategic plan. Failure to implement in time is likely to have even greater consequences for the country's budget, due to CO_2 emission reduction targets. All of this will have a significant impact on electricity prices in Serbia, as well as the country's budget in the years to come – regardless of whether Serbia chooses to restructure its TPPs or build new facilities.

4.1.2. External costs of electricity generation from renewable energy sources

On the other hand, when it comes to renewables, the feed-in tariff, i.e. the guaranteed privileged price that countries are obliged to pay for a certain period of time (usually from 12 to 15 years) to stimulate production of electricity from various renewable sources, includes, almost as a rule, both direct and external costs of electricity generation. Factors currently being considered with regard to renewables are:

- Life cycle impacts – Following the expiry of a power plant's life cycle - be it solar, wind or any other - what happens and what is the cost of said plant's decommissioning or the replacement of old equipment so it can continue operating. Can equipment (wind turbines, blades, PV panels) be recycled and, if not, where, in what way, and with what kind of environmental impacts can the operator dispose of old equipment. The environmental impact of equipment disposal needs to be treated as an external cost of renewable energy.

In terms of their overall operation, fossil fuel plants never amortize, as more energy is always consumed in the form of fuel than is produced in the form of useful energy.

[53] Energy Community Secretariat
[54] Official website of the Electric Power Company of Serbia (EPS), http://www.eps.rs/Eng/Article.aspx?lista=Sitemap&id=37

- Energy pay-back time (EPBT) – True, renewable energy is not 100% environmentally-friendly. First, pollution is a necessary byproduct of the manufacturing process for the equipment used to harness renewable energy. Second, a lot of renewable energy equipment is manufactured using energy from fossil fuel plants. Finally, the construction of renewable energy plants, including transportation of equipment from the place of manufacture to the site, the construction of roads, transformer stations, connecting infrastructure, and similar, inevitably causes some environmental damage. With all this in mind, it must be emphasized that the renewable energy industry has already quantified that negative impact and is identifying "energy payback time", i.e. the time needed by an energy system to generate the same amount of energy required for its construction, operation, and disposal; and the cumulated greenhouse gas emissions. Energy payback time does not exist for fossil fired plants because, in terms of their overall operation, these plants never amortize, as more energy is always consumed in the form of fuel than is produced in the form of useful energy. Water, wind, and solar-thermal power plants need between three and 15 months to amortize their construction energy, i.e. considerably less than their useful service life. A wind turbine is believed to have an energy payback time of five to eight months[55], i.e. over its full lifetime, a wind turbine typically generates around 40 times more power than is used during its construction and operation. The EPBT for PV modules, depending on the location of a solar park, can be anywhere between six and 15 months[56]. Solar PV is the most energy intensive renewable energy technology, yet it still manages to generate around nine times more energy than is needed to produce photovoltaic cells, and new emerging PV technologies are even less energy intensive. Once this amortization time has elapsed, each hour of operation then provides valuable energy that is ecologically free. Since the technical lifetime of PV systems is more than 30 years, and wind turbines last about 25 years, they produce net clean electricity for more than 95% of their lifetime. For the sake of comparison, nuclear power plants generate around 16 times the energy consumed during their construction and operation (including fuel supply); whereas combined cycle gas turbines only generate 14 times the energy needed for their construction and operation. At the other end of the spectrum are large hydro power plants, which, thanks to their very long lifetime and the large capacity of their generating units, generate around 200 times more energy than is consumed during their construction and operation. Finally, biomass plants are the worst performer of all renewable technologies with regard to energy payback time, with only five times more energy produced than is consumed to grow and collect crops, due to high energy requirements needed for machinery to plant, harvest and transport bulky fuel to power plants.

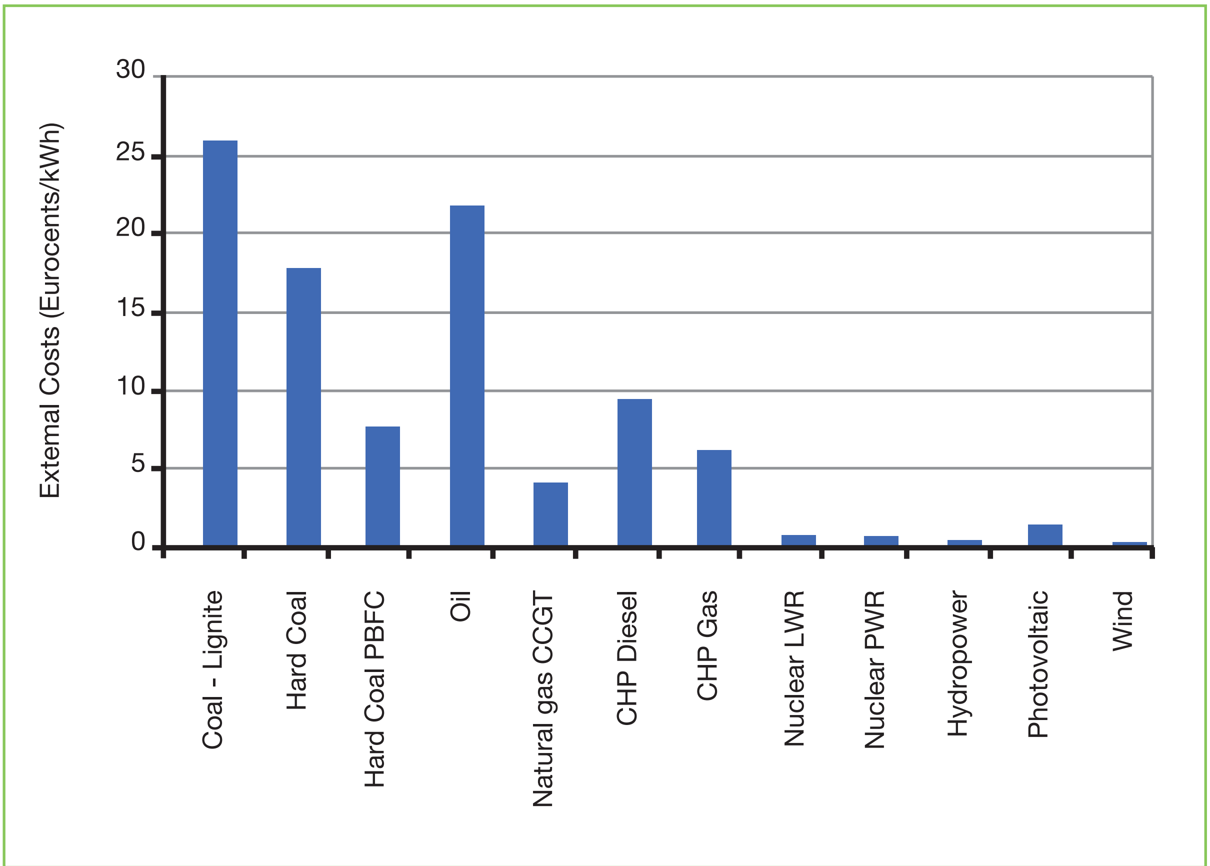
- Land footprint – the land footprint of different technologies has to be assessed as a cost in terms of the opportunity lost by using land for a renewable energy plant instead of using it for agriculture or other purposes. The key point is that renewable energy sources are usually diffuse and, thus, the energy collection system covers large areas. Solar has the biggest footprint in cases when solar panels are placed on the ground. Although the land can no longer be used for any other purpose, it is worth noting that solar panels are usually only placed on land which has very low agricultural quality. In the case of rooftop solar, this impact equals zero. In the case of wind, the land footprint is insignificant because turbines occupy a very small percentage of land and the remaining land continues to be used for agriculture. The fact that wind farms can be married well with agriculture is one of their most positive qualities. The land footprint of biomass is actually very positive, as biomass collection keeps forests healthy and increases the quality of agricultural land. So, depending on the renewable source, the land footprint is moderately negative to very positive.

[55] Inderscience publishers, "Wind turbine payback: Environmental lifecycle assessment of 2-megawatt wind turbines", Science News, June 2014
[56] Zachary Shahan, "Solar Energy Payback Time", December 2013 (http://cleantechnica.com/2013/12/26/solar-energy-payback-time-charts/)

- Specific issues – Finally, each renewable energy technology has its own unique impact on the environment, which must be evaluated very carefully in order to avoid harmful results, and which should be quantified as an external cost. Wind plants may have a negative impact on bird habitats and their visual and noise impacts are also debatable within the local communities in which they are situated. Offshore wind farms may affect marine habitats in their vicinity. Geothermal can disturb water cycles deep underground which may contain minerals harmful to the surface environment. Burning biomass causes additional GHG emissions. Hydropower has a selective negative impact on the natural habitats of many species.

Figure 3, taken in its entirety from the European Environment Agency (EEA), provides an excellent overview of the external costs of electricity generation technologies in Europe.

Figure 3: Estimated average EU external costs for electricity generation technologies in 2005[57]



It appears that coal combustion leads to the highest external costs, followed by oil, with natural gas and nuclear power being significantly less expensive, and renewables representing the least expensive options in terms of external costs. Even though the absolute magnitudes of the external costs of electricity generation technologies are highly sensitive to shifting assumptions and input parameters[58], the overall conclusion on the relative ranking of electricity generation technologies in terms of their external costs have not altered. As Krewitt (2002) concluded in his 10-year review of ExternE studies: “even under different background assumptions, electricity generation from solid fossil fuels is consistently associated with the highest external costs, while the renewable energy sources cause the lowest externalities. The robustness of this ranking is an important finding of the ExternE study, which implies a clear message to the decision maker.”

[57] ExternE-Pol (2005), CAFE, EEA, Eurostat, RECaBS (2007)
Note: PBFC - pressurized fluidized bed combustion, CHP - combined heat and power, CCGT - combined cycle gas turbine, LWR - light water reactor, PWR - pressurized water reactor.

[58] This refers to how the cost of specific damage is calculated. For example, simple economic assessment based on insurance replacement costs may not be applicable for the value put on human life or severe health damage.

4.2. Expensive renewables and cheap coal? The fairness of the conventional economic framework of cost-benefit analysis

Having analyzed the external costs of electricity produced from fossil fuels and renewable energy, it is fair to question the premise of expensive renewables and cheap coal. But the level of deception of this premise becomes even more apparent when we take into consideration two additional factors: (a) that in this region we are comparing the cost of *old* thermal power plants with the cost of *new* generation capacity from renewables – in other words, we are not comparing "apples to apples"; and that, (b), when talking about the cost of producing electricity from coal we are actually talking about heavily regulated prices.

4.2.1. The Levelized Cost of Electricity (LCOE)

National investment decisions: each country for itself, or perhaps the region as a whole, needs to develop its own LCOE model based on which future energy decisions will be made.

The costs of power from old generation capacity and new generation capacity are utterly incomparable. When comparing the old with the new, we are intentionally, or unintentionally, deceiving the public. The method of the Levelized Cost of Electricity (LCOE) was devised precisely in order to compare "apples to apples". The LCOE is an economic assessment of the average total cost of building and operating a power-generating asset over its lifetime, divided by the total power output of the asset over that same period. The LCOE can also be regarded as the cost at which electricity must be generated in order to break-even over the lifetime of the project.

If we take Serbia as an example, the feed-in tariffs for new renewable energy capacities, depending on the source, range from 5.9 euro cents per kWh (small hydro on existing infrastructure) to 20.94 euro cents per kWh (rooftop solar). Wind and biomass are somewhere in between, with wind costing 9.2 euro cents per kWh and biomass costing anywhere from 8.22 - 13.82 euro cents per kWh. These prices are guaranteed to privileged power producers for a 12-year period, after which the prices are no longer fixed and should be regulated by the market in the same way as "brown" power prices.

Table 6: Estimated Levelized Cost of new power generation (2012 $/MWh), 2019

Plant type	Capacity factor (%)	Levelized capital cost	Fixed O&M	Variable O&M (including fuel)	Transmission investment	Total LCOE
Coal	85	60.0	4.2	30.3	1.2	**95.6**
IGCC[61] with CCS	85	97.8	9.8	38.6	1.2	**147.4**
Gas – Conventional Combined Cycle	87	14.3	1.7	49.1	1.2	**66.3**
Gas – Advanced Combined Cycle with CCS	87	30.3	4.2	55.6	1.2	**91.3**
Biomass	83	47.4	14.5	39.5	1.2	**102.6**
Wind	35	64.1	13.0	0.0	3.2	**80.3**
Wind offshore	37	175.4	22.8	0.0	5.8	**204.1**
Solar	25	114.5	11.4	0.0	4.1	**130.0**
Hydro	53	72.0	4.1	6.4	2.0	**84.5**

59 Decree on incentive measures for production of electricity from renewable energy sources, Ministry of Mining and Energy, Republic of Serbia

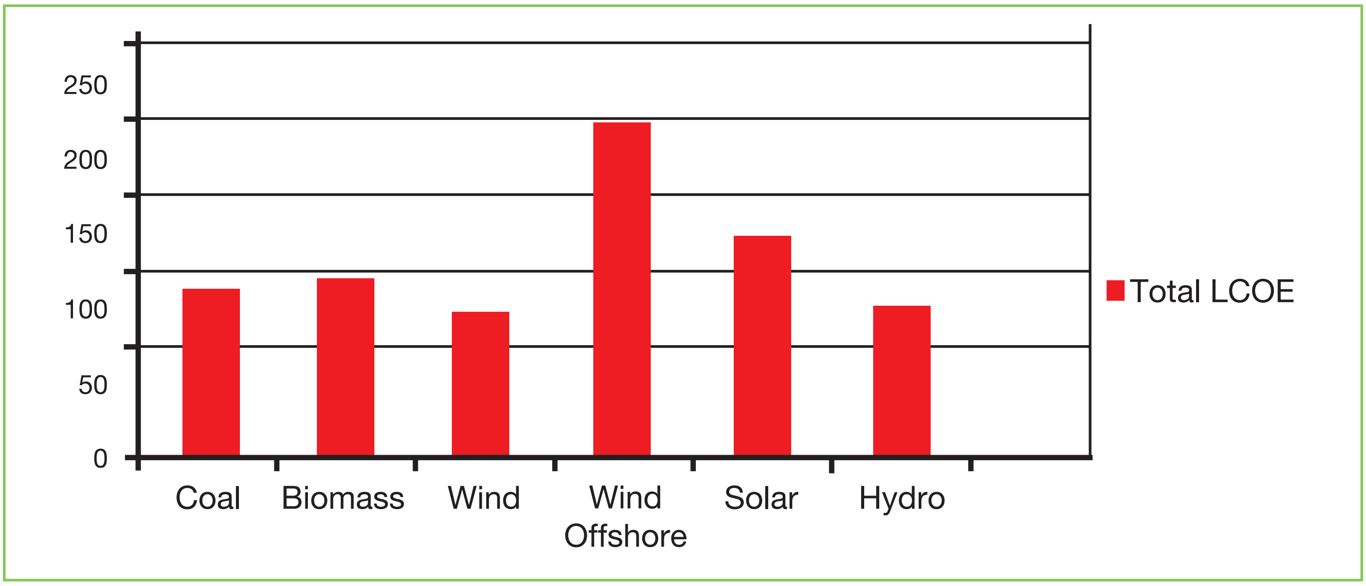
60 United States (US) Energy Information Administration, "Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy Outlook 2014", April 2014
Note: 2019 is shown because of lead times needed for some technologies to bring capacity online prior to 2019 (unless they were already under construction).

61 Integrated Coal-Gasification Combined Cycle (IGCC) with Carbon Capture and Storage (CCS)

The question now is how much electricity produced today from a new thermal power plant would cost, i.e. what would the electricity price have to be for an investor to achieve an Internal Rate of Return (IRR) high enough to decide to invest in building a new coal-fueled plant? To understand that, we need to take into account the capacity factor (availability of production), capital costs, fuel costs, fixed and variable costs of operation, and other factors, such as the cost of waste disposal, different insurance costs, etc. According to the LCOE model, in order to evaluate the total cost of production of electricity from different sources, the streams of costs are converted to a net present value using the time value of money, after which all these costs are brought together using discounted cash flow. By taking all of these factors into consideration we can produce a table with the comparable cost of electricity from different technologies and energy sources, as shown in Table 6.

When we use this table to create a graph (Figure 4) to better compare comparable costs of electricity production from different energy sources, it is obvious that renewables, due to non-existent fuel costs, are not only fully competitive with, but also more cost-effective, than coal. One thing to note in this table is that capacity factors depend greatly on the location of a power plant and, thus, can vary greatly. For this reason, it is important that each country for itself, or perhaps the region as a whole, develops its own LCOE model based on which future energy decisions will be made. Also, since the load must be balanced continuously, generating units with an output that can vary to follow demand characteristics (dispatchable technologies) typically have more value to the power system than less flexible units, and particularly those whose operation depends on the availability of an intermittent resource (e.g. wind and solar). Related capacity factors are therefore higher for dispatchable generation technologies.

Figure 4: Levelized cost of new generation resources (2012 $/MWh)



4.2.2. Regulated electricity prices

Electricity prices in Serbia and the region are heavily regulated and are among the lowest in Europe. The Draft of the Serbian Energy Strategy until 2025 envisions that Serbia will have to start deregulating the price of electricity in order for it to be set by the market. About a year ago, in July 2014, EPS requested that the government introduce an urgent increase in the price of electricity by a minimum of 15%. This has yet to happen[62].

Both of these facts indicate that the current price of electricity is unsustainable and could damage the energy sector. Revenues based on regulated prices often cannot even support the maintenance of existing generating plants or upgrades to required transmission

[62] The announced increase in electricity price by 12% from August 2015 did not happen.

network infrastructure. They certainly cannot economically justify the financing of new TPPs, which is why the entire region's energy sector is largely outdated and in desperate need of new investments.

If we take as an example two key Serbian thermal power plants – TPP "Nikola Tesla" (installed capacity 3,015 MW) and TPP "Kostolac" (installed capacity 921 MW) and data from their annual reports and financial statements (Table 7) – we can see that, in order for them to achieve the standard rate of return -- ROR (counted as 10% on the asset value), the price of electricity in Serbia needs to be raised by an average of 22.7%.

Table 7: Calculation of the necessary increase in the price of electricity in order to achieve the standard rate of return on investment (10%)

TPP	Total capacity (MW)	Turnover	Assets	Income needed to achieve standard ROR	Actual income	Difference between needed income and actual income	Increase in price needed to achieve standard ROR
Nikola Tesla	3,015	78,736,142	193,789,617	19,378,962	3,412,764	15,966,198	20%
Kostolac	921	25,842,767	113,882,442	11,388,244	3,649,024	7,739,220	30%
Total	**3,936**	**104,578,909**	**307,672,059**	**30,767,206**	**7,061,788**	**23,705,418**	**22.7%**

This is without taking into account the external costs of electricity produced from coal, rather representing a simple economic calculation of the business model employed in the Serbian energy sector over the past decades. Again, unfortunately, the situation does not differ greatly elsewhere in the region.

4.3. Impact of renewables on economic development

The impact of RES deployment on GDP has been analyzed in numerous studies, employing different econometric methodologies and countries with different RES deployment levels, and with different levels of economic development and social structures. These studies typically consider the impact of various energy policies on economic growth. As renewable policy support mechanisms increase energy costs for consumers and the costs of energy-intensive goods, governments sometimes need to complement renewable energy policy with other measures. These typically include demand-side management and energy conservation, in order to achieve renewable energy and environmental goals with the lowest possible cost to the economy. Some complementary support measures may involve other sectors – e.g. agriculture, where renewables are used in production, by introducing incentives for farmers to either use agricultural residues from their production as the main source of energy (in CHP power plants), or participate as suppliers in the biomass supply chain.

Local industries could seek their share in the production of equipment for renewable energy generating technologies, as there would be an increased demand for machinery, parts and know-how in the industry.

Economic growth arises from a country's increased energy independence and energy security, as local technologies and resources increase their independence in supplying energy to consumers. This growth is supported by local industry development, job creation and the further technological innovation that comes with higher deployment levels. Local industries could seek opportunities in the production of equipment for renewable energy generating technologies, as demand increases for machinery, parts and knowhow in the industry. For example, major industrial complexes could produce equipment for wind and solar power plants locally (steel towers for wind turbines, solar photovoltaic panels), demand for which is expected to grow alongside the growth in demand for renewable energy. Consequently, industry growth entails an increased workforce, with significant changes to labor demand among economic sectors as a result of the *green* transformation of the economy. The successful transition to a low-carbon economy will only be possible if the workforce can adapt and transfer from sectors where employment is falling, creating and maximizing know-how and human capital. With higher employment rates, additional disposable income for households would further stimulate the economy by increasing demand for other services and products.

4.4. Net financial benefits of investments in renewables

Diversification of energy sources is the key to energy security and independence.

As already apparent from multiple analyses cited throughout this report, investments in renewables offer numerous benefits. They can be classified as financial and non-financial. Some of the non-financial benefits have been mentioned already, but it is important to list them once again:

- Strengthening the country's energy sector – renewable energy sources will contribute greatly to the energy security of Serbia and the region, as well as reducing winter energy imports significantly. This is especially the case with wind farms in Serbia, where 70% of total electricity production from wind would occur during the winter months, when the country imports the most electricity and its price is at its highest. Therefore, wind farms can replace a significant percentage of electricity imports. The need to diversify energy sources was more evident than ever during May and June 2014, when the region suffered its worst ever floods and work ground to a halt at TPPs and large hydro plants (covered further in Chapter 6). Serbia was then forced to import all of its energy, but the situation would have been very different if energy sources had been more diversified and the country could have relied, at least to some extent, on its own renewable sources. The situation is even worse in the heating/cooling sector, where Serbia is completely dependent on imported natural gas. During the first Russia – Ukraine crisis, in January 2009, the country was left without heating for days and was forced, wherever possible, to switch to fuel oil in order to heat schools and hospitals. Businesses across the country lost millions in profits after being forced to halt production/services. All of this teaches countries a very important lesson: diversifying energy sources is the key to energy security and independence.

- Fostering EU integration – Politically, the greater utilization of renewables will move the region closer to the EU by contributing to attaining mandatory renewable energy targets by 2020. Although reaching the targets set will not be a determining factor in EU integration, failure to do so will certainly be an obstacle on the path to the EU if all other important elements have been satisfied. Moreover, the region's willingness and efforts to achieve internationally recognized renewable energy targets will be perceived as a sign of good will that will be much appreciated.

- Environmental benefits – Environmentally, renewables will result in a cleaner and healthier Serbia and the region. Renewables mean clean electricity generation that not only saves the environment by reducing emissions of greenhouse gases and other extremely dangerous pollutants, but also generates healthcare savings by reducing health problems related to pollution, where renewables pose the lowest "externalities". According to calculations based on a method accepted by the World Bank, the external expenses for coal are over $58 or $59 per MWh. That is 30 times more than the external expenses of wind generators, 10 times more than for solar panels and 5.5 times more than for biomass.[63]

[63] European Movement in Serbia, "Serbian EU Accession – Importance of Material Conditions in the Energy Sector", Belgrade, September 2013

Intermittent sources (wind, solar) decrease the wholesale price of electricity due to their lowest marginal costs of production.

The net financial benefits are often of the most concern to policymakers. And here there are many, and they are obvious. Investments in renewables, and wind farms in particular, as by far the biggest projects, lead to increased levels of Greenfield investments in the country, creating employment for thousands of people locally during the construction period, with jobs for local construction and transportation companies, and increasing state revenue generated from taxes. Renewable energy sources can contribute to creating a totally new industry that generates wealth by exploiting naturally abundant resources that would otherwise be wasted. This is a local industry that it is impossible to delocalize (renewable energy resources are local by nature) and which will result in new local technological and non-technological jobs once construction is complete (employment in renewable energy worldwide stood at 5.7 million in 2012, with the potential to add 11 million jobs in the years until 2030[64]). An inseparable part of the renewable energy sector is the advancement of industrial research and development and expanding knowledge that can both be used domestically and exported.

In Serbia, for example, it is expected that renewable energy sources can lead to direct investments worth over a billion euros in the next three to five years. During this time of a prolonged global financial crisis, Serbia, like all other countries in the region, is in dire need of direct investments in order to sustain its development. The Serbian Wind Energy Association (SEWEA), established in 2010, brings together foreign and local investors interested in investing in wind farm development in Serbia. To date, according to investor data, SEWEA members have invested approximately €35 million in the development of their projects in Serbia, without even starting construction. About 90% of this money was invested in the country's economy directly – through the purchase of land from local communities and citizens, engaging local companies to work on technical documentation for wind farms, geotechnical surveys and project documentation, salaries for local staff, taxes, permits, and similar. SEWEA currently represents one of the top investment potentials for Serbia.

4.4.1. Case Study: Net financial benefits and the impact of wind power deployment on end-user electricity prices (example of a 150 MW wind farm)

Net financial benefits for the country are illustrated using the example of a 150 MW wind farm: during its life span of about 25 years, the overall net financial benefit to the country amounts to €279 million. The most significant revenue generated from an operating 150 MW wind farm would be:

- Tax revenue: approximately €140 million would come in the form of direct budgetary revenue from different taxes (income tax, property tax, withholding tax on dividends).

- Income for municipalities: According to international best practice, developers have some income-sharing agreement with the local government in the area where their project is located (e.g. 2% of net annual profit set aside for the local municipality) and additional budget allocations would be earmarked for support to corporate-social responsibility (CSR) initiatives. Therefore, approximately €11 million would go to local government during the 25-year period.

- Impact on the Serbian construction industry: direct investment of about €45 million for local construction, electrical and transportation companies engaged during

[64] Renewable Energy and Jobs Report, International Renewable Energy Agency (IRENA)

construction (e.g. design, machinery, labor, civil works, materials, piling, roads, cables, TS, OHL, transports, machinery installation etc.).

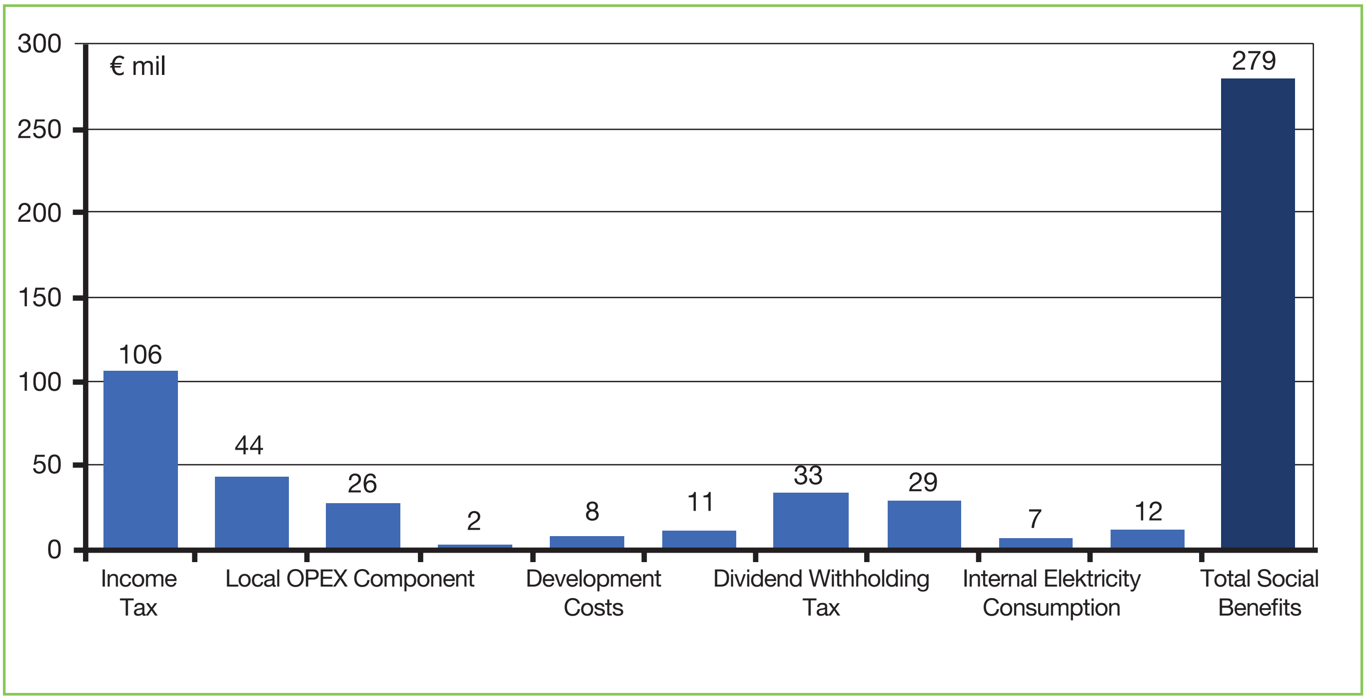
- Employment during construction: it could be expected that approximately 400 people would be employed over a period of 18 and 24 months during the construction phase of such a wind farm.

- Improvement of the national grid: in order to connect to the national high-voltage grid, it is expected that investors would have to spend about €10 million on transmission assets (a high-voltage overhead power line and transformer station). Following the completion of construction, this entire asset would be gifted to the grid operator (in the case of Serbia, Elektromreze Srbije – EMS).

- Operation and maintenance (O&M) contracts for local companies: additional engagements of local companies would be required during the operational period in order to service the wind farm (O&M). These contracts could be worth anywhere between €10 and €15 million.

- Other social income: other expenses for investors (wind farm operators) would result in income generated for the Republic of Serbia, local governments and/or local companies. These include administration of the project company, the cost of electricity to be used on the transformer station and administrative building, salaries for staff employed during operations, and similar.

Figure 5: Total direct economic benefits of a 150 MW wind farm over the 25 years of its life span (project cycle)[65]



An increase in the price of electricity for the end user is often the only argument against widespread utilization of renewable energy. In 2015, the renewable energy surcharge levied on end-users has been increased to 0.093 RSD per kWh (ca. 0,001 cents euro per kWh) from 0.081 RSD per kWh in 2014[66].

[65] Serbian Wind Energy Association (SEWEA) presentation at the Renewable Energy Exhibition (RenExpo), Western Balkans, Belgrade, June 2014
[66] Annual Implementation Report 2015, Energy Community Secretariat, September 2015

It is true that renewable energy facilities need subsidies in the form of feed-in tariffs, as a guaranteed purchasing price of electricity produced from renewables, or Green certificates, as a tradable commodity proving that electricity has been generated using renewable energy sources. It is likewise true that when the difference in price and “expensive” renewable energy sources are mentioned, the speaker is usually not taking into consideration the external costs of electricity produced from fossil fuels, or the LCOE, as already analyzed in this chapter under section 4.2. Setting these factors aside for now, we can take a look at the precise total impact of renewable energy sources on the current price of electricity, taking Serbia and wind farms development as an example.

The Government of Serbia has set a cap of 500 MW on wind farm development in the country – primarily in order to reduce the impact on end-user prices. According to SEWEA’s calculations and information on projected electricity prices taken from the official website of the Serbian Ministry of Mining and Energy, if Serbia installs 500 MW of wind farms by 2020, this will raise the final electricity price for end users in Serbia by 2.4%. This would equate to 0.2 euro cents per kWh used. In other words, the price impact of 500 MW of wind farms connected to the grid would fall within the margins of a negligible statistical error.

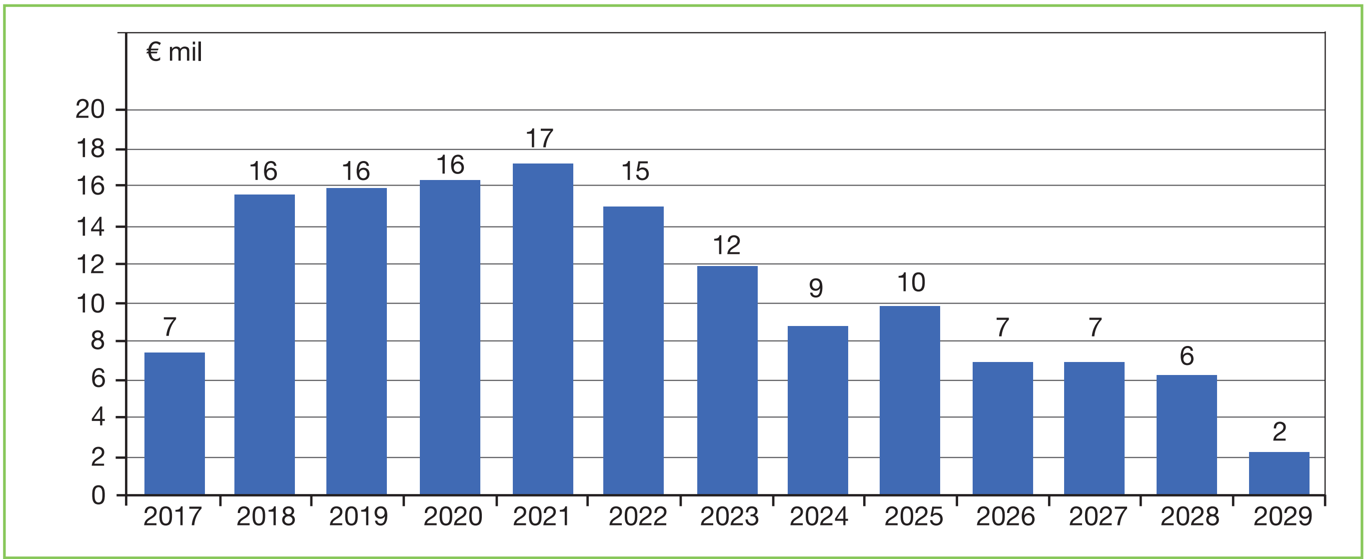
Given further consideration, this calculation makes a lot of sense. Compared to the entire system of the Republic of Serbia, 500 MW is not that significant, and capacity factor for wind farms is typically between 25-30% - and end users only pay for what is produced. Furthermore, the majority of electricity production from wind farms occurs during winter months (70%), characterized by expensive electricity imports. Also, wind farms will be built and connected to the system gradually, meaning that consumers will not start paying for all 500 MW at the same time. Finally, considering that the first wind farms could only be connected to the system in late 2016 or early 2017 – provided legislation enables the launch of construction by the end of 2015 - the impact on end-user price can only be counted as of 2017, when the price of electricity will certainly be higher than it is today. The later renewable energy sources are connected to the grid, the less their impact on the end-user price of electricity. The price impact of other renewables would be even less, as they cannot be compared to wind in terms of total capacity.

If we take the cost/benefit analysis of a 150 MW wind farm that was used by SEWEA in order to compare the net financial costs of a single project to the citizens of Serbia with its net financial benefits, we will see that the net financial costs total €141 million over the life of the project. The net financial cost to end users is estimated as a difference between the total amount of incentivized revenues (i.e. feed-in tariffs) during a 12-year incentive period and the expected wholesale market price of electricity. This cost would obviously be incurred in the first 12 years of wind farm operations, during which there would be a guaranteed privileged price. Following the first 12 years, the price will be determined by the market and will not be guaranteed – hence, end users would bear no additional costs. As shown in Figure 6, the cost to end users would gradually increase as more turbines are connected to the grid, before slowly decreasing as the market price of electricity increases.

Thus, in the example of a 150 MW wind farm, the total benefit to the Serbian economy (279 million EUR) is expected to exceed total costs (141 million EUR) by about 97%- before taking into account externalities (avoided health costs, environmental damage, benefits of EU accession etc.).

[64] Godišnji izveštaj o implementaciji, Sekretarijat Energetske zajednice, Septembar 2015.

Figure 6: Total expected costs (million EUR) for the economy as a result of the connection of a 150 MW wind farm to the grid[67]



Finally, not every renewable source carries the same cost – some are more expensive than others, but are also more work intensive – such as biomass. Others, like wind, are less expensive, but also have a lower impact on job creation. This all needs to be considered when it comes to developing an energy policy in the context of a country's sustainable development strategy.

[67] Serbian Wind Energy Association (SEWEA) presentation at the Renewable Energy Exhibition (RenExpo), Western Balkans, Belgrade, June 2014

Chapter 5

OBSTACLES TO PROGRESS: RENEWABLE ENERGY POLICY CHALLENGES

5.1. General barriers to the deployment of renewables

The interest in the sector is there, but what's lacking is stability and predictability which will ensure continued inflow of investments.

One common message throughout this report is that the utilization of renewable energy sources in Serbia and the region is far below the level projected and committed to by these countries as contracting parties in the Energy Community Secretariat. It is also clear that the lack of projects is not due to a lack of interest among investors and independent power producers (IPPs). On the contrary – the interest is there and money has started flowing into the sector, but a result is still lacking. This is due solely to a number of different barriers – economic, political and social – which hamper construction of most renewable energy projects, especially the larger example.

At this point, however, it is also worth noting as a general point that renewable energy sources are not the only economic sector suffering due to barriers blocking entry into regional markets. Serbia, like other countries in the region, is greatly starved of investments (foreign direct investments, as well as domestic investments). This is caused by many factors, the most important of which is market size (which is why, moving forward, we should all take on the task ahead of promoting the region as a whole, and only then individual countries), input costs, macroeconomic stability, and institutional and political stability. Perhaps the following data provides the best indicators that there is much room to improve business friendliness and investment attractiveness:

- Lack of stability and predictability – Key pieces of legislation, such as the Law on Planning and Construction, Law on Agriculture, and Energy Law, are amended too often and, more importantly, those changes are too sudden and are made without the input of industry and investor associations. Urgent changes to legislation cause investors to experience some kind of "emotional rollercoaster" and lead to them feeling like they are working in an unstable and unpredictable business environment – and this is among the most discouraging and demotivating factors for investors. In Serbia, the Law on Planning and Construction, as one of the key pieces of legislation impacting on all industries, including renewables, has been subjected to amendment three times since 2011. The same is the case with the Energy Law, which was changed entirely, i.e. a new law was adopted, in 2011, after which urgent amendments were implemented in the National Assembly in 2012, with the most current version of the law adopted in 2014. According to the research undertaken by the National Alliance for Local Economic Development (NALED), some two thirds of laws in Serbia are drafted and passed without any consideration given to the opinions of the business or civil sectors.[68]

- Delays in the adoption of secondary legislation, causing a legal vacuum and insecurity – in much the same way, and with much the same consequences, as issues described in the previous paragraph, delays in the adoption of secondary legislation governing the implementation of laws adds to the kind of uncertainty feared by investors. Again, thanks to the comprehensive analysis performed by NALED through its "Bylaw

[68] II Regulatory Index of Serbia produced by NALED in June 2014 (http://www.naled-serbia.org/en/news/817/II-Regulatory-Index-of-Serbia-presented)

Barometer", we can say that the average delay in the adoption of secondary legislation in Serbia was 719 days in the second quarter of 2013, but this is continuously prolonged (to 838 days by the end of the third quarter, and to 879 days by the end of the first quarter of 2014, or almost 2.5 years[69]). This was precisely one of the issues cited by investors in renewables in Serbia. Following adoption of the generally positive Energy Law in August 2011, which indicated that all secondary legislation pertaining to renewables should be adopted within four months of adoption of the law (i.e. by December 2011), investors waited as long as 16 months for actual adoption, which came in January 2013. An even more drastic example is the Law on Agriculture, which was adopted in 2009, but for which some of the secondary legislation is still pending. Particularly important for the utilisation of renewables is the Decree on the Utilization of Agricultural Land for Non-Agricultural Purposes, which remains an open issue to this day.

- Judicial system issues which lead directly to major delays in contract enforcement – enforcement of contracts is a huge concern for the investor community in general. The same can be said of equity investors in renewables and international financial institutions and/or commercial banks that act as lending facilitators for these investors. One mid-sized wind farm (150 MW) represents an investment of approximately €300 million, with 30% typically coming from equity funds, while the remaining 70% comes from lenders. The exposure of lenders is obviously so high that they ordinarily ask for a considerable level of guarantees to ensure enforcement of the Power Purchasing Agreement (PPA) as the contract that forms the basis for their lending activities. In Serbia, these guarantees, as well as contract termination provisions and dispute resolution, represent a very sensitive issue which international financial institutions are still negotiating with the Ministry of Energy. The World Bank's "Doing Business" report for 2015 estimates that 635 days are needed on average for contracts to be enforced in Serbia. This ranks Serbia 96th among 189 countries in this category[70]. It is essential that this aspect of doing business in Serbia is improved.

These are obviously all issues that impact on the general investment climate in Serbia, but none of them have bypassed the renewable energy sector, which is why they had to be noted here. The amendments to the Energy Law and the Law on Planning and Construction, delays in the adoption of bylaws, a lack of communication with relevant ministries, a lack of understanding of project financing issues, and strict and complicated standards which should be respected, all contribute directly to the gross underutilization of renewable energy sources in Serbia. Unfortunately, the situation regarding these general investment conditions elsewhere in the region does not differ markedly.

On the positive side, it finally needs to be emphasized that these things are slowly changing for the better in Serbia. The best tangible example of this change is the adoption of the new Law on Planning and Construction in December 2014. This law was drafted in a transparent, open and participatory procedure, which included a wide range of investor associations, industry groups, bilateral chambers of commerce and civil society organizations. The final form of the law caused no shocks, with all interested parties having been given a chance to work on the legislation in a hands-on way. The adoption of the law was followed by the efficient adoption of all secondary legislation and, again, all interested stakeholders were invited to assist the Ministry of Construction in the preparing of bylaws. This also sets a completely new standard for legislative activity in Serbia, raising hope that other Serbian government ministries will follow suit and employ the same level of openness and transparency.

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[69] I Quarterly Report on the Status of Reforms in 2014 (http://www.naled-serbia.org/upload/Document/File/2014_08/Report_for_I_quarter_2014_Status_of_regulatory_reform.pdf)
[70] Doing Business 2015, The World Bank Group (http://www.doingbusiness.org/data/exploreeconomies/serbia/enforcing-contracts/)

5.2. Policy and regulatory barriers

The Energy Law in Serbia is satisfactory and provides a good framework for renewable energy investments. However, investors are awaiting a set of bylaws – the Decree on incentive measures, Decree on PPP status and PPA model (for large renewable energy projects, i.e. all projects exceeding 10 MW) – in order to proceed with their investments. Other relevant legislation, except for a certain lack of clarity with respect to the use of agriculture land, as stated earlier in the paper, is now in place and is workable.

Serbia has not adopted the Energy Development Strategy – the most important document defining the future path we wish to take with respect to energy.

The situation is much the same in the region's other countries. Investors present in the field are developing their projects while awaiting completion of a set of laws that will enable the financing and construction of their projects, while investors who are not present are carefully monitoring developments on the ground in order to determine the feasibility of their potential investments.

One specific problem that often arises in the region is that a complex regulatory framework lacks transparency and leads to many overlapping pieces of legislation that lack the clear division of responsibility or jurisdiction.

5.3. Institutional and administrative barriers

Renewable energy projects and the associated legislative framework have been in development in the region since 2005, more or less. However, the fact still remains that local and national governments lack competent professionals who know enough about project financing mechanisms, the peculiarities of permitting renewable energy projects, construction processes, commissioning and making renewable energy facilities operational. This further complicates the everyday life of investors and slows the development process.

It needs to be noted that this is in no way specific to this region. All countries needed to tackle steep learning curves when initially utilizing renewable projects and de-monopolizing energy markets in order to allow the entry of independent power producers. The countries now considered advanced users of renewables began utilizing this energy option earlier and had a more robust general legislative and business environment to begin with, thus ensuring they progressed more rapidly.

Another challenge faced by the region which differs compared to Central and Western Europe, the U.S., or Australia and Asia, is that most energy facilities currently in use are more than 30 years old. This means that people currently serving in relevant institutions are hardly able, if at all, to recall the last time a large energy facility was constructed, tested and made operational, let alone a renewable energy facility. This adds to overall confusion with the preparation of new legislation and the adaptation of old legislation to cater for renewable energy projects.

Benchmarking with the leaders in the implementation of renewable projects (e.g. Germany), who have streamlined permitting procedures through a one-stop-shop approach, would be of great assistance. A one-stop-shop agency should bring together all administration levels involved in renewable energy project permitting, while taking into account the specifics of the technology. This is particularly important for smaller projects (e.g. solar PV on buildings), where waiting for permitting approvals can consume as much as 50% of the overall project development time.

5.4. Financing and investment barriers

The projects currently under development in Serbia and the region run a high risk of starting to become too expensive to finance.

If a typical project lifecycle is divided into four phases: (I) permitting (culminating with the issuance of a construction permit); (II) financing (which ends with the close of financial issues); (III) construction (culminating with an application for testing and a usage permit); and (IV) commissioning (ending with the issue of an energy license), each of these four phases has its own "normal" duration and associated costs. This has been protracted considerably in Serbia, simply because the implementation of projects that started at the very beginning of the "renewable energy era", i.e. 2008 or 2009, had to endure all the learning processes, changing legislation and other institutional and administrative barriers, and have yet to being the construction phase. This basically means that, instead of lasting for about two years, the permitting process actually lasted four years. The same applies to the financing phase, which should have lasted a year or maximum 18 months, but which is, in reality, still continuing and will do so until policy barriers are resolved. The longer the delays, the higher the project development costs, meaning that there will be fewer equity investors and lenders willing to engage in projects and support them to the end.

5.5. Capacity and infrastructure barriers

One of the most obvious technical barriers with regard to the utilization of renewables in the region is the inability of power systems to integrate new variable RES generation plants, due to an insufficient reserve capability leading to operational problems. Depending on the country, there is also an issue of outdated and insufficient infrastructure for the transmission and distribution of energy leading to significant grid losses, lack of adequate grid connection, or the necessity of grid expansion and improvement. All of this can potentially seriously hinder the economic efficiency of potential renewable projects.

In some of the region's countries, however, the grid is more robust than initially assessed by the relevant national authorities. In Serbia, for example, the cap on wind was initially set at 450 MW, because of a supposed inability of the grid to accept more wind energy. However, following careful analysis, funded by the EBRD and performed by Vattenfall Europe PowerConsult GmbH, it became clear that the grid can sustain approximately 900 to 1,000 MW of wind without any need for improvement, and even 2,000 MW of coincident wind power in-feed with only a few reinforcements and extension measures to the 110kV network.[71] This example serves to prove the importance of careful and professional resource assessment, which is greatly lacking in the countries of the region, which often operate on the basis of assumptions.

Finally, one of the greatest obstacles to establishing a unified energy market in Southeast Europe, which should be the ultimate goal of the region, is the great number of borders and often conflicting transmission capacities.

5.6. Support scheme (FIT) constraints

Many countries in the region placed a quota (or cap) on certain renewable energy sources that are eligible for incentive measures (typically feed-in tariffs and balancing costs). The renewables most commonly capped are wind and solar. In Serbia, for example, wind energy is capped to 500 MW until 2020 and solar is capped to 10 MW. In the Bosnia and Herzegovina

[71] Serbia – Power Network Analysis for Wind Power Integration, Vattenfall Europe PowerConsult GmbH, Electricity Coordinating Center Ltd, 5th April 2011

Federation and Republika Srpska, wind has been capped at an aggregate of 350 MW. More wind farms can be built, but they cannot become privileged power producers and cannot apply for incentive measures.

Although the quota system has benefits in terms of ensuring the gradual increase of renewable energy sources connected to the system, it generally discourages investment in a country by increasing the risk that a completed project will remain outside of the quota. The introduction of such measures should be considered carefully, as they can potentially kill a market before it even starts developing.

Introduction of the "cap" on technology should be considered carefully, as such a measure can potentially kill a market before it even starts developing.

Other constraints include indexation of feed-in tariffs (FITs) to annual inflation in the Eurozone – something that is often overlooked by inexperienced policymakers; availability of FITs during commissioning – an aspect which can seriously undermine project economics; and the availability of other incentive mechanisms, such as priority of dispatch and determined output.

5.7. Limited public awareness and public acceptance of renewable energy

Much of the delay in the utilization of renewables can be attributed to a lack of public education and awareness. It was a revelation to see the results of research conducted in January 2012 by Ninamedia[72], an agency specialized in monitoring and analysis of media content in Serbia and the region. The research included the citizens of Belgrade, via the method of Computer Assisted Personal Interviewing (CAPI), and showed that 83% of citizens do not see any connection between pollution and electricity generation! In other words, a great majority of Serbian citizens fail to recognize the link between an increase in cases of lung cancer, respiratory problems, allergies and similar, and the production of energy from coal.

Clearly, environmental issues in Serbia and the region are still taken very lightly and treated as some sort of "touchy-feely" thing that we in the Balkans do not have time for, and which are not really relevant for everyday life in countries facing major economic challenges, a high level of unemployment and bleak development prospects. In Serbia, but also in the region, serious environmental issues continue to always take a back seat to economic issues.

This is why it is crucial to demystify the great myth that TPPs produce cheap electricity. The price of electricity, and the gravity of climate change, has to be number one issue and a cornerstone of all public education efforts.

[70] http://www.sewea.rs/vesti/simpozijum/

Chapter 6

CLIMATE CHANGE KNOCKING ON THE REGION'S DOOR

Serbia: the total damage to the power system caused by the May 2014 floods (including damage to assets and production losses) amounted to nearly €500 million.

Serbia experienced disastrous floods in April and May 2014 that were caused by exceptionally heavy rains leading to a rapid increase in water levels in the main rivers and resulting in a major natural disaster. A number of severe floods have been recorded in Serbia during the last decade, but never of such magnitude. The record-breaking rainfall of spring 2014 amounted to more than 200mm of rain in a week's time, which is the equivalent of three months of rain under normal conditions. This situation provided a warning of the vulnerability of Serbia's power system, which relies on electricity production from lignite. The floods seriously threatened the reliability of the power system, leaving 100,000 households in the territory hit without electricity supply.

EPS faced reduced production levels at both TPPs and HPPs. Due to problems in supplying lignite from opencast mines caused by the floods, TPPs worked with a decreased capacity: with 1,000 MW of unavailable capacity from TPPs in the system. HPPs Djerdap 1 and 2 also had to reduce their production by 500 MW, due to the need to reduce the levels of river waters. EPS had to make emergency imports of electricity (from Montenegro, Republika Srpska and on the wholesale electricity traders market) in order to cover peak consumption and ensure the security of supply. This enabled the avoiding of restrictions in the electricity supply to the rest of the country that was not directly affected by the flooding. The total flood damage sustained by the power system (including damage to assets and production losses) amounted to nearly €500 million. Due to an EU policy that does not favor investments in power plants based on fossil fuels, Serbia faces a difficult situation concerning the financing of the system's modernization and expansion – leaving the country more vulnerable in terms of energy security.

6.1. View to the past: The role of energy in climate change

People, as both consumers and producers, are responsible for emissions of greenhouse gases into the atmosphere – of which CO_2 has the largest share, accounting for three-quarters of the total global warming effect caused by people. Gases gather in the atmosphere (regardless of where they have been emitted), where they "capture" heat and cause global warming. Global warming leads to climate changes, which have a negative impact on people, animals, and plants – usually through water. These changes could ultimately transform the geography of our planet. An average global temperature increase of 4-5°C would cause radical and dangerous changes to our planet, with extreme effects in some locations. Climate changes have an unquestionable impact on the occurrence of floods, even though quantitative projections of their frequency and intensity remain incomplete. Increased temperatures in Europe are expected to intensify the hydrological cycle, causing more frequent and stronger floods in many regions – increasing the share of climate change in the material costs imposed by natural disasters worldwide.

Greenhouse gases are externalities, characterized by: a) global nature - their impact is global, as is the risk they impose; and b) effects that are long-term and irreversible. Even if we stopped emitting gases right now, the climate would not return to normal, due to past emissions. The damage has been done. The historic level of carbon dioxide in the atmosphere over the course of the last ten thousand years was roughly 275 parts per million (ppm); but since the dawn of the industrial revolution it has been on the rise constantly and is currently rising by an annual value of more than 2 ppm, – and "no one really knew where the red line is" (McKibben, 2010). The world has warmed by approximately 0.7°C since mankind started using fossil fuels two centuries ago, and the current level of concentration of carbon dioxide is around 390 ppm. Climate scientists still argue about the "safe" level of carbon dioxide, but the range is somewhere between 270 and 325 ppm[73].

[73] J. Hansen, NASA Goddard Space Institute, USA; J. Schellnhuber, Potsdam Institute for Climate Impact Research, Germany (2008)

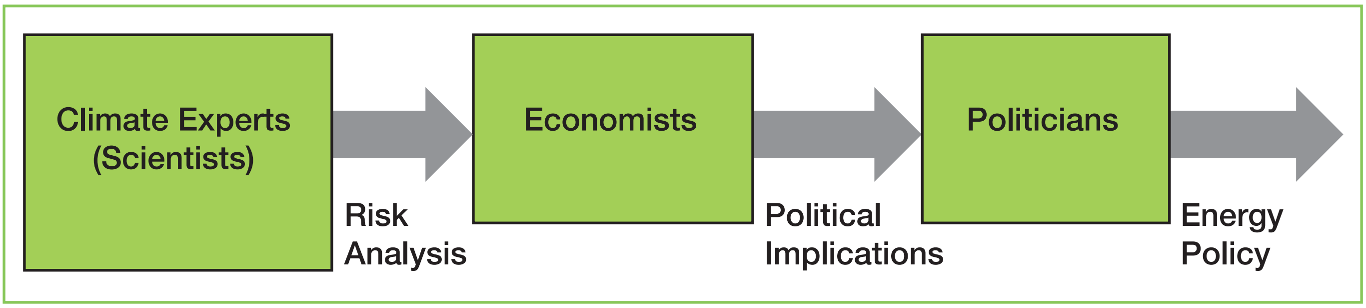
Energy-induced emissions account for 65% of total global emissions (the remaining 35% of non-energy induced emissions relate to waste, agriculture and land use). Of this 65%, the power sector has the largest share, accounting for 24% (due to the burning of fossil fuels at TPPs), followed by industry and transport, with 14% each, buildings, with 8%, and other energy-related emissions accounting for 5%. Energy has had the main role in the past, with the growth of civilization driven by the use of cheap energy from fossil fuels. And energy will continue to play the main role in our (post) carbon future, as the decline phase (which we are now in) will be led by the depletion of fossil fuels and environmental damage caused by the burning of coal and other fossil fuels. Fossil fuels have been harnessed as an abundant and easily accessible source of energy for two centuries. This cheap energy enabled the growth of populations and consumption levels; as well as facilitating the technological innovations and economic activities that produced economic growth. Increasing populations and growing economic activity led to increased demand for energy, which in turn generated an increased energy supply and created a positive, self-reinforcing, feedback loop. However, this growth also came at a cost: in terms of a negative impact on the environment and climate change; scarcity of resources, water and food; increasing conflicts over diminishing resources and absolute dependence on economic growth that is difficult to achieve.

Climate policy is a complex blend of politics, economics and technology. The debate is no longer about the (climate) science; it is rather about the (climate) economics.

6.2. International response and the global debate on climate change

There are three main outcomes resulting from analysis of the economics of climate change: targets for the reduction of emissions; instruments of energy policies and global action aimed at achieving the first two. The typical flow chart of actions and responsibilities is presented below. Climate policy is a complex blend of politics, economics and technology. Even though climate scientists are among the loudest advocates of climate policy, economists' conclusions about climate change, and their economic analysis, have a major impact on the decisions governments take in this respect. Thus the debate is no longer about the (climate) science; it is rather about the (climate) economics.

Figure 7: Climate change and energy policy – decision-making process



World leaders meet annual to try to reach agreement on a common response to the threat of climate change. This international political response is articulated by the conclusion of the UN Framework Convention on Climate Change (UNFCCC) - which established actions to be taken to stabilize atmospheric concentrations of greenhouse gases (GHGs) and avoid "dangerous anthropogenic interference with the climate system". The implementation of UNFCCC is reviewed at the annual Conferences of Parties (COPs). The most important Conferences to date were: COP3, where the Kyoto Protocol was adopted; COP11, with the Montreal Action Plan; COP15 in Copenhagen, where an agreement to succeed the Kyoto Protocol failed due to the absence of political will; and COP17 in Durban, where the Green Climate Fund was created. COP21 will be held in Paris in November/December 2015 and will aim to achieve a legally binding and universal agreement on climate change, in order to reach the goal of keeping global warming below 2°C.

Countries have agreed that prior to the Paris Conference they will outline which post-2020 actions regarding climate change they intend to take. This is defined under a new international agreement, the Intended Nationally Determined Contributions (INDCs), which is expected to largely determine whether the world will achieve the *ambitious* climate change agreement to be made in Paris in 2015.

In the meantime, and in anticipation of COP21, much debate has been continuing between advocates of an immediate and large-scale policy response to climate change (mainly climate scientists) on one side; and skeptics (mainly economists) on the other. Advocates emphasize unfairness of the conventional cost-benefit analysis, insisting instead that the climate policy should be considered as insurance for the planet, aimed at preventing worst-case scenarios rather than calculating average or expected values. Skeptics consider climate change as a moderate problem that should be solved through the imposing of slow and gradual policy measures that shouldn't be too expensive for the economy to bear (without unnecessary expenditure). It is clear that conventional economics is essentially biased in favor of the status quo; considering environmental impacts as externalities, or damages imposed from one party to another. Externalities can be priced and incorporated into the calculations of a produced energy unit – allowing fair comparison of different generating technologies. Avoiding those damages represents the benefits of the climate policy. Calculation of the benefits includes comparisons between two scenarios: a "business-as-usual" scenario, based on extrapolation of the current emissions and trends without a climate policy in place; and a "policy" scenario, which includes measures to combat climate change. The difference between the greater damages under the business-as-usual scenario and the lesser damages under the policy scenario is the benefit of adopting the policy. A significant contribution was provided by both sides (of the continuum) that went beyond the boundaries of the debate. From policy instruments that impose a small carbon tax that would reduce emissions by 25% below business-as-usual levels by 2050 (which in essence means that they would rise well above current levels) to announced emissions reductions in some European countries of 50-80% below 1990 levels by 2050.

Finally, the conventional economic framework for a cost-benefit analysis of climate change has little to say on issues of fairness. The early stages of climate change will be less harmful to some countries than others, and they may decide to adopt a less ambitious climate policy (and consequently pay less for emissions). On the other hand, some of the poorest countries, which are among the least responsible for climate change and least able to pay for emissions reductions, will be the first and hardest hit by the changing climate.

6.3. Harmonization of Serbian environmental legislation with that of the EU

The EU combats climate change through the implementation and monitoring of its environmental policy. All EC Contracting Parties are obliged to harmonize their climate policies and relevant environmental legislation with that of the EU. As discussed earlier in this chapter, the energy sector is considered - from the generation to consumption of energy - as the top polluter of the environment, and thus represents an important strategic determinant of the development of the EU's economic policies[74].

The most important sources of EU legislation in the area of environmental protection relevant to the energy sector include: Environmental Impact Assessment Directive (2011/92/EU) and Strategic Environmental Assessment Directive (Directive 2001/42/EC); Directive on Public Access to Environmental Information (Directive 2003/4/EC); Directive on Providing for Public Participation in Respect of the Drawing Up of Environment-Related Plans and Programs

[74] The environmental policy and regulation has direct impact on three sectors: power, heating/cooling and transportation; however the focus of this paper is on the power sector only.

(Directive 2003/35/EC); Directive on Environmental Liability (Directive 2004/35/EC); Directive on the Assessment and Management of Environmental Noise (Directive 2002/49/EC) – *particularly relevant for wind power projects* – and, most importantly, two directives related to (industrial) emissions from large combustion plants (Directive 2001/80/EC and Directive 2010/75/EU), whose adoption and implementation represent major challenge for all countries that rely on fossil fuels as their dominant source of energy.

The main challenge facing the transportation sector is the implementation of the 'Sulphur in Fuels Directive', which Serbia must completely transpose into its national legislation, as well as ensuring its implementation. An emphasis has been placed on provisions in the Rulebook on Technical and Other Requirements for Petroleum-Derived Liquid Fuels related to HFO[75]-S, which are not in line with the Directive, as well as the monitoring rules. The Secretariat launched infringement procedures against Serbia in 2013, and will continue its infringement action until the breaches are rectified.

Furthermore, Serbia ratified the United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol, the Convention on Long-Range Transboundary Air Pollution (CLRTAP) and its protocol on long-term financing of the cooperative program for monitoring and evaluating the long-range transmissions of air pollutants in Europe (European Monitoring and Evaluation Program - EMEP)[76]. As a Non-Annex I Party to the Kyoto Protocol, the Republic of Serbia assumed the obligation to reduce emissions of greenhouse gases and announced in June 2015 its new climate pledge to cut emissions by 9.8% compared to 1990 levels by 2030, in anticipation of COP21 in Paris, which "has been hailed by the European commission as an "exemplary" step towards EU accession, even though official figures show that it involves a 15% increase in the country's emissions by 2030"[77], considering the UNFCC report on Serbia which states that emissions have already fallen by a quarter since 1990, mainly due to industrial collapse.

Sustainable Energy Policy goals:

- **Introduce improved fossil fuel technologies with a reduced environmental and social impact (*"clean-up" fossil fuel technologies*);**
- **Enable deployment of renewable technologies on a wider scale *(change the patterns of energy use)*;**
- **Introduce energy efficiency measures in the fields of energy conservation, distribution and consumption.**

What lies ahead for EU candidate countries when it comes to environmental issues? They will face the challenging process of aligning all relevant legislation with the *acquis communautaire*, which will entail numerous regulatory and administrative changes. The EU environmental policy is very demanding for candidate countries, due to considerable differences in previous standards, legislative and administrative systems and state of the art environmental technology. One particular challenge is the adoption and implementation of two directives related to limiting emissions from large combustion plants: *Directive 2001/80/EC* on the limitation of emissions of certain pollutants into the air from large (existing) combustion plants (Large Combustion Plants Directive), with a general implementation deadline of December 31st, 2017; and *Directive 2010/75/EU* on industrial emissions in new power plants (integrated pollution prevention and control), with a general implementation deadline of January 1st, 2018 (i.e. *applicable to new plants as of 2018 onwards)*.

[75] HFO stands for heavy fuel oil; the maximum sulfur content of certain fuel categories (HFO-S and HFO-T) in Serbia are above 1% by mass, which constitutes a breach of the Directive. Serbia has addressed one of the shortcomings related to implementation of this Directive by banning HFO-T, while other breaches, i.e. those related to the definition of fuels, HFO-S as well as sampling and analysis, still persist.

[76] Nature protection and wind farm development in Serbia, United Nations Development Programme (UNDP), Belgrade, Serbia, 2013.

[77] "European commission hails 'fiddled' Serbian climate pledge", The Guardian, 11 June 2015, http://www.theguardian.com/environment/2015/jun/11/european-commission-hails-fiddled-serbian-climate-pledge

The overall aim of the Large Combustion Plants Directive 2001/80/EC is to reduce emissions of acidifying pollutants, particles, and ozone precursors. However, as we have already discussed, implementing this directive requires investments of a magnitude that candidate countries have difficulties raising, especially with electricity prices often below the real cost of production. The implementation of the Directive implies that many outdated power plants would be shut down, and/or replaced by new facilities. Most of the countries have already taken steps to prepare for the implementation of the Large Combustion Plants and Industrial Emissions Directives, though they have done so while hoping for the deadline to be extended – given the Ministerial Council's Decision of October 2013 to "activate the flexibility options inherent in the original Directive" to show that "the Energy Community is capable of adapting its legal framework to the reality, without giving up the thrust for change."[78]

In the meantime, Serbia has adopted the Decree on the Emission Limit Values of Air Pollutants, aligned with the elements of the Large Combustion Plants Directive; and is currently preparing amendments to this Decree, with the aim of completely transposing the relevant provisions of the Large Combustion Plants Directive into national legislation. This Decree contains detailed technical requirements for large combustion plants, including emission limitation values and monitoring standards. Furthermore, Serbia has announced the adoption and implementation of a National Emission Reduction Plan, under the terms of the Large Combustion Plants Directive, following adoption of the amendments to the Decree on the Emission Limit Values of Air Pollutants. All those actions are being taken to ensure that the Directive's provisions are implemented by the deadline set by the Treaty, which is December 31st, 2017. However, much like the situation in Serbia with regard to renewable energy legislation and its compliance status with the *acquis,* there is a noteworthy discrepancy between action taken to draft and adopt all necessary harmonized legislation, and its implementation in real terms. Serbia has nine plants operated by EPS that fall under the scope of the Large Combustion Plants Directive, with a total installed capacity of 4,679 MW, which require either modernizing or replacing by new capacities.

6.4. Status of compliance

As stated previously, EPS has already instigated investments in environmental protection with the support of international funds[79], while it is estimated that an additional €1.2 billion of investment in EPS would be needed for the filtering systems, transportation of ash and dust, and water purification systems, in accordance with the Large Combustion Plant Directive. The implications of implementing these Directives (*2001/80/EC and 2010/75/EU)* were reflected in the scenarios of the draft Energy Development Strategy of Serbia until 2025, with projections until 2030 (the adoption of which is still pending). In both scenarios, business-as-usual vs. energy efficient, the total new capacities to be built, total capacities to be modernized and total capacities to be decommissioned, are estimated for the period between 2018 and 2024, as a consequence of implementing the two applicable directives.

The new draft Energy Development Strategy continues to rely predominantly on electricity production at TPPs. As such, revitalization and modernization of existing TPPs (above 50 MW of installed power) in the Serbian power system are driven by the need to implement the Large Combustion Plants Directive. The investment needed for the modernization of thermal power units (each) above 300 MW, which are critical for the operation of the power system, as well as the country's energy security (namely TENT A3-A6, TENT B1-B2 and Kostolac B1-B2, with total installed power of 3,160 MW and average annual production of around 19,000 GWh) equals €634.5 million and is the number one investment priority in this field.

[78] Energy Community Implementation Report, 2014

[79] Japan International Cooperation Agency (JICA) invested through Loan Agreement with EPS €250 million into the flue gas desulphurization (FGD) plant at TPP "Nikola Tesla A", and this represents to date the largest investment in this field in Serbia.

Thermal power units with a rated power below 300 MW (TENT A1-A2, Kostolac A1-A2, Morava, Kolubara, Panonske elektrane) are outdated units, with an average age of 45 years and average energy efficiency below 30%. Successive decommissioning of these units is envisioned to occur during the 2018–2024 period. The total average electricity production from units earmarked for shut down equates to around 6,000 GWh, which implies the need for new electricity generating capacities with higher efficiency (typically over 40%), in order to ensure the stable supply of electricity to end users without having to depend on electricity imports.

The draft strategy document included the development of different scenarios related to the further development of the power system of Serbia, including new electricity generation capacities to replace the old ones (Table 8). As indicated in this document, the main criterion for the selection of projects was ensuring the security of supply with the lowest production costs and minimal impact on the environment and society, as well as enhanced local economic development resulting from electricity generation.

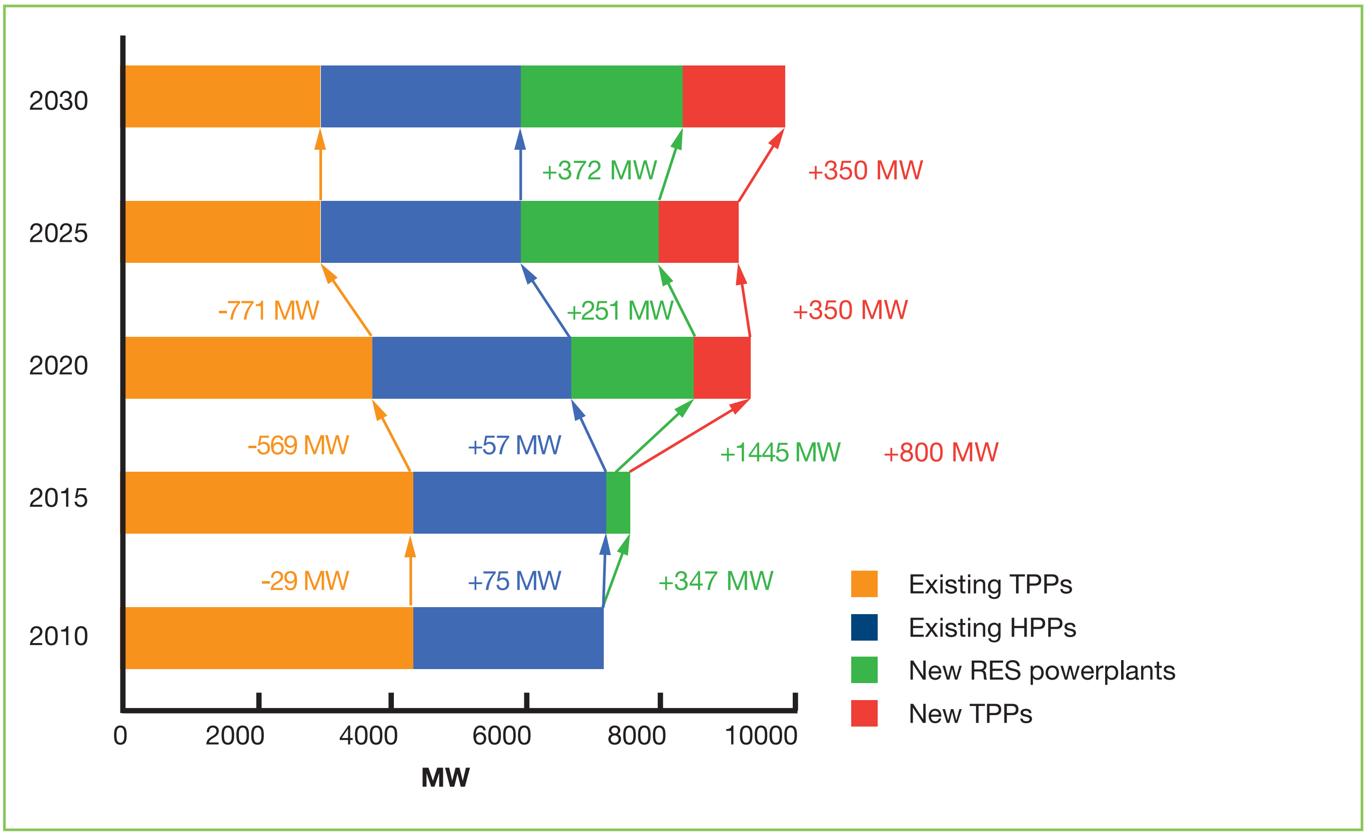
Table 8: New electricity generation projects identified in the draft Energy Development Strategy of Serbia until 2025, with projections until 2030

Project name	Installed power	Construction period	Required investment
TPP TENT B3	750 MW	4-6 years	€1.6 billion
TPP Kolubara B	2x375 MW	6 years	€1.5 billion
TPP Kostolac B3	350 MW	4 years	€450 million
TPP Novi Kovin	2x350 MW	6 years	€1.33 billion
TPP Stavalj (incl. coal mine)	300 MW	5 years	€750 million
CHP Novi Sad	340 MW	3 years	€400 million
Gas-fired CHP (Pancevo, Bg, Nis)	860 MW	4 years	€1.5 billion
HPPs Velika Morava	148 MW	3-7 years*	€360 million
HPPs Ibar	117 MW	2-7 years*	€300 million
HPPs Middle Drina	321 MW	5-9 years*	€819 million
RHPP Bistrica	4x170 MW	5 years	€560 million
RHPP Djerdap 3	2x300 MW	5 years	€400 million
Mini HPPs	387 MW	6 years	€500 million

* phased approach

The draft strategy document also recognizes the need to utilize renewable energy sources and provides a graph (Figure 8) showing overall electricity generation capacity during the 2010-2030 period for the base scenario (without energy efficiency measures). This graph illustrates an increase in generating capacity from different sources, with additional capacity from RES (347 MW by 2015 and an additional 1,445 MW by 2020) and new TPPs (800 MW by 2020) on one side and planned decommissioned thermal power capacity on the other side. The current level of utilization of renewable energy and the lack of investments in the power sector generally, due to the low electricity price, result in the fact that the reality is lagging behind plans. Thus, the draft Strategy should be updated accordingly prior to its adoption.

Figure 8: Electricity generation capacity during the 2010-2030 period (taken from the draft Energy Development Strategy of Serbia until 2025 with projections until 2030)



The penetration of new generation capacity from intermittent sources (i.e. variable electricity production from wind and solar PV) requires increased flexibility of the power system, including balancing capacities, where reversible hydro power units play a dominant role (e.g. RHPP Bistrica, RHPP Djerdap 3). It is envisioned that one new RHPP will become operational by around the year 2020, while the requirement for the other RHPP would be defined in accordance with regional developments (e.g. RES utilization levels and construction of new nuclear power plants in the region etc.).

At this point it is unclear what the consequences of a country failing to implement the Large Combustion Plants Directive within the set deadline would be. Most countries that are dependent on coal are struggling to reach required implementation levels in this respect. The reality in Serbia, however, is characterized by an electricity price that doesn't allow investment in the modernization of existing TPPs, nor the construction of new ones. At the time of writing this policy paper (October 2015), construction had not started on a single new generation capacity, nor had the necessary permits been obtained. If we look at the time required to construct a power plant (see table 8), it is highly unlikely that any new generation capacity (except small HPPs) will be operational by 2020. The new Energy Strategy needs to address this challenge as soon as possible.

Chapter 7

WAY FORWARD: KEY POLICY THEMES AND RECOMMENDATIONS

Every policy paper centered on securing a sustainable energy future is based on three key themes: introducing improved fossil fuel technologies with lower environmental and social impact (*"cleaning-up" fossil fuel technologies);* utilizing renewable technologies on a wider scale (*changing the patterns of energy use*); and introducing energy efficiency measures in the fields of energy conservation, distribution and consumption. Furthermore, a credible energy policy needs to consider the adverse impact of energy production and consumption on the environment, climate and human health – commonly expressed as *externalities* associated with electricity production technologies.

Our decisions about climate and renewable energy policy are, above all, our political and ethical judgments about what we can do for our planet and the generations to come.

The starting point… is the status quo

Serbia's NREAP developed indicative paths for the share of energy from renewable sources for each sector individually – electricity, heating/cooling, and transportation - based on data related to expected energy consumption in each sector, and the projects planned to be implemented/ constructed during that period. All of these individual sector-based targets are supposed to enable the meeting of the cumulative target of 27% of gross final energy consumption in 2020. Serbia's NREAP was prepared on the basis of estimates of energy generation from renewable energy sources, which depends on a number of variable factors, such as the country's economic development forecasts, development of the energy market, the relationship between GDP and energy intensity, etc. However, no statistics related to renewable energy are used for scenario modeling, except for hydro potential and wood biomass for heating purposes only.

A new assessment of renewable energy sources' potential should address a range of barriers that have slowed down and/or prevented their utilization: from infrastructure constraints, regulatory risks, land and permitting constraints and the ease of collecting a primary energy source, to environmental constraints.

The assessment of the technical and economic potential of RES should also address a range of barriers that have prevented the utilization of RES to the expected extent: from infrastructure constraints, regulatory risks, land and permitting constraints, ease of collecting primary energy source with respect to distances and access to infrastructure, environmental constraints, and many more. A new assessment of renewable energy sources potential should provide a realistic picture of the exploitable opportunities in this sector – taking into account both the technical and economic potential of these energy sources. This is the very first step in creating a sustainable energy policy and respective action plans aimed at securing its implementation. Today, however, a comparison of the results achieved with the targets planned for 2020 indicates a considerable gap between expectations and the reality, preventing the country for meeting its mandatory 2020 target. All renewable energy sectors underperformed (except small hydro), especially wind power, which was expected to provide half of the required overall new capacity from RES (planned 500 MW, as opposed to 500 kW connected to the grid); and biomass, which has been presented in all strategic documents as the most promising renewable energy source in both the electricity and heating sectors.

What went wrong with the RES assessment?

Serbia has significant RES potential, most of which is unexploited, with the exception of hydro potential and wood used for heating. While wood has always served as a fuel for conventional heating technologies, advanced biomass utilization technologies go a few steps beyond that. The potential lies in the combustion of biomass for combined heat and power production, as well as in the substitution of coal, gas and heavy oil – currently used in district heating utilities for heat production – with biomass.

We have seen a disappointing level of biomass utilization for electricity production. The main field of application of this energy source is for heating purposes, but it can also contribute modestly to electricity production in smaller capacity biomass-fired cogeneration power plants (up to 1 MW each) – as envisioned in related regulation and the NREAP. However, the 100 MW of the predicted contribution of electricity production from biomass power plants until 2020 in the overall RES target for Serbia is *well beyond reach* – even if the new increased tariff for electricity production from biomass were to be enacted, based on recent calculations from the industry association. Utilization of agricultural biomass is still currently undeveloped and most of the biomass remains in fields. Wood biomass is used inefficiently as firewood or is processed into pellets and wood chips, and exported to other markets. Financing products are available for biomass projects, but the main obstacle remains securing an adequate and continuous supply of biomass for the duration of the operating period. A long-term supply contract, typically with a duration of 10-12 years and concluded with the state-owned forest utility enterprize, is today impossible to obtain – this poses a major risk for investors to continue with their projects and reach the completion phase. On the other hand, long-term supply contracts with private forest owners are possible, but only in theory, as there are numerous owners of small forests and no overarching organization connecting them. Furthermore, the quantities declared as technical potential are often unrealistic, since their logistics are often too expensive to be economically viable – usually this issue relates to inadequate forest infrastructure and harvesting machinery. The increased production of pellets in Serbia, which mostly end up being exported, has led to competition between pellet producers and CHP developers for firewood. A precondition for the widespread use of pellets for household heating in Serbia (as opposed to their export) certainly remains an increase in retail electricity price – to make pellets the source of a competitive energy price in the long run.

Government should intensify activities that would enable massive deployment of biomass projects in the future – from changes in the feed-in tariffs to make project more attractive to investors, to the activities aimed to develop a sustainable biomass supply chain and bioenergy market in Serbia.

Even though use of biomass is not significant or notable, it is nevertheless important for the government to intensify activities that would enable its mass deployment in the future – from changes in the feed-in tariffs to make the project more attractive to investors, to activities aimed at developing a sustainable biomass supply chain and bioenergy market in Serbia.

For the wind power and solar PV, the potential is determined by the technical capacity of the grid and currently available system reserves. As such, capacity is limited by the cap, allowing for the slow and gradual implementation of energy policy and avoiding excessive spending. But what is the true limit of the system? And shouldn't policy instruments impose actions to improve the status quo and enable positive changes, rather than merely identifying constraints and limitations? Numerous studies have dealt with the assessment of large-scale wind power integration into the system in Serbia, as well as in the region. Most have sought to determine the optimal size and timing for the construction of new generation capacities (focusing on intermittent sources), as well as reinforcement of the transmission grid and interconnection capacities between countries over a certain period of time (typically 10-15 years).

Deployment of renewable energy sources would bring Serbia sizeable benefits from attracting investments and mitigating environmental concerns.

Increasing the share of RES in the region's energy mix has been set as a priority – even though policy and regulatory frameworks designed to support the deployment of RES are at an early stage in most of the region's countries. The current low level of wind power integration in the region is associated with the obstacles that TSOs have to overcome due to the very nature of power output from wind farms – un-dispatchable and variable production, with uncertainty in wind forecasting. TSOs can easily integrate small variable inputs into the existing grid. However, capacity redundancy (with flexible generation) and eventually storage, and some grid extension, may prove necessary in order to balance larger electricity production from variable sources. The first assessment of wind potential, undertaken by Serbia's Ministry of Mining and Energy (before a more detailed wind integration study was conducted), showed the country's total estimated wind power capacity to be connected to the system is 1,300 MW - approximately 15% of the nation's total capacity. Later, the wind integration study for Serbia, adopted in April 2011, provided findings that the network limitation in terms of transmission capacity is actually 2,000 MW of coincident wind power in-feed. This figure involved additional grid reinforcements and extensions in the 110 kV transmission grid. In the next step, the study analyzed the system reserve with respect to wind power integration, taking into account ramping capabilities of existing power plants in operation. Under these circumstances, the maximum wind power capacity that could be integrated into the Serbian power system amounted to a minimum 900 MW (i.e. 1,000 MW of installed wind capacity with a utilization factor of 0.90). However, the final conclusion was a wind power capacity that was capped at half of what was conservatively assessed as the technical potential of the grid (without further investment in grid reinforcement) – which is 500 MW. Thus, if we want to see large-scale wind power in operation in Serbia, it is necessary to carefully consider putting a cap on technology, as such a measure can potentially kill a market before it even starts developing.

Further deployment of large-scale RES will be conditioned by investment in grid infrastructure, particularly interconnection lines to enhance cross border trade of green energy; as well as investment in new flexible electricity generation (e.g. gas fired power plants or pump storage HPPs).

Solar photovoltaics used for electricity generation are limited to small projects with a 10 MW quota for the whole country, for both rooftop PV and PV on the ground in aggregate. Their capacity integration limits are also determined by grid constraints, like wind power integration - it is not yet clear how the total estimated grid capacity for intermittent power generation is methodologically divided between those two technologies. However, solar PV technology is expected to have a major impact on the share of RES in the future generation mix, as the price of technology decreases and the utilization of solar PV systems increases, leading to a more mature market. This would, in turn, reduce incentives for solar technology and costs would converge toward those of the least-expensive systems, while the cost gap with other newly-built generating technologies would ultimately vanish. Accordingly, a cap on solar technologies should be reconsidered carefully.

Solar technologies will have a major impact on RES share in the future renewable generation mix, as the price of technology decreases.
Accordingly, both feed-in tariff and cap on solar technology should be reconsidered carefully.

Cleaning-up fossil fuel technologies: some costs are better than others

Calculations of the cost of producing electricity in Serbia do not take into account the serious and extremely dangerous costs resulting from burning, excavating, transportation and displacement, as well as water, air and land pollution, particularly from low-quality lignite-burnt power plants. The other increasingly important costs to consider are those of CO_2 emissions into the atmosphere, incurred due to the environmental improvements of old TPPs connected directly to the implementation of the Large Combustion Plants Directive. Compliance with this Directive implies investment in the installation of desulphurization filters, filters for dust particles and changing combustion parameters to reduce nitrogen oxide emissions. In order to fully implement the Large Combustion Plant Directive and align with EU standards, EPS estimates that investments of €1.2 billion will be needed for filtering systems, transportation of ash and dust, water purification systems and similar. All of the aforementioned will have a significant impact on the price of electricity, as well as the country's budget in the years to come, regardless of whether Serbia chooses to restructure its TPPs or build new ones, because the failure to implement this in time would likely have even greater consequences for the country's budget, due to CO_2 emission reduction targets.

Successive shut down of outdated thermal power units (of the rated power below 300 MW) is foreseen for the period 2018 – 2024. Modernization of larger thermal units (of the rated power above 300 MW) requires investment of €634.5 million.

It is estimated that Serbia would need to reconstruct or completely replace about 4,000 MW of currently installed capacities for electricity production, and almost the entire central heating infrastructure. In some cases, for extremely outdated power plants, this revitalization process will prove simply too expensive and they will have to be decommissioned completely and replaced by new ones – this relates to outdated and inefficient units with a rated power below 300 MW (TENT A1-A2, Kostolac A1-A2, Morava, Kolubara, Panonske elektrane). The total average electricity production from units earmarked for closure amounts to around 6,000 GWh, which implies the need for new electricity generating capacities of the higher efficiency (typically over 40%), in order to ensure a stable supply of electricity to end users without depending on electricity imports. On the other hand, investments in the modernization of thermal power units (each) above 300 MW, with aggregate installed power of 3,160 MW (namely TENT A3-A6, TENT B1-B2 and Kostolac B1-B2) have been identified as a strategic priority. A total of €634.5 million is required for their modernization.

How to attract investments in renewable energy technologies?

Serbia enacted its NREAP in order to comply with EU Directive 2009/28/EC on renewable energy, thereby contributing to the harmonizing of the national energy policy with that of the EU, ultimately aimed at helping Serbia fulfill its international obligations. Still, it is equally important to recognize that a high level of utilization of renewable energy sources (by building large-scale plants and/or scaling up smaller projects) would yield sizeable benefits for Serbia due to the attracting of investments in the sector and boosting the local economy, as well as in mitigating environmental concerns.

Policy instruments used to foster low-carbon investments and promote renewable energy should reflect particularities and cost structure of different power generating technologies.

The level of electricity prices should not be kept at an unsustainbly low level. It should reflect economic costs in order to support new investments in generation capacity or grid infrastructure. Otherwise the result is a long-standing lack of investment and a low level of energy efficiency and competitiveness in the energy sector, which we have witnessed during the last decade and more.

Moreover, low-carbon, renewable energy technologies generally remain more expensive and more CAPEX intensive than conventional technologies. Certain renewable energy technologies are actually less resources-intensive and may be even cheaper than conventional technology – e.g. wind is today marginally competitive with some CCGTs. Thus, it is important to recognize that financing renewable energy generating technologies in a competitive framework requires high returns on capital invested and an adequate risk-return ratio. Therefore, policy options used by governments to foster low-carbon investments and promote renewable energy should reflect the particularities and cost structure of different generating technologies. It is essential to develop a LCOE model based on the country's future energy decisions, which should be translated into respective regulation to allow fair competition among different power generating technologies. The measures taken to increase the level of RES utilization still include support schemes like feed-in tariffs, which in turn require either sound budgets or the corresponding absorption capacity of customers – both of which represent a challenge for government.

Fundamentally, the value of low-carbon investment projects is exposed to regulatory, construction, market and operational risks. Extra effort should be exerted to make risk allocation more transparent to all stakeholders. Investors need a clear, credible and consistent signal from policymakers, which can lower utilization risks and bring confidence to investors. "By contrast," Mrs. Van der Hoeven said, "where there is a record of policy incoherence, confusing signals or stop-and-go policy cycles, investors end up paying more for their investment, consumers pays more for their energy, and some projects that are needed simply will not go ahead".[80] Policy measures used by governments to foster renewable energy investments usually involve a transfer of risks from investors to end-users. One group within the Energy Community Secretariat recommends the introduction of risk mitigation schemes for investments, in an effort to increase investment flows, such as an Energy Community Risk Enhancement Facility. This facility is aimed at providing investment guarantees or insurance products, and assisting in the harmonization of permitting procedures and criteria in order to enhance transparency and shorten the duration of such procedures. It is therefore important for policymakers to recognize the significance of risk mitigation measures and include them in any policy framework.

Make risk allocation more transparent to all stakeholders.

Energy Policy To-do List

Even the most aggressive energy policy cannot help Serbia reach its mandatory target(s) in five years from today. But the path towards reducing the gap between targeted and actualized levels of RES utilization leads in two parallel directions which are equally important to pursue. One direction is fast implementation of large wind power projects – there is a pipeline of wind projects in advanced development phase in excess of the currently imposed cap of 500 MW. This proposal is justified by the fact that wind power is the cheapest renewable source of electricity with regard to the levelized cost of electricity production, but it is also a technology with the lowest marginal costs of production with a positive (downward) effect in the long run on the wholesale electricity price (due to the merit-order effect). Furthermore, alternatives to fossil fuels must be found. Replacements for the capacity from TPPs to be decommissioned in the near future could be wind energy and solar PV, but the latter requires an enormous land surface area, making wind the only renewable energy source that could be scaled up quickly enough. The further deployment of large-scale intermittent energy requires investment in flexible dispatchable electricity generation, which includes, but is not limited to: gas-fired power plants, pump-storage hydro power plants, enhanced grid infrastructure (to enable their integration into the grid), and demand-side management to balance fluctuating electricity production.

On supply side, alternatives to fossil fuels must be found. But renewable energy – *except for wind* – cannot be scaled up fast enough to replace fossil fuels in the time frame needed.

The second, equally important direction heads towards distributed electricity generation (i.e., the construction of numerous small generating units close to the point of consumption in order to avoid big investments in grid infrastructure). Thus, alongside large-scale wind power generation, solar PV and all other sources of distributed generation (small hydro, biomass, biogas, waste, and geothermal) should have a dominant role in Serbia's renewable energy

[80] *Mrs Van der Hoeven, Executive Director of IEA, 2012*

mix. Distributed generation implies lower electricity losses, improved voltage profile, reduced impact on the environment and easier administrative and financing procedures of project development and construction – compared to large centralized units. Both installations of solar PV (rooftop and ground) are expected to have a dominant role as a result of their ease of development, construction, and operation, all of which reduce technology costs and lower the available financing options, and subsequently the potential risk to investors. These projects can be easily scaled up to make a significant combined effect. Further deployment of solar PV naturally implies a cap increase. Both issues of feed-in tariffs and caps on solar technology must be addressed accordingly, as the costs of technology decrease over time.

Small scale solar PV plants can be easily scaled up to make significant combined effect – due to ease of construction, decreasing technology costs, low risk for investors and available financing options.

With an increasing share of distributed renewable generation in the future, grid integration requirements will become more demanding as the load flows run in both directions, instead of the traditional unipolar direction (*from* centralized generation units *to* consumption). This challenge can be addressed through the introduction of smart grids.

Smart grids play important role in the transition to a sustainable energy future in many ways: facilitating integration of high shares of variable renewable energy; supporting distributed decentralized generation; creating new business models through enhanced information flows, consumer engagement in demand-side management and improved system control.

Smart grids incorporate information and communications technologies into the generation, transmission and distribution of electricity, as well as consumption, and can be implemented at every level of the power system. Electricity grids today involve smart functionality features, though they are used mostly to balance supply and demand in the system. One of the key approaches to managing power systems experiencing a rapidly increasing share of renewable energy is managing the grid through the use of smart grids. Smart grids are used to adapt consumption to fluctuations of electricity production from renewable sources. Variable and volatile electricity production from wind and solar, with hydro energy dependent on the availability of the primary energy source, requires system flexibility. System flexibility can be secured by means of dispatchable generation using grid infrastructure to connect different markets, by demand side integration, and through the use of storage capacities to balance fluctuating electricity production. Thus, the need for storage capacity is expected to increase with the further integration of intermittent energy sources into the system. Storage capacity is dominated by pump storage hydro power plants on the supply side, where investments decisions are often driven by the deferral of investments into transmission and distribution infrastructure, but business cases for storage capacities are only viable option under market and regulatory conditions where storage power capacity is allowed to participate in ancillary service markets and receive adequate remuneration.

Smart grid technologies can attract private investment and make better use of existing infrastructure.

On the other hand, power storage technologies on the demand side (in the end-user domain) have numerous manageable applications – from batteries for electric cars to all household appliances for which consumption management can be applied. Opportunities should be exploited to efficiently balance fluctuating electricity production in the system using demand-side management, instead of constructing large storage capacity power units. The key concept of this bottom-up approach where consumption has to adjust to generation is consumption management (or demand-side management), aimed at producing desired changes in the

As the share of renewable energy increases, smart grid technologies, in combination with appropriate supporting policies, become crucial in the creation of grid infrastructure to support a sustainable energy future.

power utility's load shape. The idea behind this is to manage loads in such a way as to engage electricity consumers (devices) during periods of cheap electricity (e.g. when there is maximum output from wind and solar power plants), moving the load along the timeline, so that consumption ultimately starts monitoring, and adjusting to, production. The role of smart grids is to enable this consumer engagement and demand-side management.

Therefore the fulfillment of strategic objectives to secure a country's energy independence, enhance energy security and supply reliability, increase renewable energy deployment levels to reach 2020 targets, and develop new technologies, can be improved and accelerated through the widespread use of renewable energy for distributed generation. However, the successful implementation of smart grid technologies requires an adequate policy and regulatory framework to address non-technical issues, primarily with regard to the distribution of costs and benefits among suppliers, consumers and grid operators.

The transition from fossil fuels to renewable energy sources will not be possible if we continue to use energy in the way we do today and if we maintain our growth-based consumer economy. Energy intensity in Serbia – a measure that shows the amount of energy used to produce one unit of GDP - is among the highest in Europe: it is *five times higher* than the average energy intensity in EU member states, proving the inefficiency of our energy.

Renewable energy technologies, such as solar PV, micro turbines, and fuel cells, can be used to redesign buildings and help communities live more efficiently. These policy measures on the demand side are aimed at changing the patterns of energy usage. The policy should promote zero-energy and zero-carbon buildings, thereby reducing the carbon intensity of new structures radically. These policies must be supported by adequate policy measures and regulation (including net metering) and incentives to build green, in order to ensure payback on energy efficiency improvements.

Energy efficiency and energy-saving measures have a major influence on the utilization levels of renewable energy sources because they represent an important input in calculating gross final energy consumption. Total energy savings in the 2010-2020 period are expected to reach 10% - which would mean a consequently lower level of RES deployment, but also implies a positive impact on the expected increase in the retail price of electricity. However, even if we take into account the effect of energy efficiency and energy saving measures, and correct the numbers accordingly, the national target remains way beyond reach. Energy efficiency measures must be taken in conjunction with the renewable energy policy, as energy efficiency is the starting point providing the basis for the building of renewable energy capacities.

Energy policy to-do list:

- **Collecting renewable energy-related statistics, redefining the potential of renewable energy sources and updating the NREAP;**
- **Updating long-term targets for RES utilization and setting GHG emissions reduction targets;**
- **Completing the lagging regulatory framework (in particular a bankable PPA);**
- **Developing streamlined procedures for issuing permits and enabling grid connection;**
- **Implementing remuneration schemes that reflect the true value and costs of technologies, as well as reconsidering the cap on technologies (consequently some FIT would increase, while some would decrease);**
- **Developing a LCOE model for the country to ensure a fair comparison between different power generating technologies;**
- **Implementing energy efficiency measures in conjunction with the renewable energy policy – energy efficiency is the starting point providing the basis for the building of renewable energy capacities.**

The authors of this policy paper believe that the issue of renewable energy utilization associated with climate change mitigation and the promotion of green economy is too important to be left solely to economists, scientists and politicians. It is about *values*, not science. Energy-related environmental issues in Serbia and the wider region are still taken very lightly. To the average citizen in countries facing huge economic challenges, high levels of unemployment, and bleak development prospects, these issues are not seen as being relevant to everyday life. Serious environmental issues still take a back seat when compared to economic issues, because they fall lower on the basic pyramid of needs. However, it is of utmost importance not only to raise public awareness, but also public advocacy of renewable energy. It needs to be made clear that, even if it results in higher costs today, these investments pay off multifold in the future, financially and in other ways. Issues of renewable energy require consensus among the widest group of stakeholders, because our decisions about climate and renewable energy policy are, above all, our ethical judgments about what we can do for our planet and future generations. Ignorance is not acceptable. We must be forward-thinking or we will deprive our children of the resources required to ensure their economic and national security.

Tables and Figures

Acronyms and Abbreviations

2DS	Two Degrees scenario
APEE	Action Plan for Energy Efficiency
AMI	Advanced Metering Infrastructure
CAPEX	Capital Expenditures
CAPI	Computer Assisted Personal Interviewing
CCGT	Combined cycle gas turbine
CCS	Carbon capture and storage
CEKOR	Center for Ecology and Sustainable Development
CHP	Combined heat and power
CIS	Commonwealth of Independent States
CLRTAP	Convention on Long-Range Transboundary Air Pollution
CO2	Carbon dioxide
COP	Conference of Parties
CSP	Concentrated solar power
CSR	Corporate-social responsibility
DA	Distributed Automation
DR	Demand Response
DSO	Distribution System Operator
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EEA	European Environment Agency
EMEP	European Monitoring and Evaluation Program
EMinS	European Movement in Serbia
EMS	Elektromreze Srbije (in English: Serbian Transmission System Operator)
ENTSO-E	European Network of Transmission System Operators for Electricity
EPBT	Energy pay-back time
EPS	Elektroprivreda Srbije (in English: Electric Power Industry of Serbia)
ETS	Emission Trading System
EU	European Union
EURACOAL	European Association for Coal and Lignite
EWEA	European Wind Energy Association
ExternE	External Costs of Energy
FGD	Flue gas desulphurization
FIT	Feed-in tariff
FYR Macedonia	Former Yugoslav Republic of Macedonia
GDP	Gross Domestic Product
GHG	Greenhouse gases
HEAL	Health and Environment Alliance

HFO	Heavy Fuel Oil
HPP	Hydro power plant
ICJ	International Court of Justice
IEA	International Energy Agency
IFC	International Finance Corporation
IGCC	Integrated coal-gasification combined cycle
INDC	Intended Nationally Determined Contribution
IPP	Independent Power Producer
IRENA	International Renewable Energy Agency
IRR	Internal Rate of Return
JICA	Japan International Cooperation Agency
kV	Kilo Volt
kW	Kilo Watt
kWh	Kilo Watt hour
LCOE	Levelized Cost of Electricity
LWR	Light water reactor
MW	Mega Watt
MDM	Meter Data Management
NALED	National Alliance for Local Economic Development
NGO	Non-governmental organization
NREAP	National Renewable Energy Action Plan
OHL	Overhead power line
OPEC	Organization of the Petroleum Exporting Countries
OPEX	Operational expenditure
OPIC	U.S. Overseas Private Investment Corporation
O&M	Operation and maintenance
PBFC	Pressurized fluidized bed combustion
PECI	Project of Energy Community Interest
PPA	Power Purchase Agreement
PPP	Public-Private Partnership
PPP	Privileged Power Producer
P-PPP	Preliminary Privileged Power Producer
PPM	Parts per million
PV	Photovoltaic
PWR	Pressurized water reactor
PYLL	Potential Years of Life Lost
RenExpo	Renewable Energy Exhibition
RES	Renewable energy sources
RHPP	Reversible Hydro Power Plant
ROR	Rate of Return
RoS	Republic of Serbia
R&D	Research and development
SEWEA	Serbian Wind Energy Association

SHPP	Small hydro power plant
STE	Solar thermal energy
TENT	Thermal Power Plant "Nikola Tesla"
TOE	Tons of oil equivalent
TPP	Thermal Power Plant
TS	Transformer station
TSO	Transmission System Operator
TW	Terra Watt
TWh	Terra Watt hour
UK	United Kingdom
UNDP	United Nations Development Program
UNFCCC	UN Framework Convention on Climate Change
USA	United States of America
VAT	Value Added Tax
YOLL	Years of Life Lost

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Note about the Authors

Maja Turković has specialized in the field of renewables over the course of a professional career lasting nearly 20 years. She began her career at the Electrical Engineering Institute "Nikola Tesla", Belgrade, as Research Associate, and later held the position of Assistant Minister for the Electrical Energy Sector at the Ministry of Mining and Energy in the Government of the Republic of Serbia. For the last seven years she has been engaged in the development of renewable energy projects for wind power, biomass and solar PV technology. She worked as Managing Partner at company Energowind and Managing Director at the Plandište Wind Park. She is also a member of the Serbian Chamber of Commerce's Expert Team for Renewable Energy Sources and a member of the national CIGRE Committee on Electricity Markets. She is author/co-author of 22 published papers,in the context of conference materials or in scientific magazines. She is a graduate of the University of Belgrade's Faculty of Electrical Engineering, in the Power Systems Department. Maja also holds an MBA from Imperial College London's Tanaka Business School.

Ana Brnabić has an MBA from the University of Hull, England, and more than 10 years' experience working in the corporate sector and on donor funded projects in the field of local economic development and national competitiveness. She currently holds the position of Director of Continental Wind Serbia. Moreover, she is also an authorized representative of SEWEA. She received the 2013 "Most European" award in recognition of SEWEA activities and the "Business Woman of the Year" award in the category of Corporate Social Responsibility for her engagement with the PEXIM Foundation. Ana was actively involved in the establishment of the National Alliance for Local Economic Development (NALED) and has since been working on strengthening the capacity of NALED, as the most effective group for representing the interests of the business sector, local governments and civil society in Serbia. She is current Deputy Chairperson of NALED's Management Board.

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