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Energy Security and Clean Energy Development in the EU Neighborhood

The Case of Bosnia and Herzegovina

A Master's Thesis submitted for the degree of
"Master of Science"

supervised by
em. Univ.-Prof. Dr.-Ing. Günther Brauner

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Vienna, June 2016

Affidavit

I, LAMIJA DŽIGAL, hereby declare

1. that I am the sole author of the present Master´s Thesis, “ENERGY SECURITY AND CLEAN ENERGY DEVELOPMENT IN THE EU NEIGHBORHOOD: THE CASE OF BOSNIA AND HERZEGOVINA”, 62 pages, bound, and that I have not used any source or tool other than those referenced or any other illicit aid or tool, and
2. that I have not prior to this date submitted this Master´s Thesis as an examination paper in any form in Austria or abroad.

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Signature

Abstract

This master thesis examines the challenges Bosnia and Herzegovina faces whilst transitioning its energy sector, implementing cleaner technology systems and utilizing its renewable energy potential, all within the wider framework of EU accession.

Extensive research is focused on evaluating the potential outcomes of mitigation measures, cleaner energy solutions and processes fostering renewable energy utilization projects. In order to understand the impact of these, Bosnia and Herzegovina´s energy market intricacies will be contextualized in great detailed.

Special focus is placed on Bosnia and Herzegovina´s international cooperation. Due to its goal of EU accession, Bosnia and Herzegovina must adjust its energy policy in line with that of the EU. This paper will explain why, as a post-war country with a transitioning energy sector, Bosnia and Herzegovina faces plenty of difficulties in doing so.

Afterward, this thesis will give a detailed explanation of barriers to change and mitigation options that will comparatively give indication of the potential future outcomes of various energy generation choices that can be made in the short, medium, and long run.

This is followed with a discussion on possibilities of emerging new renewable energy systems, their potential, and problems that Bosnia and Herzegovina might face in utilizing them. Connections will be made throughout this paper between international obligations, political and administrative problems within the state, use of new technologies, and other mitigation measures.

The paper concludes that steps toward reforming the energy sector that take into account use of renewable energy sources, clean technologies, and mitigation measures make economic, social and political sense for Bosnia and Herzegovina, and can greatly improve the situation in the state on all levels if implemented strategically and in the best interest of the greater population.

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List of Abbreviations

BD ..... Brčko District
BiH ..... Bosnia and Herzegovina
CDM ..... Clean Development Mechanism
DERK ..... State Electricity Regulatory Commission
ECSEE ..... Energy Community of South East Europe
ECT ..... Energy Charter Treaty
EPIA ..... European Photovoltaic Industry Association
EU ..... European Union
FBiH ..... Federation of Bosnia and Herzegovina
FERK ..... Regulatory Commission for Electricity in FBiH
FIPA ..... Foreign Investment Promotion Agency
GHG ..... Greenhouse gasses
HPP ..... Hydro Power Plant
IAP ..... Ionian Adriatic Pipeline
IEA ..... International Energy Agency
LNG ..... Liquid Natural Gas
MoFTER ..... Ministry of Foreign Trade and Economic Relations
NOS BiH ..... The Independent System Operator in Bosnia and Herzegovina
NREAP ..... National Renewable Energy Action Plan
PEEREA ..... Protocol on Energy Efficiency and Related Environmental Aspects
PV ..... Solar photovoltaic
RERS ..... Regulatory Commission for Energy of RS
RES ..... Renewable Energy Sources
RETs ..... Renewable Energy Technologies
RS ..... Republika Srpska
SEE ..... Southeast Europe
SFRY ..... Socialist Federal Republic of Yugoslavia
SHPP ..... Small Hydro Power Plant
SMEs ..... Small- and Medium-sized Enterprises
TANAP ..... Trans Anatolian Natural Gas Pipeline
TAP ..... Trans Adriatic Pipeline
UNECE ..... United Nations Economic Commission for Europe
UNFCCC ..... United Nations Framework Convention on Climate Change

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This master thesis is the biggest and one of the most gratifying pieces of work of my academic career thus far.

For that, I would like to thank my advisor Dr. Günther Brauner for encouraging me to pursue the topic of my dissertation and boosting my confidence throughout the process of writing this challenging piece of work.

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Lastly, I would like to thank my lovely friend Sabina for her support and for driving with me cross-country to conduct my research.

1 Introduction

Over the past few decades, the world has seen an ever-increasing interest in clean energy and the use of renewable energy sources to balance out the use of fossil fuels for energy production. This consciousness was heavily sparked by environmental concerns. States and energy consumers have increasingly been turning to renewable energy sources to satisfy their needs for energy, while at the same time ensuring that the environment is protected and that future development is consistent and sustainable.

Bosnia and Herzegovina (abbreviated in this paper to BiH) has not remained immune to the debate on renewable energy sources. However, unlike its fellow Balkan and Western European counterparts, it has been warming up to this idea at a slower pace. This paper will take the future of renewable energy development in BiH into question, and place it within the wider context of a transitional economy, EU integration, and regional cooperation. Development and reform in line with EU norms could substantially aid BiH in developing an energy system that is best for its consumers and electricity exporters.

This paper will emphasize how the complex political environment and frequent political stalemates hinder reforms that are necessary to foster a profitable and sustainable energy environment. As a UNFCCC non-Annex I country, Bosnia and Herzegovina is not directly obliged to work towards reducing greenhouse gasses, but can nonetheless implement changes that work in its own self-interests – for example, that work in cohesion with its efforts to someday join the EU, that improve the living standards of its population, and to make it a more profitable energy producer and exporter.

In 2005, the share of renewable energy sources in total energy production in EU member states was only 8.5 % (Petrović et al., 2014, 20). By 2020, this share will rise to 20 %, as was vowed to be done in the *Europe 2020* goals. The process of EU accession also requires of BiH to agree with EU energy politics and abide by its Directives.

What will be shown in this paper is that implementing strategic measures that foster positive changes in terms of more efficiency, renewable energy use, and cleaner energy practices would put BiH on a faster track toward reaching EU membership,

complying with international and regional obligations, create sustainable growth and a stronger economy. Progress towards utilizing renewable energy sources and cleaner energy systems does not only offer more energy efficiency, energy independence, reduction of GHG emissions, but also a better quality environment and overall greater competitiveness of the economy.

BiH´s outdated and rigid energy climate is slowly evolving and adjusting to EU standards so it will be interesting to see how this reflects on its ability to use and implement renewable energy technologies and increase efficiency of its current energy system. Since the utilization of new renewable energy sources (such as photovoltaic and wind turbines) are at the beginnings in BiH, I expect this to be an interesting topic to write about. Further, the country as a whole can be used as a case study for other transitioning and developing economies, and neighboring states that find themselves in similar political situations regarding EU membership aspirations and have a similar transitioning economy – and thus face similar difficulties.

Right now, BiH as a post-war state with a transitioning economy and outdated energy system that has the potential to possibly become a positive example to other states who chose to embark on a similar journey in the future. Similarly, BiH is a coal-intensive country in terms of heat and electricity production. In its journey toward embracing and diversifying the types of energy sources it obtains this energy from – use of renewable energy sources provides a good alternative and this can also serve as a good example to other coal-intensive energy countries that are also seeking to diversify, and preserve and clean up their environment.

What will also be questioned in this thesis, is how regional cooperation and development impact renewable energy use and other energy choices, and vice versa. Renewable energy use and regional energy system development is an issue that transcends political and regional boundaries. In other words – envisioning a common future and reaching common goals requires strategic cooperation, planning, and dialogue in the present.

1.1 Literature Review

Energy policy has not always been a matter of national security. In prior decades, narrow views on what constitutes security have been at fault for excluding environmental concerns in regards to debates on international security. As Dabelko

and Dabelko (1995) discuss, this has changed in large due to the impact of the 1970s oil crisis that brought the question of resource scarcity and state security to the fore.

Transference of environment to the realm of so-called high-politics, and "a demilitarization of security thinking" (Graeger, 1996, 111) has brought the issue of energy to the forefront of international cooperation. This is so much so that, sometimes in large part, energy discussions can hardly be uncoupled form political discussion.

The potential impact of this popularized evolving debate arguing that popularity of the issue, caries the cost of polarization and political stalemate, which in turn can stall the development of renewable energy resources. However, Gromet et al. (2013) argue that this should serve as a reason to focus on developing individual conscientiousness of independent renewable energy use.

Claussen (1995, 42) writes that "democracy and the efforts of ordinary citizens to protect their environment are often intertwined." It is this mentality that lead to international cooperation in forms of treaties and international organizations. However, Myers (2002, 8) adds that although this rationale has become standard thinking, some states still have not included environmental goals in their overall long-term goals to a significant degree. In the EU, precisely such concerns about energy security have forced it to modernize its approach to the use of energy and make it a topic through which it communicates with future member states (Petrović et al., 2014).

What is more, these concerns are coupled with anxieties about pollution and the stability of the environment. Numerous environmental catastrophes and discoveries "have led to a state of heightened ecological awareness" (Dabelko and Dableko, 1995, 4). Matthew (1995) contextualizes this idea within the context of environmental politics and argues that "there is no clear path toward an environmentally secure future, but there are many routes likely to lead to conflict, violence and misery" (Matthew, 1995, 22). Locally available renewable energy sources create an avenue to solving the problem of security, while at the same time, lowering GHG emission levels and protecting the Earth (Petrović et al., 2014).

The introduction of various new renewable energy technologies that are accessible to the wider public in recent years, along with the widening political and economic debate on energy security, has popularized the use of renewable energy sources. Trombetta (2009, 600) explains that "appeals to security have emphasized the relevance of

preventative, non-confrontational measures, and the importance of other actors than states in providing security."

For the first time, energy generation (such as from photovoltaic cells) has become possible in virtually all corners of the globe at relatively economically justifiable costs. Pleßmann et al. (2014, 22) assess the strides developed in regards to renewable energy and conclude that significant development worldwide can be achieved at a "decent cost".

The key with renewable energy sources is that they are not perishable, nor can they be depleted – unlike fossil fuels. Moreover, they do not pollute or harm the environment like the combustion of fossil fuel does. This is not the only choice in bettering the energy sector. Measures to increase efficiency and strategies of more rational energy use are also possible pathways of action (Petrović et al., 2014). These can also be coupled with mitigation measures that address excessive pollution.

Another significant aspect investigated in this paper are regional interest – that is, the interest of BiH to join the EU in the future and the cooperation of the same entities through the Energy Community today. Lastly, Pidgeon et al. (2014) discuss that an engagement process for an energy policy requires harmonization of national and local (citizen) interests that would bring together science communication and science policy formation.

This paper will build on this idea and argue that the same awareness needs to be taken a level higher – to the regional (i.e. the EU neighborhood). Delaying this is in hand self-sabotaging, as this paper will show. Thus, common decision-making made today, will provide essential insight into wider policy goals for tomorrow.

For those aspiring to one day become member states of the EU – energy security, efficiency and RES use should take high priority (Softić & Glamočić, 2012). BiH, as the rest of Southeast Europe, face "major security and efficiency issues" (Zibret et al., 2014, 1), which they must address in order to achieve sustainable development. Countries of SEE have the option to "become important players in improving the continent's overall [level of] energy stability" (Zibret et al., 2014, 1).

The concept of energy security encompasses utilization of old and emerging types of energy sources. For Bosnia and Herzegovina, given that it has also previously suffered

from gas shortages due to geopolitical scuffles (i.e. the 2009 gas crisis), ensuring security and efficiency of supply is key. For Bosnia and Herzegovina, a key objective, along with exploring new energy sources, is to set up a long-term plan and strategy for energy use (Pasic, 2011).

What is clear is that states have various natural potentials that need to be tapped into. Renewable energy sources carry great potential in mitigating the adverse effects of climate change, create much needed economic opportunities, and enhance energy security. Significant strides could be made through government support and the provision of economic incentives. The important point is that in the case of Bosnia and Herzegovina, political structures can be important in making the transition to renewables and the political/institutional conditions need attending to before looking to economic solutions.

1.2 Methodology

This thesis was a product of my interest in BiH as a young person from Sarajevo. The question of this thesis is how the current and future applications of renewable energy goals and new technologies in BiH´s complex political, administrative, legal, and economic climate could be realized. Furthermore, the additional factor of how these topics are addressed within the context of EU integration places more attention on approaches taken. This paper provides a way to understand and answer these questions.

Therefore, qualitative research was conducted to gain the best possible understanding of the situation. All available literature such as official reports and academic analyses on the past and current political, environmental, and energy climate of BIH was gathered. To complement the literature, first hand interviews were conducted with people who are directly involved with the topic of this thesis.

All of the interviews were recorded and completed by myself in Bosnian and English. Most interviewees were recruited through direct e-mail/telephone contact (contact details were obtained from official websites and open to the public). All interviewees were informed beforehand of the topic of my research and the type of questions they can expect to be asked in the interview. They all expressed their interest in helping young academics learn more about renewables and clean energy systems in BiH, a new and emerging curiosity in the country.

1.3 Organization of the thesis

This thesis will examine the challenges BiH faces whilst transitioning its energy sector, implementing cleaner technology systems, and utilizing its renewable energy potential. In order to achieve this, research will be divided up into 4 concise chapters (contained in chapters 2, 3, 4, and 5).

In order to understand the difficulties the state faces in its transition, it is necessary to outline the socio-economic and political situation of the energy sector. Therefore, chapter 2 will contextualize BiH´s energy market and focus especially on its electricity sector. The third chapter will explain the international and regional context. The chapter will show that BiH´s commitments and desire to be an EU member state drives its energy policy.

Thus, chapter 4 will focus on the traditional energy system existent in the country in greater detail. This will be accompanied with a discussion of barriers to change and mitigation options that will comparatively give indication of the potential future outcome of various energy generation choices that can be made in the short, medium, and long run.

In light of previous chapters, chapter 5 will discuss potentials of emerging new renewable energy systems, their potential, and problems that BiH might face in utilizing them. Connections will be made throughout this paper between international obligations, political and administrative problems within the state, use of new technologies, and other mitigation measures.

In Chapter 6, the paper will conclude that moves toward reforming the energy sector makes economic, social, and political sense for BiH, and can greatly improve the situation in the state on all levels if implemented strategically, and in the best interest of the greater population. Chapter 6 will end discussing future avenues for research and consideration.

2 Bosnia and Herzegovina´s Energy Market in Context

BiH is a relatively small country in the Balkans with a surface area that encompasses 51,209.2 sq. km and has an estimated population of 3.83 million, with a negative annual population growth of -0.1 % (Mileusnić, 2015). Although having a relatively small population, management of the state and supply of citizens with energy is not without difficulty. The recent war of 1992-95 has left the state with a complex administrative political setup containing multiple governments and layers of government. This is coupled with difficulties of a transitioning economy moving toward privatization.

Being one of the least developed countries in Europe, BiH has vast untapped potential. Looking at the situation optimistically, BiH has the chance to choose and implement the right policies that would utilize this potential while under advisement and support of the international community during its accession process and treaty obligation implementation.

In order to understand the intricate set-up and organization of the energy sector, explanations on the geo-political context are necessary. The lack of development can in large part be attributed to the War of 1992-1995 that significantly slowed down and retracted the development of the energy sector, lagging BiH behind its European counterparts.

Before the declaration of independence of Bosnia and Herzegovina and the eruption of war in 1992, BiH was a part of the Socialist Federal Republic of Yugoslavia (SFRY). The SFRY was constituted by 6 states: BIH, Croatia, Slovenia, Montenegro, Macedonia, and Serbia (additionally consisting of two autonomous provinces Vojvodina and Kosovo); and was centralized by the Communist Party.

The energy sector was mainly developed during the times when BiH was a part of SFR Yugoslavia. Because of its central position within the former socialist republic and its abundant potential in coal and hydropower, BiH´s generation capabilities were developed in mind to supply other parts of Yugoslavia with energy. Accordingly, main hydro and coal power plants that are still in operation today, were built during this time.

Nowadays, they still work and supply the country with electricity, but are not efficient as can be because they do not exploit the benefits of latest technologies that seek to maximize energy production while at the same time, minimizing the negative impacts on the environment. These power plants could benefit from the use of newest clean technologies and mechanisms that can increase their efficiency. Further, BiH is lagging behind in terms of privatization as main government bodies still hold most (if not all) ownership of the main (and only) electricity companies.

On 21st November 1995, the Dayton Peace Accords were signed, which officially ended the war in BiH. The war damaged the State´s energy infrastructure and many investments to date were designated to reverse this damage back to the pre-war status-quo. Nowadays, funds may be allocated toward actual improvements, increasing quality and capacity of generation.

As a consequence of the Dayton Peace Agreement, BiH was left to operate as a sovereign state with a decentralized political and administrative structure with decision-making left in the hands of the Council of Ministers, Brčko District (BD), and the two Entities governments, under the sovereignty of BiH. The two Entities are the Federation of BiH (FBiH) which is further divided into ten cantons and Republika Srpska (RS), which is further divided into municipalities. Brčko District is not an Entity, but a special self-governing administrative unit. Figure 2 shows an administrative map of BiH and the governing areas of each Entity and BD.

Figure 1 BiH in Europe (maps-of-europe.net)

Figure 2 Administrative map of BiH (UNFCCC, 2014)

This post-war administrative Stale-level and multiple Entity-level distinction reflects on the organization and functioning of the underlying relevant regulated sectors. In regards to the energy sector, “energy is in the primary competence of the entities, however certain issues necessary for the functioning of the energy sector on state level have been transferred to the competence of BiH” (Salihović-Whalen, 2014). For instance, the Independent System Operator (NOS BiH) is in joint Entity ownership, and the Ministry of Foreign Trade and Economic Relations (MoFTER) deals with BiH´s energy commitment on the international level. There is the State Electricity Regulatory Commission (DERK) that regulates the electricity sector on the state level.

Nonetheless, within the Entities there are additional (and arguably – unnecessary, as will be discussed in the sections to come) administrative governmental layers. Overall, there are 3 electricity regulators – one at state level (DERK) and one for each Entity (FERK in FBIH and RERS in RS). There are also 3 government-owned “incumbent electricity operators” (Salihović-Whalen, 2014), one in RS (Elektroprivreda RS) and 2 in FBiH (Elektroprivreda BiH and Elektroprivreda HZHB).

Thus, as Salihović-Whalen (2014) points out, even though BiH is “formally defined as a single economic space, the electricity sector is characterized by fragmentation and a complex administrative, legislative and regulatory structure, as practically three parallel structures operate in the territory of BiH.” The consequences of this fragmentation of the energy sector will be highlighlighted throughout this thesis.

The following table 1 lists all relevant actors in the electricity sector on both the national (BiH) level and on the level of the Entities (FBiH and RS).

Table 1 Relevant governing bodies in the energy sector:

BiH Level	- MoFTER BiH - DERK BiH - NOS BiH - Elektroprenos
FBiH Level	- Ministry of Energy, Mining and Industry of FBiH (FMEMI) - FERK - JP Elektroprivreda BiH - JP Elektroprivreda HZHB
RS Level	- Ministry of Industry, Energy and Mining of RS (MIEMRS) - RERS - Elektroprivreda RS

2.1 The Energy Mix

Coal and water are the two types of energy sources that BiH has traditionally used and that which it is abundant with (Softić & Glamočić, 2012; Mileusnić, 2015). Coal is the dominant source of the two. Hard, lignite, and brown coal are "produced from local mines throughout the country and estimated reserves are more than six billion tons" (Pasic, 2011; Mileusnić, 2015).

In 2014, 11,651,362 tons of coal were consumed in the energy sector. The type of coal consumed was mainly brown coal (5,947,498 t or 46 %), which coincidentally produces the most greenhouse gas emissions during combustion than any other type of coal. The second most common type of coal used is lignite coal (5,703,864 t or 43 %), followed in third place by hard coal (11 %) (Agency for Statistics of Bosnia and Herzegovina, 2015e). Figure 3 gives us a visual representation of this ratio.

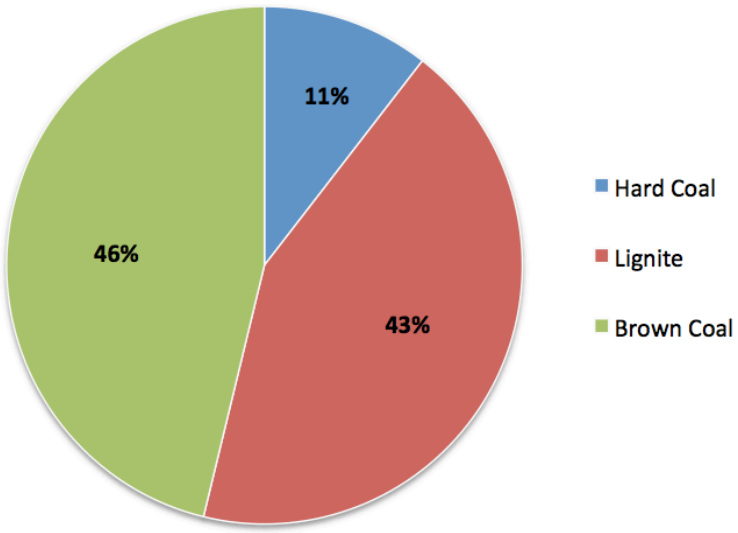

Figure 3 Consumption of coal by type in the energy sector for 2014 (Agency for Statistics of Bosnia and Herzegovina, 2015e)

The second biggest source of electricity produced domestically in BiH comes from hydropower utilization. However, only a third of the hydropower power potential has been developed so far, and thus this energy type carries a big potential of further enlargement – BiH is estimated to be in "8th place with its hydro power potential" (Pasic, 2011), among European countries. A testament to this is continuously expressed interest by foreign companies in investing in utilizing this potential (Pasic, 2011).

However, not all of BiH energy needs are satiated through domestically produced energy. The country turns to imports of foreign energy in the form of oil and natural gas to do so. As Pasic (2011) points out, BiH remains to be dependent on imports of gas and oil energy, “despite the presence of untapped energy resources in the country”. This is because replacements for oil and gas are either not possible, not supported by the traditional energy infrastructure, or not widespread enough.

Households are the biggest demanders of energy in general, accounting for 52 % (Softić & Glamočić, 2012). Industry and transport come in second, accounting for 20 %, followed by services (6 %), and agriculture (2 %) (Softić & Glamočić, 2012). Of this household demand, 57 % is satiated by firewood, electricity accounts for “18.7 % and coal for 10 %” (Softić & Glamočić, 2012, 5).

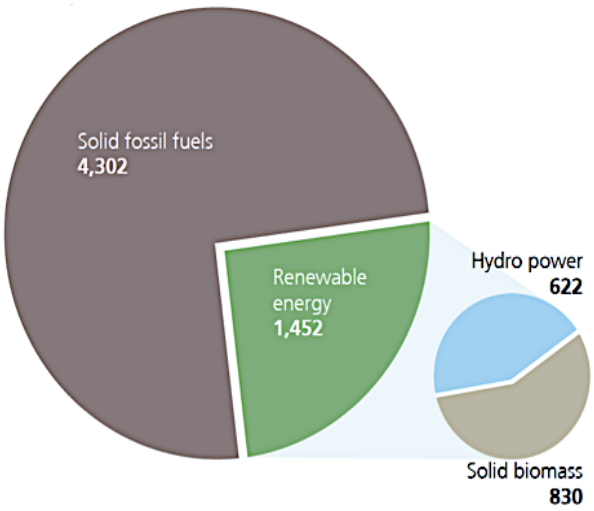

Figure 4 BiH´s Energy Mix in primary production in ktoe for 2013 (Energy Community, 2015)

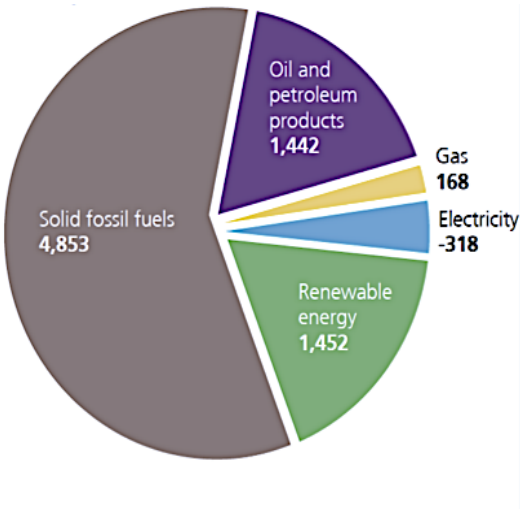

Figure 5 BiH´s gross inland consumption in ktoe for 2013 (Energy Community, 2015)

For instance, natural gas is used to provide district heating for households. Gas is piped to BiH from Russia, from a pipeline traveling through Ukraine, Hungary, and Serbia. In 2014, 186,556,000 Sm^3 of natural gas were imported into the country (Agency for Statistics of Bosnia and Herzegovina, 2015a). The gas infrastructure is not widely developed and is mainly set up to supply bigger cities (such as Sarajevo and Zenica).

Up until late, alternatives for using natural gas for district heating was not possible. On the other hand, most of the lower-income households are not heated up through district heating and natural gas, but use firewood to satisfy these needs (Softić & Glamočić, 2012). Figure 6 gives a graphic representation of how natural gas is used in BiH. Industry was the biggest consumer of natural gas in 2014 (56 %), followed by households with 24 % (Agency for Statistics of Bosnia and Herzegovina, 2015a).

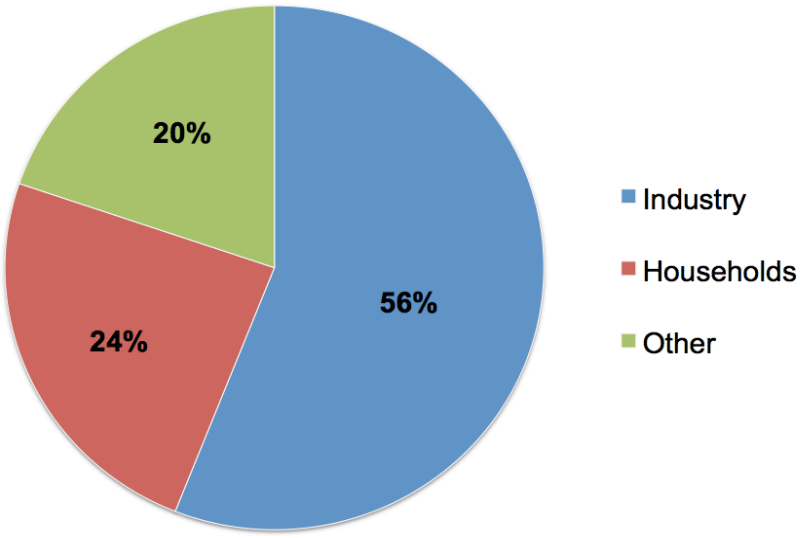

Figure 6 Final natural gas consumption for 2014 (Agency for Statistics of Bosnia and Herzegovina, 2015a)

Even though gas is not widely used, this was still enough to cause the country to suffer from the gas shortages during the 2009 gas crisis when "Russia halted its supply to Europe due to a dispute with Ukraine" (Pasic, 2011). Going through a gas crisis in wintertime, and being "the only country in Europe left with no gas reserves" (Pasic, 2011), means that immediate impact on the local population was severe.

BiH found itself in a situation of having to negotiate the transfer of gas reserves from the more resilient countries (Germany, Hungary, and Serbia) and turning to electricity to sustain activities previously supported by gas energy, thus placing unnecessary and overwhelming burden on the electricity power system.

An outcome of the 2009 gas crisis was the signing of "agreements between *BH Gas* with Hungarian (*Mol*) and Serbian (*Srbijagas*) counterparts for transporting the gas" (Pasic, 2011) and an expression of interest in developing infrastructure to combat future problems of this type.

Pasic (2011) points out that an issue is that projects that work towards ensuring the gas crisis does not repeat itself are not being developed on a country-wide scale due to the “chronically non-cooperative political situation”, resulting instead with separate entity cooperation – with the Federation of BiH connecting to neighboring Croatia, and Republika Srpska to Serbia.

The natural gas market needs to be unbundled and a regulating authority is yet to be established. In fact, this crisis showed that the whole SEE region would benefit tremendously from “a pipeline and LNG terminal infrastructure that connects it to gas-rich regions” (Zibret et al., 2014, 6). However, having insurances of gas from neighboring countries is not necessarily the best way forward to ensure security of energy supply.

BiH and its citizens would be much better off in terms of international political leverage and living standards if the country developed a plan that would remedy a weakness by developing energy systems that would replace the need to import natural gas in the first place – or at least replace a portion of the gas used to generate heat for households through district heating.

The current gas infrastructure in made up of 191 km of gas pipelines, for a 1 billion cubic meter capacity (Softić & Glamočić, 2012). However, long–term needs require the building of additional pipelines for a capacity of 3 billion cubic meters and reserves capable of storing enough to supply for more than 90 days (Softić & Glamočić, 2012). Funds needed to invest in developing that need would also be possible to invest in energy source that the country is abundant with, such as hydropower. This option is addressed great detail in chapter 5.

BiH imports oil from Croatia, Serbia, Montenegro, and Hungary. Again, as is the situation with gas, BiH´s total dependency means that it is leaving itself open and vulnerable to external factors. Luckily, a refinery in Bosanski Brod has “recently been restored and privatized” (Pasic, 2011) by *Zarubezhneft*, a Russian company which brings the promise of employment and security in the form of an internal source of oil supply. However, the refinery in Bosanski Brod lacks operational efficiency.

The A. T. Kearney Refinery Health Checker Benchmarking Study (Zibret et al., 2014, 5) concluded that SEE “refineries produce limited amounts of value-added petrochemical and lubricant products and do not have the advanced equipment found

in refineries in neighboring EU countries" and gave the sole BiH refinery a 2.2 on the composite index (on a scale of 1 to 4, with 4 being the highest mark). This suggests that the refinery has to update its operating model and address its efficiency.

2.2 Electricity Sector Facts and Figures

Electricity in BiH is mainly generated from coal and hydropower-powered stations, with an approximate ratio of 60 % to 40 % respectively, but that ratio varies due to factors affecting the water flow such as precipitation and flooding (Salihović-Whalen, 2014). From the electricity point of view, BiH is energy sufficient. BiH and Serbia are the only countries in SEE who are net-exporters of electricity (Zibret et al., 2014). Ensuring stability, security, and efficiency of supply are thus of national political and economic interest to BiH and its electricity producers.

In 2014, total electricity production equaled 16,160 GWh, and consumption approximately 10,587 GWh – an increase from 2011 (Agency for Statistics of Bosnia and Herzegovina, 2015c; UNFCCC, 2014, 17). In 2013, total electricity production equaled 16,303 GWh, and in 2014 it was slightly less due to largescale flooding that hit the country, and equaled 15,030 GWh (Energy Community, 2015, 57). In 2014, about 37 % of the electricity produced was generated by hydro power plants and 61 % was generated by thermal power plants (Agency for Statistics of Bosnia and Herzegovina, 2015c). This can be seen in figure 7.

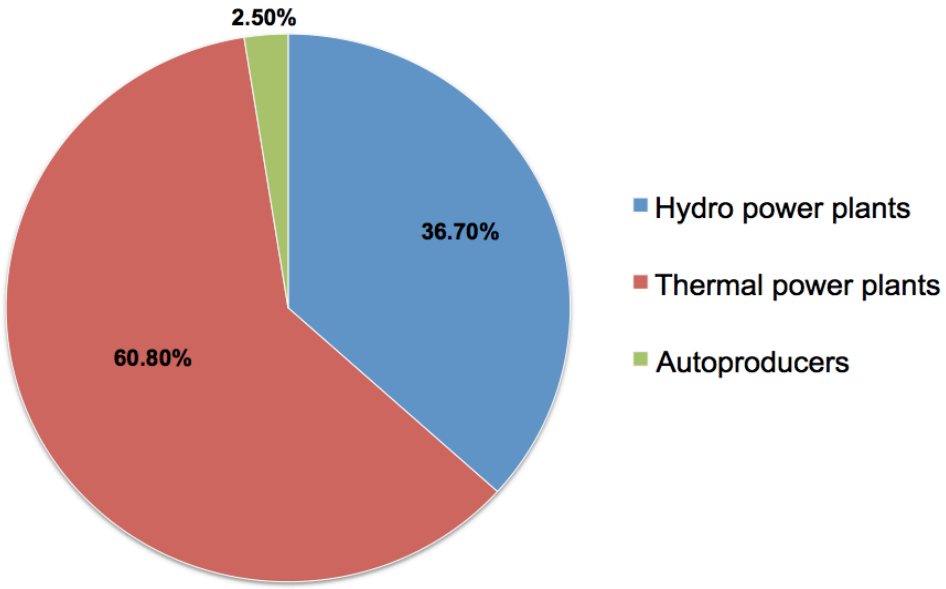

Figure 7 Gross electricity production in 2014 (Agency for Statistics of Bosnia and Herzegovina, 2015c)

Up until recently, new renewables (excluding hydropower) had no impact on the electricity grid. This has been changing, with photovoltaic cells being installed and wind energy parks in development. As of new, solar energy use for the production of heat and electricity are favorable and quickly developing. So far, “estimates show that there are close to 7000 m² of installed collectors, and their annual increase is close to 28 %” (UNFCCC, 2014, 40).

2.3 Generation, Transmission & Distribution

As mentioned before, the three electricity generating companies are: *JP Elektroprivreda BiH*, *JP Elektroprivreda HZHB*, and *MP Elektroprivreda RS*. The three electricity companies are largely owned by the Entity governments and at this time, there are no plans of privatization. For instance, in FBiH, 90 % of *JP Elektroprivreda BiH* and *JP Elektroprivreda HZHB*. RS has 100 % ownership of *MP Elektroprivreda RS* (Salihović-Whalen, 2014).

All of the above mentioned electricity companies “are vertically integrated and combine generation, distribution, and trading activities” (Salihović-Whalen, 2014). In BD, on the other hand, the company *Komunalno Brčko* is only in charge of distribution and supply in the area. To get electricity it establishes contracts on a yearly basis with the other electricity operators.

JP Elektroprivreda BiH and *JP Elektroprivreda HZHB* operate in FBiH and generate 50 % and 10 % of electricity respectively. *MP Elektroprivreda RS* generates electricity for RS, which is approximately 40 % of total generation in BiH (Salihović-Whalen, 2014).

The main coal powered stations are TE Tuzla, TE Kakanj, TE Gacko, and TE Ugljevik. *JP Elektroprivreda BiH* owns TE Tuzla and TE Kakanj, while MP Elektroprivreda RS owns the latter two - TE Gacko and TE Ugljevik. The main hydroelectric power stations are: HE Jablanica, HE Salakovac, HE Rama, HE Čapljina, HE Višegrad, and HE Trebinje I. *JP Elektroprivreda BiH* owns HE Jablanica and HE Salakovac, while *JP Elektroprivreda HZHB* owns HE Rama, and HE Čapljina, and lastly, *MP Elektroprivreda* RS owns the last two – HE Višegrad and HE Trebinje I. The following table 2 has an extensive list of all power plants in the country, including their production in GWh for the 2012-2013 period.

Table 2 Production of electricity in 2012 by generating station (GWh) (Salihović-Whalen, 2014)

Hydroelectric generating stations		Coal generating stations	
Station	**Production (GWh)**	**Station**	**Production (GWh)**
HE Jablanica	901.6	TE Tuzla	3,117.8
HE Grabovica	364.9	TE Kakanj	2,232.3
HE Salakovac	576.0	TE Ugljevik	1,616.8
HE Visegrad	1,216.0	TE Gacko	1,773.3
HE Trebinje 1	700.3		
HE Trebinje 2	0.00		
HE Dubrovnik (G2)	621.0		
HE Bocac	266.8		
HE Rama	707.1		
HE Mostar	299.3		
HE Jajce 1	255.0		
HE Jajce 2	88.6		
PHE Capljina	712.9		
HE Pec-Mini	93-0		
HE Mostarsko Blato	168.8		
Total	6,971.30	Total	8,740.2
Total production in BiH 2012-2013 - 15,711.5 GWh			

Investments to increase generation are in the works. In FBiH, *JP Elektroprivreda BiH* plans to expand coal generation and increase "installed power capacity of 450 MW in TE Tuzla and 300 MW in TE Kakanj, by 2018 and 2019 respectively" (Salihović-Whalen, 2014). In RS, increases are also planned and underway. The energy trading and investment group EFT is also planning to construct a new coal-powered generating station with an installed power capacity of 300 MW near Doboj (TE Stanari), to be completed in 2016" (Salihović-Whalen, 2014).

In accordance with the Energy Community *acquis communautaire*, the transmission system is "legally unbundled since 2004, and is under the control of *NOS BiH* and *Elektroprenos BiH*, which are under the regulation of DERK" and jointly owned by FBiH and RS (Salihović-Whalen, 2014). *DERK* also regulates third-party access.

The transmission system is still not sufficiently independent in regards to operation "because of a lack of capacity allocated to the management structure of *Elektroprenos BiH* for independent decision-making, and because of a lack of interest by FBiH and RS [governments] in overcoming mutual disagreements relating to the operational structure and investments" (Salihović-Whalen, 2014). The source of this problem is two

fold. Firstly, government ownership dilutes the forces of demand and supply that would idealy aim to increase overall efficiency and reach best price for the product. Secondly, dual government ownership translates into dual opinions on operation of the company and direction of future strategies. If these two governments are in opposition to one another, this impedes on the operation of the company.

In the past, due to political, Entity-level government friction, there were frequent disagreements in the management, decision-making of *Elektroprenos BiH*, the distribution of its profits, and investment in its infrastructure. The blockade has been resolved in 2014 and has opened up the company to conduct business and invest in energy projects throughout the country. However, the danger of this situation repeating itself will be present as long as government holds most of the ownership power in main electricity companies.

Another factor that weighs on the transmission and distribution system are technical loses. During the War in 1992 – 1995, most of the electricity grid was damaged. Since, it has almost fully restored to its pre-war state but nonetheless operates with outdated equipment. Still, the electricity network infrastructure works at capacity limit and this causes problems. Thus, the transmission and distribution network suffers from electricity losses and this can have an impact on security of supply. If this was to be addressed and reduced to a standard level of 5 %, BiH could save up to 86 million euro in electricity spending, narrow the gap between demand and supply, and reduce GHG emissions (Zibret et al., 2014, 7). This can be seen in figure 8 below.

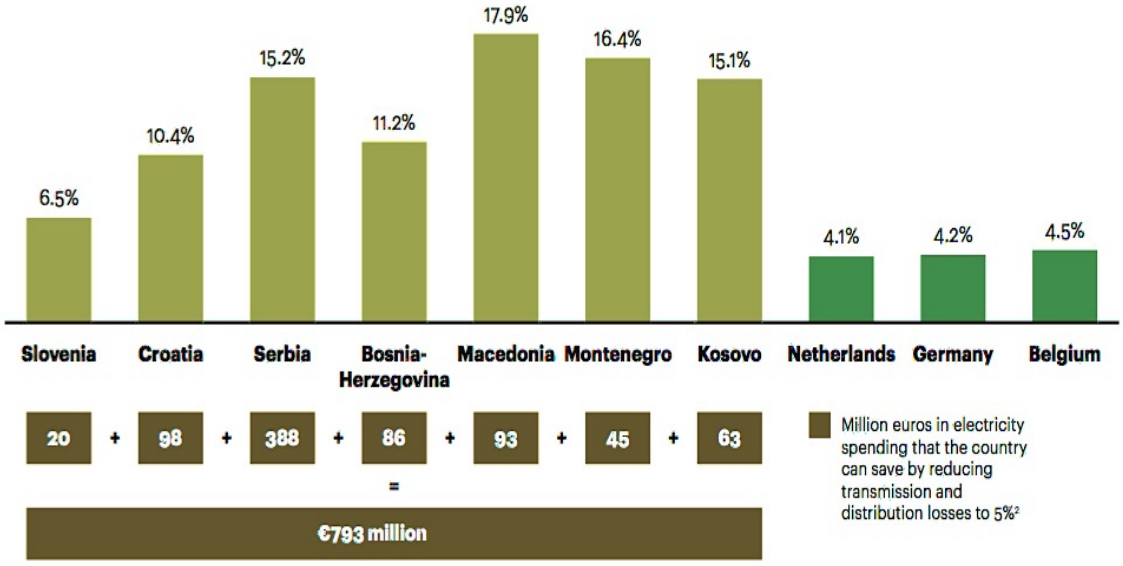

Figure 8 Comparison of transmission and distribution losses as % of apparent consumption for 2011-2012 (Zibret et al., 2014)

Electricity distribution is at fault for 60 % to 80 % of the transmission and distribution losses, which makes improvements a high priority (Zibret et al., 2014; Weishaar & Madani, 2015). Figure 6 also shows that in comparison to EU states, SEE states experience relatively higher losses on their electricity grid.

In the EU, these improvements are encouraged by setting appropriate tariff rates at a level that incentivizes suppliers and consumers to engage in improving efficiency. Energy efficiency could also lead to savings that would help the net position of BiH in the long-run. For instance, “tariffs should reflect achieved network cost savings” (Zibret et al., 2014, 7). Also as security of supply improves, the net position of BiH as an electricity exporter would also be improved.

Moreover, to mitigate these technical grid losses, the grid capacity should be improved and made stronger. The transmission system operator must satisfy conditions necessary to connect renewable energy generators to the electricity network. Electricity distribution would also be optimized with the creation of micro grids and local cells that could balance generation and demand.

Also, the supply market is undergoing “a transitional phase of opening up to competition” (Salihović-Whalen, 2014). Across all of BiH, since 1 January 2015, relevant laws and bylaws allow the status of qualified purchaser to all. A qualified purchaser has free choice (switching conditions, procedures, rights, and obligations defined by law) of electricity supplier (domestic or international).

This has opened the market up for competition, but the use of this choice is not common (Salihović-Whalen, 2014). Privately actors who generate electricity sell to the incumbent electricity companies. On the grassroots level, there is lack of awareness about electricity options. Consumers are not sufficiently educated on their energy choices, how they may be substituted, and how they impact the overall environment.

At this time, renewable energy use is encouraged in the Entities with “feed-in-tariffs or feed-in premiums” (Energy Community, 2015, 68) and priority dispatch of electricity from RES. There is a need to establish financial incentives that would encourage investment, connectivity to the grid, and feed-in-tariff reform. Not all power utilities are required to purchase electricity from renewable sources.

Additionally, there is limited availability of public funding that discourages RES projects and the implementation of more efficient technologies. Capacity building of local financial institutions to encourage them to fund renewable energy projects would help. Awareness and consciousness raising would foster more support for projects of this kind and should thus be encouraged.

Another way of encouraging RES projects could be done by: “increasing the feed-in tariffs in order to become competitive in comparison to other markets in region; [...] and in plants that produce large amounts of thermal energy and thermal power plants, strategically evaluate the possibility of production and distribution of combined heat and power” (Softić & Glamočić, 2012, 21). These options are described in more detail in chapters 4 and 5.

2.4 Authority, Legislation & Administration

As emphasized before – although on paper BiH is one electricity market, it operates in 3 zones. There are three regulators: DERK, FERK, RERS (with DERK being the state level regulator). There are 2 administrators on the transmission system: Elektroprenos BiH, and NOS BiH.

In FBiH, the electricity operators, under the Electricity Law of FBiH, are required to undergo accounting unbundling. This is not yet properly implemented. In FBiH, legal unbundling is also not achieved, while in RS it is “relatively advanced”, with “MP Elektroprivreda RS controlling eleven legally unbundled subsidiaries – five distribution utilities, five generation companies and a research center” (Salihović-Whalen, 2014).

In regards to government, the Parliamentary Assembly is in charge of the legislative process and has the power to change legislation, and the “Ministry of Foreign Trade and Economic Relations of BiH is responsible for other energy related tasks and duties falling within the jurisdiction of the state of BiH” (Salihović-Whalen, 2014). Herein lies the power to adjust legislation and bring it in line with the Energy Community *acquis communautaire.*

For instance, in terms of the legal framework, there is “no guaranteed or priority access to the transmission network for renewable energy producers” (Energy Community, 2015, 68) and no national-level strategy for renewable energy development. In FBiH especially, lengthy authorization procedures that can be attributed to its political and

administrative complexity, discourage some investment. In terms of compliance with the *acquis communautaire*, FBiH lags behind RS. The process of setting up new projects is slow because of "the long, cumbersome process for authorization, licensing, and network connection" (Zibret et al., 2014, 9).

If the administrative makeup of BiH was to be made a less complex and more cohesive unit, as the EU accession process demands, this could positively reflect on the implementation of favorable energy projects by streamlining the process and in general, cancelling out the negative impacts that the multi-layered system of governance creates.

In 2013, new legislation was passed relating to RES projects in FBiH. Under this new system: "the incumbent electricity companies have an obligation to purchase electricity by concluding a twelve-year contract with new renewable energy generators for the purchase of electricity at a guaranteed price based on a reference price and a determined coefficient. The highest coefficient was for solar generating stations and the lowest for hydroelectric plants. After the twelve-year contract has expired, generators of electric energy from renewable sources lose only the right to a guaranteed price" (Salihović-Whalen, 2014).

On the other hand, "in RS, this area is regulated by a 2011 Government Regulation on Generation and Consumption of Energy from Renewable Energy Sources and the Law on the use of renewable energy and efficient cogeneration from 2013. It also provides that generators of electricity from renewable energy sources can achieve one or more incentives for a period of 15 years, such as, inter alia, the right of mandatory purchase of the electricity generated under a guaranteed price by the incumbent electricity company, determined based on a reference price and an additional premium. The amount of electricity eligible to receive incentives is limited, with a yearly amount prescribed each year until 2020" (Salihović-Whalen, 2014).

BD still requires detailed regulation. Legislation on improving energy efficiency is still largely lacking and "facing several challenges, including the lack of a clear regulatory and policy framework" (World Bank, 2015, 12).

All in all, the legal and administrative system is highly stratified, with doubled legislation for all, and regulation sometimes being more or less thorough in one entity than the

other. The following table 3 expansively list all relevant laws in BiH, per level of governance and administration.

Table 3 Relevant laws in the energy sector:

BiH Level	- Law on Transmission of Electric Power, Regulator and System Operator of BiH - Law on Establishing the Company for the Transmission of Electric Power in BiH - Law establishing an Independent System Operator for the Transmission System of BiH - Licensing rules of DERK - Connection rules of DERK - Grid Code of NOS BiH - Market rules of NOS BiH
FBiH Level	- Law on Electricity of FBiH - The law on the use of renewable energy and efficient cogeneration of FBiH - Rulebook on licensing of FBiH
RS Level	- Law on Electricity of RS - The law on the use of renewable energy and efficient cogeneration of RS - Regulation on incentives for generation of electricity from renewable sources and co- generation of RS - Rulebook on licensing of RERS
BD Level	- Law on Electricity of BD

This could be solved with a national level body (such as a Communication Council that exists in the EU). This would ensure transparency, communication, streamlined parallel procedures, propagate and report stakeholder-relevant information, and ideally – foster cooperation on relevant environmental and energy questions and policies.

A country-wide energy strategy could remedy many issues (European Commission, 2015). This also includes the establishment of a national action plant for renewable energy and energy efficiency. The lack of a state level strategy "prevents it from addressing issues of security of supply, in particular oil and gas" (European Commission, 2015, 53). As explained, measures to date have not been comprehensive and coordinated due to this.

The Ministry of Foreign Trade and Economic Relations BiH (MoFTER) is the Ministry in charge of fulfilling BiH international obligations in relations to the energy sector. To develop a long-needed state-level strategy, MoFTER "should work on agreeing the terms of reference for the development of a comprehensive Energy Development

Strategy of BiH for the period up to 2030, taking into account that the entity strategies are harmonized and that BiH as a whole can respond to the requirements of the Treaty establishing the Energy Community with the aim of integrating the energy market of BiH with regional energy markets and the EU energy market" (Softić & Glamočić, 2012, 17).

To accelerate toward progress in this regard, BiH needs to build from the recent electricity market liberalization and comply wholly with the *acquis communautaire* to "allow country-wide wholesale and retail markets to develop" (European Commission, 2015, 53). Similarly, because "legislation and regulation on renewable energy remain split between entities" BiH is left "without any state legislation that would satisfy obligations to adopt a NREAP or the possibility to enter into corporation mechanisms to meet the target in the most cost-effective way" (Energy Community, 2015, 7).

Besides, "with a generally low awareness of the interdependence between environment and development, national priority setting in this area is quite limited" (UNDP, 2016). Investment in education and awareness-raising is a must. Capacity building measures for policy makers and other relevant actors should be conducted. Public participation also needs to be improved (European Commission, 2015). A low level of awareness among the general population needs to be addressed as well in order to combat inefficiencies from the bottom-up.

All in all, a greater level of awareness is a necessity in order to open up the electricity market and foster RES investment, along with "a greater level of awareness and knowledge about the impacts of climate change among decision-makers and the broader public, in order to enable a systemic response and build resilience" (Knežević et al., 2013, 78).

Also, formation of shared and reliable country-wide database is a necessity. A need for information and transparency is also clear, as a comprehensive database is lacking (Softić & Glamočić, 2012). All this is a disservice to a transitioning energy sector as a "lack of information is a limiting factor to obtain clear assessment of quality of power system" (Afgan, Begić, & Kazagić, 2007, 51).

Finally, there are 4 main levels of barriers to investment: 1) political, 2) legal and administrative, 3) economic and financial, and 4) human. All of these present obstacles to investment in RES projects or more efficient and clean technologies for present

power plants.

Figure 9 below illustrates the administrative and structural distinctions of BiH´s energy system.

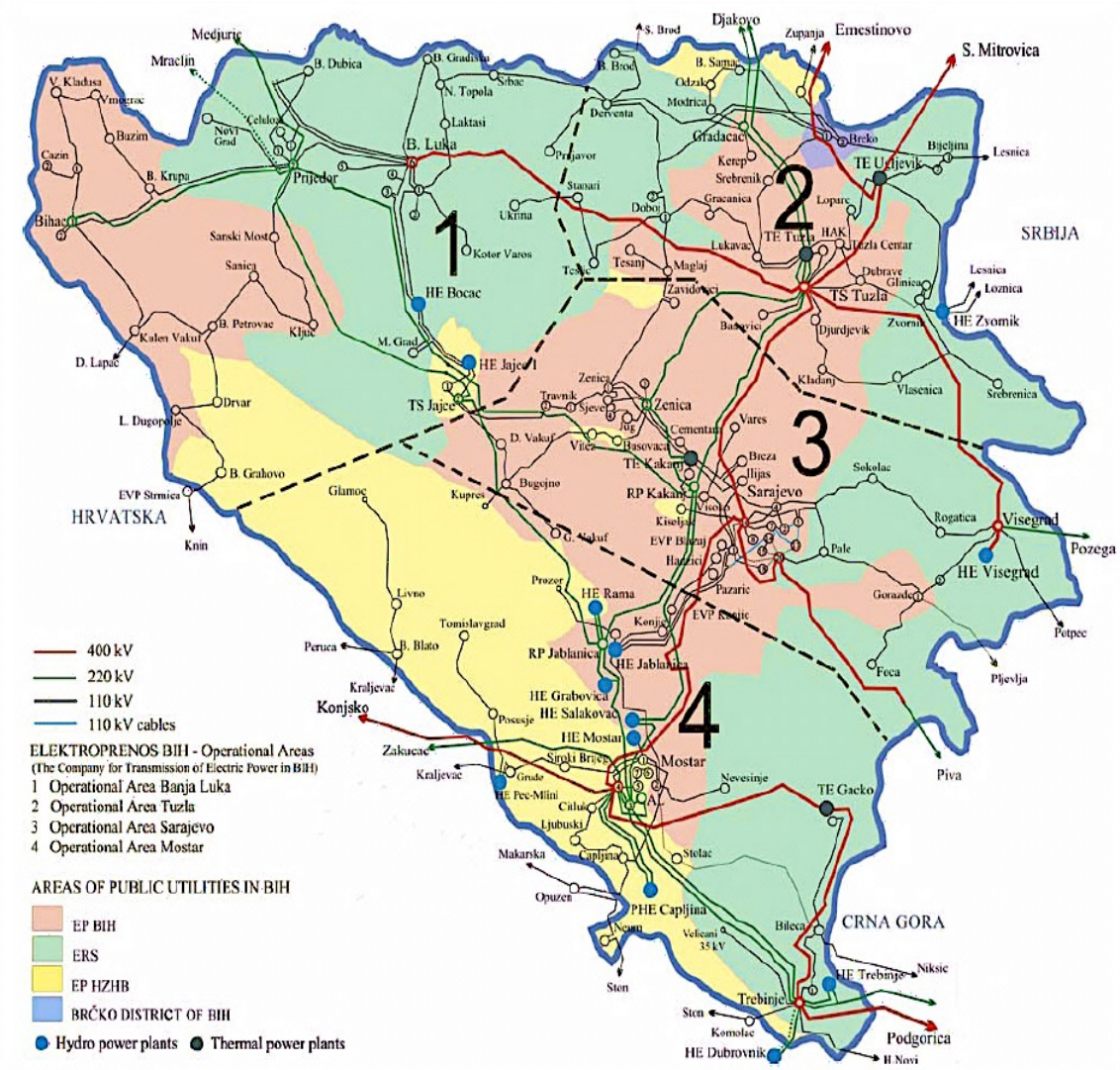

Figure 9 BiH´s complex electric power system (Softić & Glamočić, 2012)

3 International Cooperation & EU Integration

From a diplomatic perspective, BiH government has always eagerly participated in international forums. Notably in 1992, even while undergoing a debilitating war, BiH participated in the UNFCC in Rio de Janeiro in May and ratified the Vienna Convention. Furthermore, in April 2007, BiH became the 168th country to sign on to the Kyoto Protocol, reaffirming its aspirations to help combat climate change.

BiH also has a previous trend in international dialogue in regards to energy. In 2001, BiH ratified the Energy Charter Treaty (ECT) and the Protocol on Energy Efficiency and Related Environmental Aspects (PEEREA). In doing so, it committed itself "to formulate and implement policies for improving energy efficiency and reducing the negative environmental impact of the energy cycle" (Energy Charter Secretariat, 2012, 3).

Recently, the Berlin process reaffirmed the decision of the EU to welcome the remaining Balkan states into the Union. The EU has its own ambitions regarding energy use. Until 2020, the EU has set its goal to reach a 20 % reduction of GHG emissions, a 20 % increase in energy efficiency, and a 20 % of energy use coming from renewables.

Since BiH wishes to be a member state of the EU, these goals must be aligned. The Energy Union "is based on three key objectives of the EU energy policy: security of supply, sustainability, and competitiveness" (Mileusnić, 2015, 14) and emphasize the use of renewable energies and unused energy efficiency in achieving this.

In regards to EU and energy – the EU engages with BiH, and it's SEE neighborhood in general, through the Energy Community which strives to connect these states to EU´s energy market with the overall aim of reducing prices, improving energy security, encouraging de-carbonization and encouraging "wider use of renewables" (Mileusnić, 2015, 15). The Energy Community treaty was signed in 2005 between the EU and nine Southeastern European countries and created the Energy Community of South East Europe (ECSEE).

For BiH, this agreement opened it up to cooperation with the EU and lead to the harmonization of policies and standards of BiH energy market with that of the EU (the *acquis communautaire* on energy, environment, RES, and competition). The objectives

are also “connected to the creation of social stability and economic development” (Mileusnić, 2015, 15). What is more, cooperation is promoted and the states are able to conduct common energy projects with one another.

The EU has recognized that it can strengthen its energy policy by investing in the development of energy systems in its neighborhood. As Mileusnić (2015, 3) points out, present decisions “will lay ground for reshaping the energy system over the next several years.”

The EU´s long-term development strategy could have a positive influence on this important sector. Nonetheless, there is a need to start now to reach these long-term goals. As Softić & Glamočić (2012) argue, EU energy policy is a moving target that is characterized by constant changes, resistance, and harmonization. However, the three main characteristics of EU´s energy policy are continuously security of supply, competitiveness, and sustainability (Softić & Glamočić, 2012, 3).

These norms have been trickling down from politics to practice in the EU. The EU market has been changing and companies within the EU have been divesting from fossil fuel businesses – a notable example being the Norwegian pension fund (Mileusnić, 2015). These winds of change have the potential to carry on to EU´s immediate neighborhood through the mechanism of the Energy Community Treaty who´s strategy “recognized the need to tap into the major unused energy efficiency and renewable energy potential in Southeast Europe” (Mileusnić, 2015, 3).

3.1 The EU Directives

The Directives make up the *acquis communautaire* of the Energy Community and are legal acts that BiH must comply with. Some of them deal with RES, promotion of efficiency, and sustainable development and use of resources. For instance, the purpose of Directive 2009/28/EZ on the promotion of use of energy from renewable sources is to set up a common frame of action to promote the use of renewable energy, with the aim of common trade in energy and the ambition to increase the share in energy coming from renewable sources over time.

The aim of Directive 2010/31/EU on the energy performance of buildings is to remedy the unused potential of energy savings in buildings. This Directive also makes sure that prior to building of new buildings, other alternative and best-practice scenarios are

taken into account. Directive 2005/89/EZ acknowledges that need for transparency and non-discriminative politics when considering the security of supply of electric energy. To ensure safe and secure operation of the grid, reserve capacities need developing and responsibilities need to be given to the appropriate actors involved in the energy sector.

Additionally, Directive 2010/75/EU is another important Directive worth highlighting. This Directive deals with industrial emissions and thus indirectly co-operates with the aforementioned Directives, and measures that affect more efficient practices and cleaner practices, that also translate into lower emission levels.

The implementation of these Directives has been cumbersome in the country as they go against the current, and long enforced, order of the electricity sector. For instance, one more major requirement that is left for BiH to complete is the creation of a "state level legislation or strategy regarding energy from renewable sources, and therefore the implementation of Directive 2001/77/EC" (Salihović-Whalen, 2014).

The issues surrounding the lack of a national level strategy were discussed in detail in Chapter 2. As the Energy Community (2015, 59) progress report points out, "legal compliance on state level is particularly important for the required structural reforms and liberalization of the electricity market." Related further requirements that are left to be instated (compliance so far is fragmented and inconsistent) are related to Directive 2009/28/EC, as "each of the entities (FBiH and RS) defines its own framework for the transposition of the directives and both entities have laws governing the electricity sector and regulatory requirements to foster production of energy from renewable sources" (Salihović-Whalen, 2014).

Finally, in regards to Directive 2009/72/EC, BiH still experiences shortcomings because the "authorization of new generation capacity and tendering procedures are in competence of the two Entities and BD" (Energy Community, 59). Further unbundling of the electricity system is required, especially of ownership of transmission companies from generation and supply, and of distribution system operators in FBiH. This could be enforced with strengthening laws that do not specify these obligations and proper unbundling would also allow consumers to make independent electricity use choices. This Directive also requires that the legal framework also "transposes the customer protection provision" (Energy Community, 2015, 61) and protection of socially vulnerable customers which the current electricity laws fail to do.

3.2 Comparison to EU Average

According to Zibret et al. (2014, 2), there are "7 strategic priorities" vital for future energy success for SEE countries. These are: commitment to joint gas infrastructure (in light of 2009 Gas Crisis); cross-border energy projects involving RES, encouraging private investment in RES projects (involving streamlining of relevant procedures; infrastructure, certification schemes); operational efficiency and capacity sharing; reduction of electricity losses and movement toward smart metering technology use; education of electricity consumers about efficiency; and developing strategic national plans.

Because of the previously, already established use of hydropower to supply the country with electricity, "BiH has high participation of RES in electricity production, which is one of the biggest shares in Europe" (Gvero et al., 2010). From this point of view, BiH already has a leg up on its European counterparts. However, this should not be used as an excuse to delay any new development in this regard.

In fact, since 2009, the RES share of energy in each country of SEE was higher than the EU average (Zibret et al., 2014, 8). This comparison can be seen in Figure 10. What is more, all countries of SEE, including BiH, plan to expand their use of RES until 2020. BiH plans to increase this share by 6 % to reach an overall total of 40 %. For FBiH, the target is set for 41 % from a 36 % starting point in 2009, and for RS, the target is 35.98 %, from an initial level of 29.1 % in 2005.

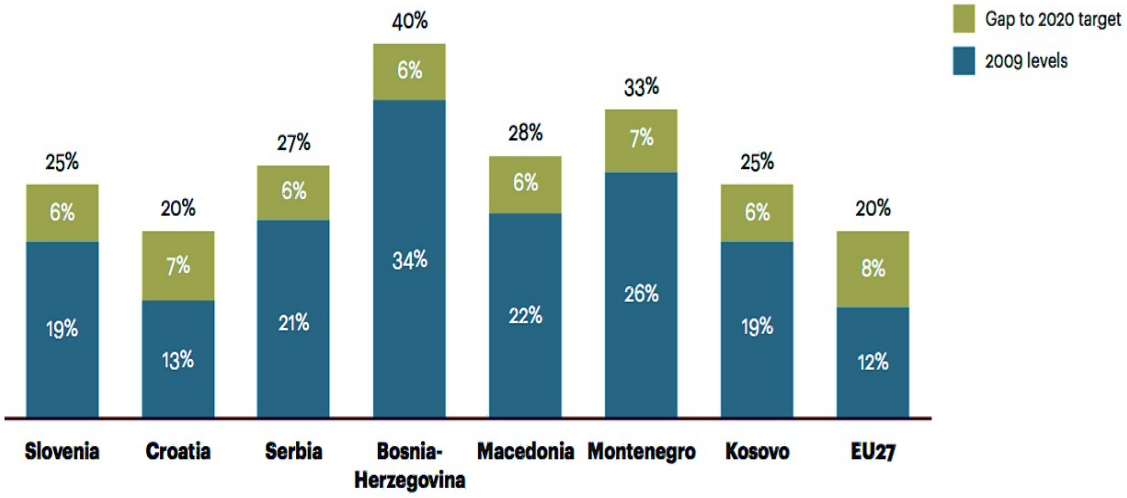

Figure 10 A comparison of the share of energy from renewable sources in gross final energy consumption (Zibret et al., 2014)

Comparing energy intensities is another good indicator of energy performance because it reflects on efficiency of energy use and production. BiH´s energy intensity is comparatively higher than that from EU member states. Compared to its EU and OECD competitors, BiH "needs proportionately more energy to create one dollar of GDP" and "emits more CO_2 per unit of GDP produced" (Mileusnić, 2015, 6).

Similarly, data collected 2000 showed that, "on average, 10.14 GJ was consumed to produce 1000 $ of GDP on the world level. In the same year, developing countries used 22.57 GJ for 1000 $, and in BiH 30.1 GJ was consumed for generation of the same level of revenue" (Softić & Glamočić, 2012, 5). This data indicates that in BiH, "with the existing energy intensity, the energy sector spends more than 20 percent of GDP" (Softić & Glamočić, 2012, 5). This further places importance on increasing energy efficiency, and remedying unnecessary losses created with outdated infrastructure.

In fact, energy intensity has increased from 0.52 in 2012 to 0.58 in 2013 (Energy Community, 2015, 73) and this is an indicator that the economy is becoming less competitive and is in need to "stronger energy efficiency measures" (Energy Community, 2015, 73) Figure 11 shows the comparison in energy intensities of EU and SEE states. What is obvious is the significantly lower efficiency in states of the Balkan region.

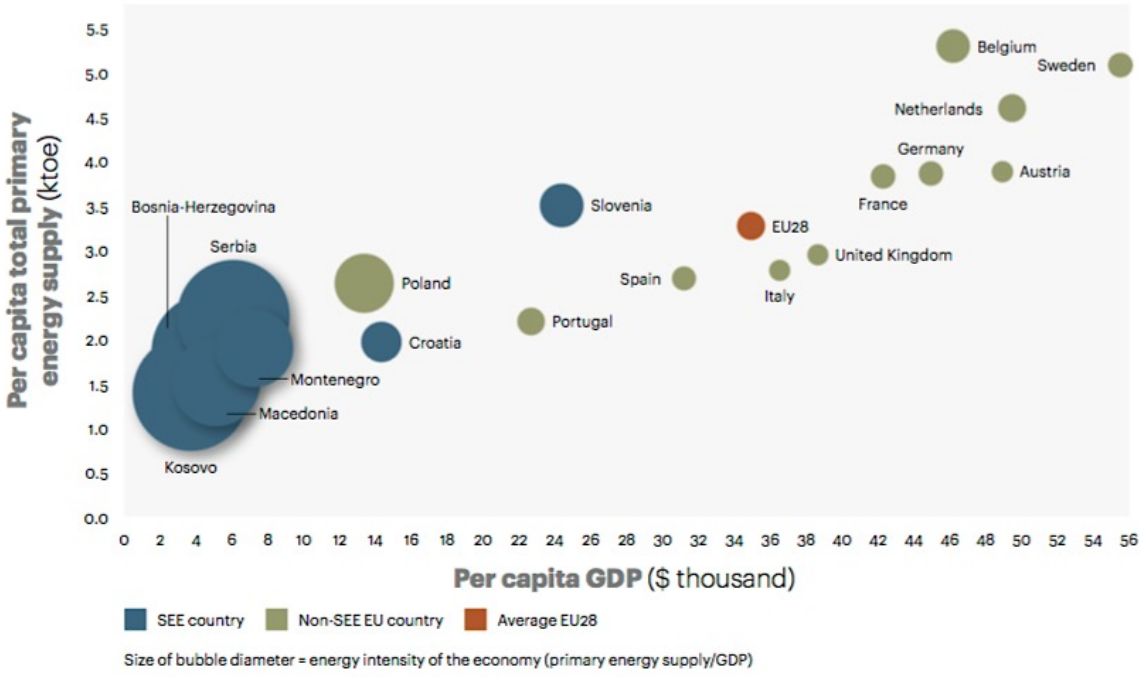

Figure 11 Energy intensity of EU and SEE countries in comparison (Zibret et al., 2014)

As a result of this, in the future SEE countries will face increasing pressure to increase energy efficiency, security, self-sufficiency, lower their dependence on imports and balance their individual energy mixes. With projected “annual real GDP growth between 2 to 4 percent until 2018” (Zibret et al., 2014, 2) each, there will be accompanied increasing energy demand.

Of course, energy use and demand goes hand-in-hand with economic development and living standards (Zibret et al., 2014; Softić & Glamočić, 2012). In comparison to EU 27 average in 2012: GDP per capita for BiH is only 28 % of EU average, and consumption per capita is 37 % of the EU average (UNFCCC, 2014, 17). There is a positive correlation between GDP and energy needs.

In comparison to EU average, countries of SEE (excl. Slovenia) “spend 2 to 3 times less energy per capita” (Zibret et al., 2014, 2). This is attributed to the lower level of development in SEE countries and their lower level of energy efficiency. However, they are largely dependent on energy imports to fuel basic activities.

As was described in detail in the previous chapter, BiH along with other SEE states such as Serbia and Slovenia import all its demand for natural gas and oil. BiH however, in this regard, has the advantage to be abundant in coal and therefore does not have to spend extra on these imports. Also, BiH is unique in comparison because it actually manages to produce enough electricity to export it to neighboring states, as seen in Figure 12.

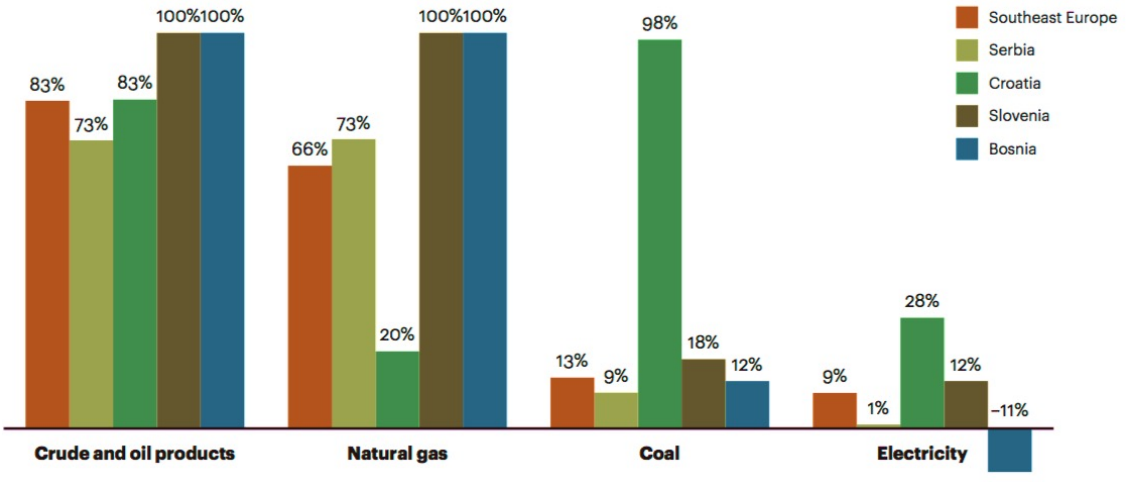

Figure 12 Comparison of net energy imports as % of energy supply for 2011-2012 (Zibret et al., 2014)

Because BiH already manages to profit from its current energy setup, despite its drawbacks in terms of efficiency, it does not have as much pressure on it to adhere to the principles of the Energy Union as soon as possible. If we take into account the slowing pace of adherence to the Energy Community *acquis communautaire*, it is reasonable to question BiH success in increasing efficiency and RES use if it continues with business as usual.

The Energy Community (2015) National Implementation Report expresses doubt over the goal of BiH of reaching a 20 % renewable energy share in gross final energy consumption. The report concludes that this share is likely to drop (instead of growing steadily until 2020), despite the recent legal revisions and planned policy initiatives. This is because, in practice, BiH activities in the energy sector do not reflect its long expressed political aspirations. Figure 13 shows the Energy Community (2015) National Implementation Report forecast of BiH´s gross final energy consumption – which is projected to grow steadily.

On the other hand, Figure 14 shows the forecast of the share of RES in gross final consumption. As can be seen, the green lines are shown to slightly and steadily decrease with time until 2020, widening the gap between it and the red line which shows the necessary RES minimum goal over time, in order to reach the 2020 goal.

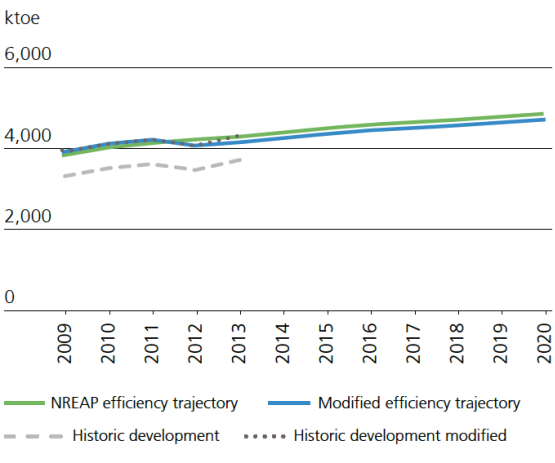

Figure 13 Evolution and Forecast of gross final energy consumption in BiH (Energy Community, 2015)

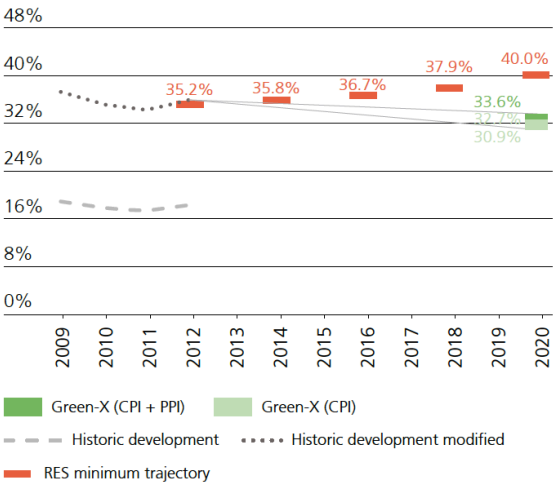

Figure 14 Evolution and forecast of RES share in gross final energy consumption in BiH (Energy Community, 2015)

3.3 Managing Climate Change & Air Pollution

With high coal reliance in energy production, it is to be expected that, in comparison to EU states, countries of SEE "emit nearly 30 percent more CO_2 to supply one unit of energy, relative to the EU27 average, as they remain highly dependent on imports of crude oil, petroleum products, natural gas, and transformed electricity" (Zibret et al., 2014, 3). Likewise, options of nuclear and natural gas energy are largely unexplored. This comparison is illustrated in Figure 15 below. What is also noticeable is that the share of renewables is generally the same for all. Together, this data indicates that just increasing the share of RES alone is not the only solution. What is imperative, is to mitigate the negative effects of coal and crude oil use.

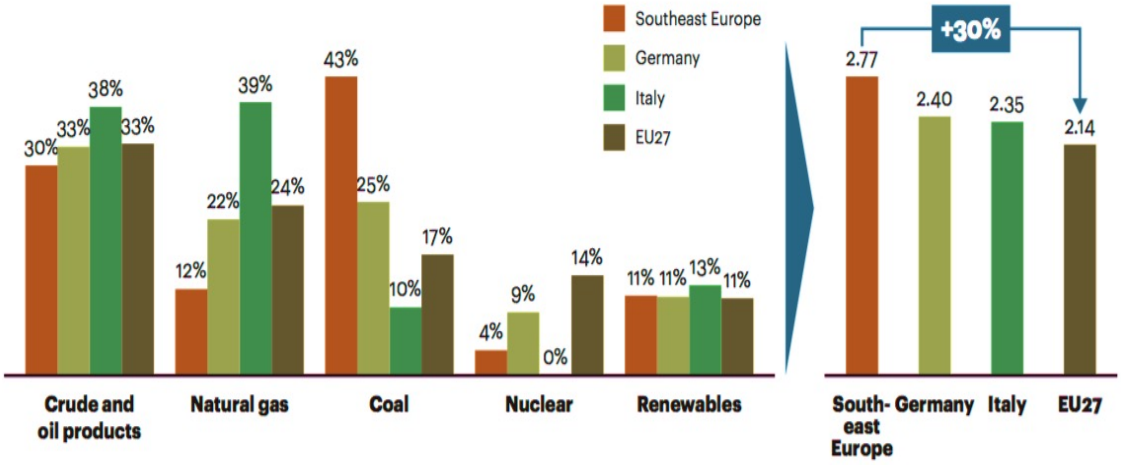

Figure 15 Comparison on energy types in TPES and carbon intensity in tons CO_2 per ToE of TPES for 2011 (Zibret et al., 2014)

The UNFCC report for 2014 recognizes the energy sector as the largest contributors to CO_2 emissions – approximately 76.3 % (using data from 2010). Conclusively, reforming this sector also carries significant potential in reducing CO_2 emissions. The most recent UNFCC report (2014, 9) predicts that "the increased use of RES, coupled with avoiding external costs, would bring about an average annual benefit of approximately $ 12.3 million" in the case of a gradual increase in the use of new RES technologies, and $ 82 million if this use of new RES technologies is also accompanied with "a high level of climate change mitigation actions".

In the long-run, these savings could be redirected into developing other energy systems and development options that would bring about a positive impact on the living

standard of citizens in this country – and also impact the the country´s employment level by diversifying the character of its energy sector.

Similarly, Figure 16 shows that BiH total share of GHG emissions is slowly reaching its pre-war level in 1990 when its energy generation was at peak level. Figure 17 gives a visual representation of the total share of emissions per sector, with the energy sector carrying the biggest part of the burden.

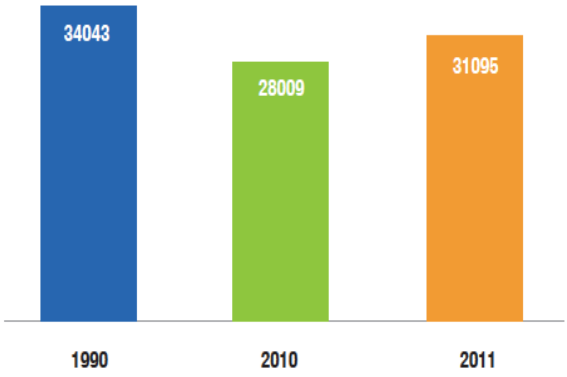

Figure 16 BiH´s total GHG emissions in Gg CO_2eq (UNFCCC, 2014)

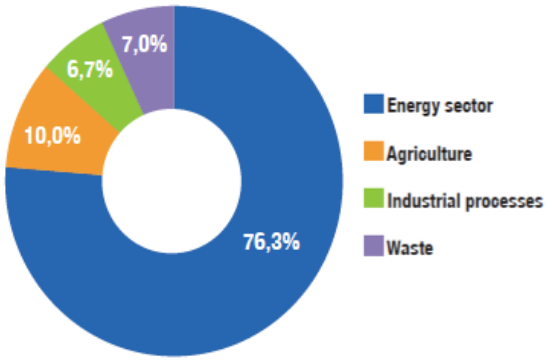

Figure 17 Total share of CO_2eq emission is BiH per sector for 2010 (UNFCCC, 2014)

An additional concern is the impact of emissions on the health of citizens of BiH. Mileusnić (2015) points out that the health costs of air pollution from coal burning amounts to about 20 % of national GDP. With the heavy use of coal-fired energy plants "Balkan countries will need to do their share in the global effort to reduce CO_2 emissions" (Mileusnić, 2015, 5). The urgency of doing so does not only reflect on the health of the citizens, but also the wellbeing of future generations.

It is no surprise that the high concentration of GHG emissions from the energy sector can be attributed to "coal production and thermal power plants in the electricity production sector" which also indicates that "these sectors represent the biggest opportunities for mitigation actions" (Knežević et al., 2013, 34). Figure 18 shows what that share per sector could look like in 2025 if BiH was to implement mitigation measures that would combat these emissions.

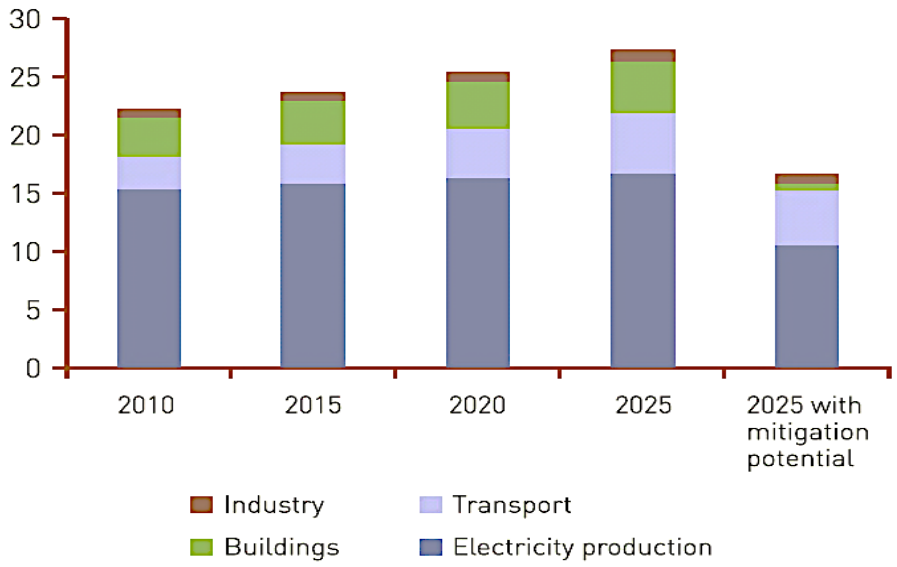

Figure 18 Trends and projections of emissions from fossil fuel combustion per sector (Knežević et al., 2013)

In BiH, external costs associated with air pollution are estimated by the World Health Organization to lower the total GDP by 20 % (Mileusnić, 2015). Data like this suggests that a shift away from "plants with substandard efficiency" (Mileusnić, 2015, 9) is not socially, but also economically justifiable.

To give an idea of what could come about for BiH in the future in relation to GHG emission mitigation actions, the UNFCCC Report (2014, 41) has developed three mitigation scenarios related to GHG emission reduction assuming use of RES (see figure 19 for graphic). In the first scenario (S1) the model assumes that there are no changes in the use of RES that may otherwise result from research, legalization and incentives in this field. All that would work towards increasing competitiveness and encouraging the use of new technologies.

The second scenario (S2) assumes a steady increase in the use of RES "by the gradual introduction of new technologies, (increased orientation towards RES); the launch of initiatives for large-scale use and domestic production of RES equipment (e.g. for solar energy); a closer and more systematic analysis of cost-effectiveness, sustainability and energy efficiency improvements; and the use of limited support and incentive schemes" (UNFCCC, 2014, 41).

Finally, the third and last scenario (S3) assumes that the use of RES is encouraged by authorities from our levels of government, funding schemes, use of newly-developed

incentives, the “full implementation of legislative provisions requiring the use of RES in new buildings larger than 500 m2 where this is technically and economically viable; accession of BiH to the EU by 2025 [...] extensive use of solar energy with planned coverage of about 200,000 m^2 by 2025 and proportionally by 2040; as well as increased use of geothermal resources with heat pumps in the household sector and SMEs” (UNFCCC, 2014, 41).

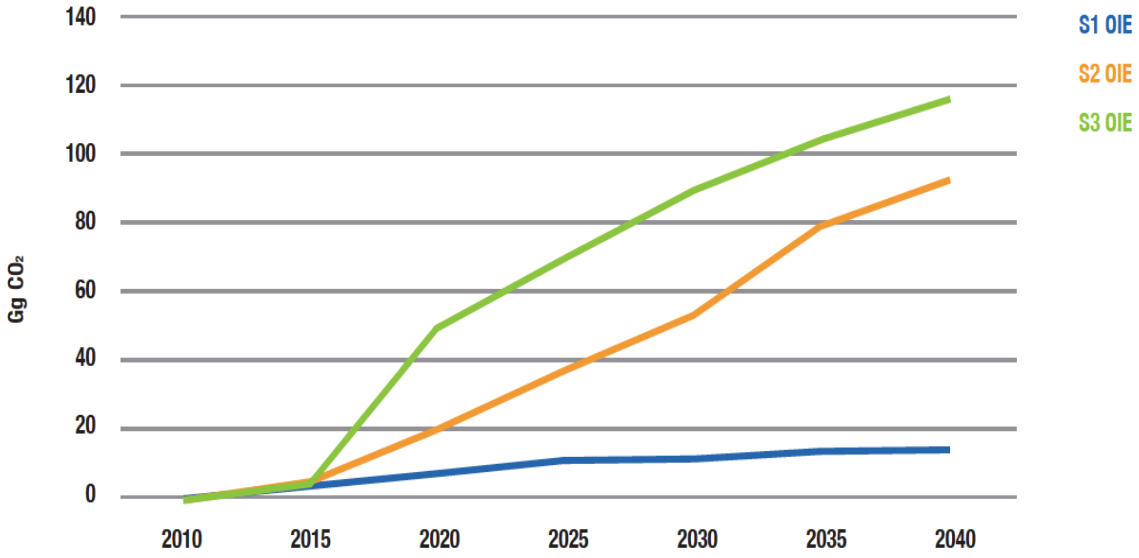

Figure 19 Comparison of CO_2 emission savings in BiH for the period 2010 - 2040 in BiH resulting from RES use (UNFCCC, 2014)

As the figure 19 indicates, the S1 scenario shows only a modest change in comparison to S2 and S3 scenarios that assume high use of RES in the short and long-run. It can be concluded that even with only partial adaptation (scenario S2) to RES use, the overall impact on CO_2 emission savings would be significant in the long run.

Thus, RES use would not only bring BiH closer to its goal to join EU, increase efficiency and GDP per capita, but also help combat the negative effects of global warming and pollution on health i.e. quality of life. Education on the interconnection of energy, environment, and human health is necessary, and “significant efforts are still needed to raise awareness at all levels of society, and to promote cooperation between all relevant stakeholders” (European Commission, 2014, 46).

This disregard reflects in the state legislation. For instance, there is no existing legislation “on environmental impact assessment at state level” (Energy Community, 2015, 74). However, these laws do exist on Entity level. Furthermore, the legal

framework governing the maximum Sulphur content in fuel oil and gas oil is not in line with BiH´s requirement under the Energy Community Treaty.

Thus, in 2013 the Energy Community Secretariat has "launched infringement action against BiH" (Energy Community, 2015, 76). All in all, "inter-institutional cooperation and coordination mechanism on climate change needs to be considerably strengthened to address the need to step up climate action in a sustainable manner, beyond the current project by project basis" (European Commission, 2014, 46).

Adherence to the Energy Community *acquis communautaire* will also remedy the fact that "BiH does not have an emissions allowances system as it is not a part of the EU Emissions Trading System. However, it has an obligation to implement Directive 2001/80/EC by 31 December 2017" (Salihović-Whalen, 2014).

What is more, under the UNFCC (2014, 70), BiH "has not yet established a mechanism for approving and submitting NAMAs (Nationally Appropriate Mitigation Actions)". Is this mechanism would be established, the country would be able to "record the demand for international support for the implementation of NAMAs and to facilitate the matching of financial resources, technology and capacity building support with these measures" (UNFCCC, 2014, 70). Use of CDM is another avenue through which investment may be attracted and can result in the "reduction or sequestration of greenhouse gases [...] while achieving the goals of sustainable development" (Softić & Glamočić, 2012, 18).

4 Reform of Traditional Energy Systems

To reiterate from the preceding chapters, looking at what BiH has committed to do in its aspirations to join the EU, it can be seen that BiH has somewhat "stagnated in further reforming its energy sector" (Energy Community, 2015, 56). On the other hand, BiH has "committed to a 40 % renewable target for 2020, starting from 34 % in 2009" (Energy Community, 2015, 68).

It is clear that legislative, political, and technical changes need to be made now in order to fulfill these commitments, and foster new developments in a positive direction. Otherwise, BiH risks missing its target for 2020 and delegitimizing its EU accession process.

Technological backwardness, irrational energy consumption, and divided authority (weak communication between state and entities, inadequate enforcement of agreements) are just some of the various problems of the energy sector in BiH. On the other hand, the strengths of the energy system in BiH are its hydropower potential, large reserves of coal, RES use potential, and potential positive economic potential" (Softić & Glamočić, 2012). These contrasts make up the energy landscape of BiH today and with the implementation of right mitigation measures, can present an optimistic path forward.

4.1 Efficiency Measures

Investment in mitigation actions that remedy energy inefficiency are one method with which to proceed. Some estimates suggest that up to 30 % of energy can be saved in the public and private sector. Such was the case with "energy efficiency programs in Bulgaria that showed that potential savings in public schools are 40 %, in Serbia 44 %" (Softić & Glamočić, 2012, 19). This is significant because quick return on investment can be achieved.

Softić & Glamočić (2012, 19) write that "in fact, there are no measures in the economy that are more profitable for BiH at this point than measures of investment in energy efficiency in the public sector", in accordance with the "main EU directive related to energy efficiency in the public sector is The Energy Services Directive (2006/32/EG)."

These measures include: “creating an action plan for energy efficiency in the public sector; applications of energy management schemes in the public sector at local levels of government; modification of the regulations related to public procurement in the areas related to energy efficiency and the strengthening of legislation [...], and creating a binding database and reporting mechanisms, as well as and databases in the public sector for comparison, monitoring and reporting” (Softić & Glamočić, 2012, 19).

Thus an energy efficiency Action Plan and database reporting in “accordance to the Eurostat / IEA / UNECE standards, including information on supply and demand for energy” (Softić & Glamočić, 2012, 20) can make significant strides toward energy savings.

It is important to keep in mind that with the rise of prices of electricity, poorer households are left vulnerable. With awareness of energy saving and implementation of these measures, they can combat potentially harmful effects to their quality of life. Figure 20 shows how households in SEE states have a larger share in electricity and energy consumption relative to OECD and EU states. Thus, these households are vulnerable to price changes and shortages. Also, this suggests that measures should be implemented that would increase efficiency of household consumption, thus lowering the share of electricity and energy use, while lowering expenditure.

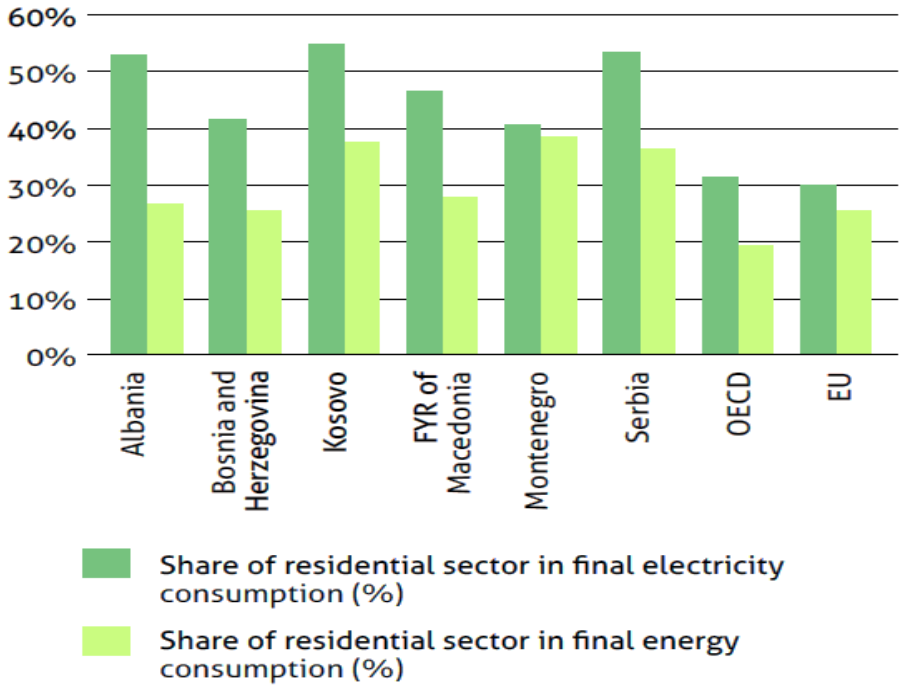

Figure 20 Residential sector´s share in final electricity and energy consumption (Mileusnić, 2015)

Additional measures to alleviate pressure off households would be to do some of the following: ”facilitate the residents of certain buildings to make decisions about renovations [...], or establish a targeted subsidy for households with lower incomes; make energy efficiency a priority for private houses and public buildings, if there is still some money left in the budget for reconstruction [...], establish a program for home renovations for the most affected with better insulation” (Softić & Glamočić, 2012, 20). These measures have had success in the Czech Republic and Romania.

Additionally, Softić & Glamočić (2012, 20) argue that it is necessary to “restructure the district heating system and reduce enormous distribution costs of thermal energy”, financing this “from funds that are used for power stations or fuel subsidies (direct fuel subsidies) during winter.” In any case, greater efficiency results in lower expenditure, thus justifying the investment in these measures.

Correspondingly, improving energy efficiency is of growing interest to businesses. Studies show that energy costs are a significant part of operating costs (Avdić, 2009). The trend of rising energy prices is another contributing factor that motivates toward investment in more efficient energy production and the modernization of energy systems (Avdić, 2009).

Plus, these moves are justified with return on investment, increase in competitiveness, and the fact that clean and efficiently made products are ever more important to consumers when making purchasing choices. All in all, an increase in profits can be expected for more than one reason. Moreover, Avdić (2009) adds that with savings made from saving on energy costs, production can be increased and expanded.

4.2 Reform of Coal Power Plants

Through a multi-criteria sustainability assessment, Afgan, Begić, & Kazagić (2007, 43) assessed “potential options for capacity building within the energy power system of BiH”, with the aim of helping decision-makers chose the overall most sustainable and efficient choice considering “functional requirements, costs, possibilities, and risks.” The options included both RES technologies and fossil fuel clean solutions that could be implemented in JP Elektroprivreda BiH owned power plants.

Other options that rank high on the sustainability index are reconstructing of pulverized coal-fired power plant and a combined cycle gas turbine power plant use. However, if the “economic indicator with the domination of the power price indicator” (Afgan, Begić, & Kazagić, 2007, 51) is given advantage, the option of reconstructing a pulverized coal-fired power plant falls down on the sustainability index and options of biomass, wind and solar power plants become more sustainable. “Preference should be given to projects that are based on the combined production of heat and electricity” (Softić & Glamočić, 2012, 20) because they promise most in terms of efficiency.

As discussed in preceding chapters, heavy reliance and inevitable expansion of coal-generation capacities contrast harshly with BiH´s commitments to lower GHG emissions and combat global warming. This “contrast sharply with the situation in the EU, where most countries are giving up building new coal plants and seven EU states are already coal-free” (CEE Bankwatch Network, 2016b, 1).

The coal mining sector employs a substantial part of the population and it is too idealistic to expect this situation to drastically change anytime soon. A country with a vulnerable working class, and relatively high employment levels, would be hurt by any drastic measures that would call for a step away from the coal-fueled energy sector in the short and medium-run.

Looking at energy reserves, “coal accounts for 93 % of the total energy potential of BiH. Exploited for now are only lignite and brown coals [...], based on them, strong thermal systems have been built [...]. Analyses show that for the next fifteen-year period (and probably longer) coal has certain energy market prospects in BiH” (Softić & Glamočić, 2012, 21). Coal presents a strong option for energy producers in BiH and this means that the processes of coal burning should be made to be as clean and efficient as possible. At the same time, other RES systems should be developed to function as an alternative to coal in the long-run.

Figure 21 gives a comparative view of this utilization of coal. In SEE states, with the exception of Albania, coal is an integral part of the energy sector. In the EU and OECD this is not the case. If BiH and other aspiring EU member states model their policies and strategies in line with that of the EU, we can expect a change in these shares in the long-run.

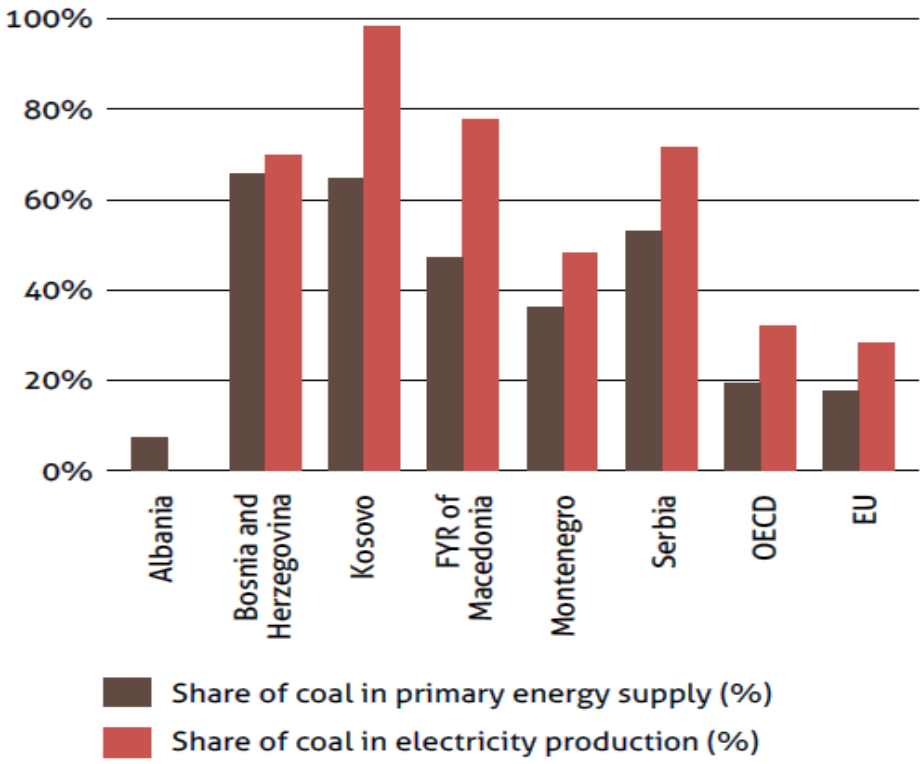

Figure 21 Share of coal in primary energy supply and electricity production (Mileusnić, 2015)

To reiterate, quite simply, in the short and medium run, use of coal to generate power, cannot be simply replaced in BiH with the use of RES. This means that BiH must work with what it already has as a starting point. With new implemented EU legislation, new coal thermal plants must comply with best practices and have an efficiency of 40 % minimum. Old coal-generated power plants have high emissions (approximately 1.3 t CO_2/MWh) and about 30% efficiency.

Knežević et al. (2013, 35), argues that if only the existing capacity were to be replaced with an improvement of efficiency from 33 % to 40 % and in accordance with Directive 2001/80/EC on the limitation of emissions, "the total emissions would be reduced by some 4.8 Mt/a. In addition, 0.15 Mt equivalent of CO_2 annually could be reduced by capturing and using the methane from existing coalmines". Table 4 gives a comprehensive list of individual possible mitigation actions and their mitigation potential.

In fact, "the total mitigation potential of the electricity production sector – compared to taking no mitigating action – is between 3.62 Mt to 6.09 Mt CO_2 equivalents annually by

2025, depending on the installed capacity of new thermal power plants" (Knežević et al., 2013, 36).

Table 4 Potential emission reduction actions in electricity generation compared to business as usual (Knežević et al., 2013):

Mitigation action	Technical reduction potential (Mt CO_2 eq)
Replacement of existing thermal power plants (30% efficiency) with new ones (40% efficiency)	4.8
Building all planned thermal power plants: increasing installed capacity from 1,675 MW to 3,200 MW, improving efficiency from 30% to 40%	-4.85
Biomass co-generation plants 200 MW	0.88
New hydro power plants	0.11
New wind generation	0.15
Capturing and utilising methane from coal (Zenica, Breza)	0.15
Total mitigation potential of the electricity sector	– 3.62 to 6.09

Furthermore, a gradual change toward the replacement of existing power plants and a long-term view of dependence on RES, would "make it possible to gradually restructure their economy at low cost" (Knežević et al., 2013, 62). Again, this would be an outcome of a long-run strategy.

Poland is oftentimes taken as an example that coal-intensive energy sector is "not in a contradiction to EU membership" (Mileusnić, 2015, 9). However, what is not said is that the Polish coal industry is facing many challenges. For instance, "mining companies are experiencing major losses" and "planned projects are already being abandoned" (Mileusnić, 2015, 9).

Furthermore, at the time of accession, Poland had a much better negotiating position in regard to its geopolitical situation, which offset its drawbacks from its coal-intensive energy sector. This is leveraging that Balkan states do not have. If anything, the example of Poland can serve as another reminder to BiH, that even states that are already member of the EU, must remodel their GHG-heavy practices.

There are plenty of grounds for positive cooperation and development through the Energy Union. The EU should use this "as the basis for re-engaging with the Balkans and promoting positive solutions, instead of pushing them to become the dumping

ground for dirty energy projects." (Mileusnić, 2015, 14) Figure 22 shows that by 2020, the share of coal in planned generation capacity will still be substantial.

In February 2015, the Energy Union Strategy "declared the EU´s determination to decarbonize by 2050 and enable the transition to a low carbon economy by ending support to fossil fuels, including coal" (Mileusnić, 2015, 13). Mileusnić (2015) questions whether further development of coal-burning capacities in its neighborhood could in fact be a testament to EU losing reforming leverage in the region and suggests that it directs its pre-accession assistance into supporting environmentally-friendly projects.

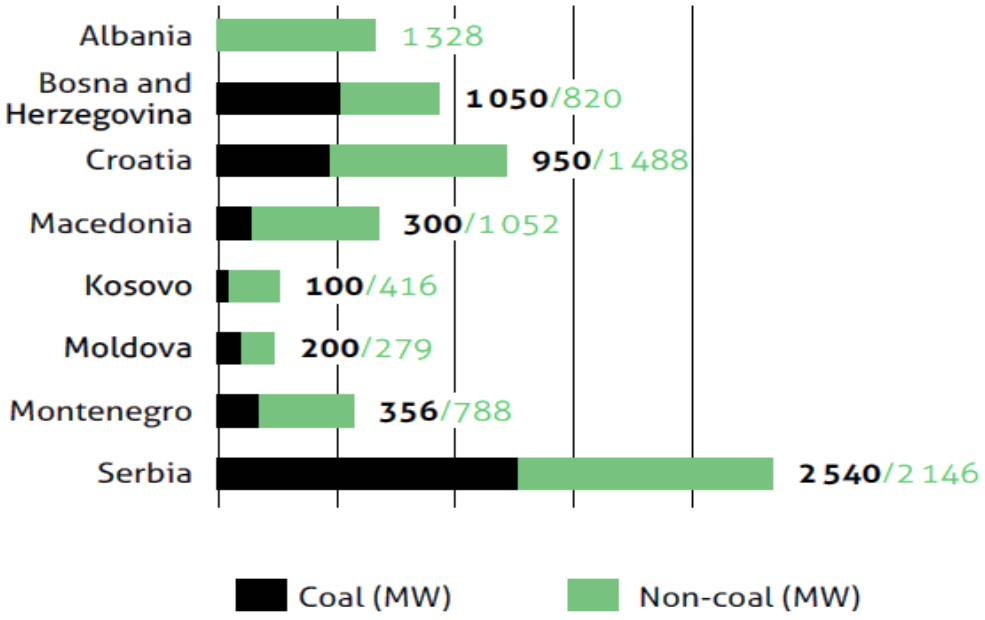

Figure 22 Share of coal in planned generation capacity by 2020 (Mileusnić, 2015)

4.3 Developing a Gas Infrastructure

It is also realistic to expect natural gas utilization to stay a common fixture on BiH´s energy market in the short and medium-run. If it is to judge by international negotiations, BiH still eagerly participates in any future plans on international pipelines that would ensure a secure supply of natural gas to its territory.

Adopting a law on gas is one of the obligations of the Energy Community Treaty (European Commission, 2015). The Energy Union came into being from the 2009 gas crisis and thus emphasizes security of gas supply in its agenda. The EU-conducted

Gas stress test in the wake of the recent Ukraine conflict rated BiH as “highly vulnerable to another tap closure, as they are fully reliant on Russian gas dispatched via Ukraine” (Mileusnić, 2015, 5). This comes to no surprise, as BiH´s dependency on foreign gas, as described in detail in chapter 2, has not been remedied.

The development of the gas sector would be “unquestionable in terms of strategy” if done in conformity with national and regional interests, and “from the aspect of the economic development, and primarily development of small and medium industrial and agricultural businesses, the gas is the best energy choice” (Softić & Glamočić, 2012, 23).

Furthermore, in all of Europe, “BiH consumers buy the most expensive gas in Europe, and have completely unreliable supply” (Softić & Glamočić, 2012, 24). Again, consequences of this became clear during the 2009 Gas Crisis. Any reform should be in line with “the EU Gas Directive and liberalization of markets, which is a prerequisite for integration into the European market” (Softić & Glamočić, 2012, 24).

The gas sector development hinges strongly on international developments. In 2013, the South Stream project was abandoned due to the active Ukraine-Russia conflict. The preferred project at present is the Trans Adriatic Pipeline (TAP), which connects to BiH through the connecting Ionian Adriatic Pipeline (IAP), which is due to start its 2-year construction in 2016. The following figure 21 shows all the planned pipeline projects in BiH to date. The following figure 23 shows all the planned pipeline projects in BiH to date.

Gas also represents an alternative to coal use – “it is estimated that, with application of modern gasification processes, one million tons of coal, which is a realistic increase for the mining sector, could fully substitute the present imports of natural gas” (Softić & Glamočić, 2012, 23). Further improving bilateral relations with its neighbors and regional cooperation is “an essential part of Bosnia and Herzegovina´s process of moving towards the EU” (European Commission, 2014, 23).

However, just substituting coal for another non-environmentally friendly energy fuel (and an energy fuel that has to be imported at that) is not a game-changing strategy.

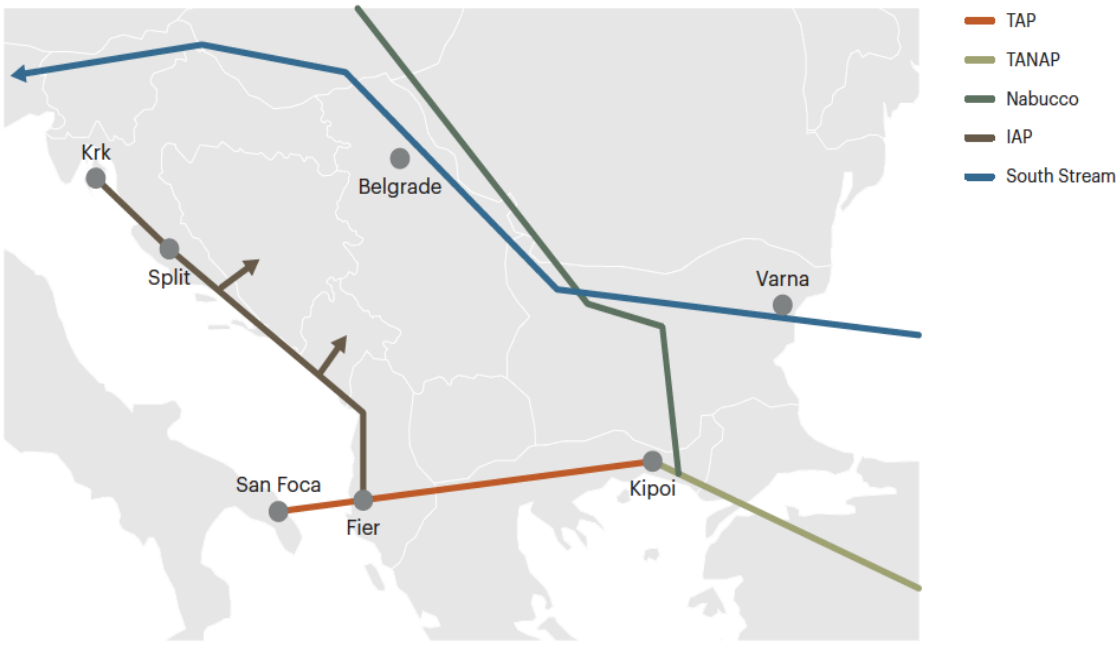

Figure 23 Gas pipeline projects in the Balkans (Zibret et al., 2014)

5 Potentials of New Renewable Energies

BiH has a hopeful future if it chooses to go down the RES route. Estimates suggest that BiH has the greatest potential of all countries in the Balkans and could possibly produce 30 % more energy from RES than the EU average (Softić & Glamočić, 2012, 4). Introduction on new technologies cannot only increase BiH energy security, but also have a positive impact on other sectors such as tourism, agriculture, etc. Gvero et al. (2010) highlights use of renewable energy technologies (RETs) as potential "major economy drivers, not only in BiH, but in the whole region".

The highest potential lies in the development of small hydropower, solar, wind, and geothermal energy systems. Small-scale hydroelectric, photovoltaic, and biomass stations are the ones attracting most attention from foreign investors (Salihović-Whalen, 2014). Potential energy from renewables is estimated to be 6.8 GW for hydropower stations, "2 GW from wind, 33 MW from solar, 18 TWh/a from biomass," and 40 GWh per year from geothermal (Salihović-Whalen, 2014). For the Energy Community, BiH´s geothermal energy potential is in second place. Thus, RES use in energy generation can also have significant impact and mitigation potential in BiH.

5.1 Hydro Power

When it comes to hydroelectric power potential, BiH is listed as 8th in Europe (first in the Balkans) and it currently only uses 37 % of its estimated potential (current production capacity is 2100 MW) (Softić & Glamočić, 2012, 4). There "are a large number of possible opportunities related to infrastructure projects on the rivers Drina, Neretva, Bosna, Una, Trebisnjica, and Vrbas" in particular (Softić & Glamočić, 2012, 8). In addition to this, the "development of over 200 small hydropower plants on other rivers" is also perspective (Softić & Glamočić, 2012, 8).

Along with major water streams who´s potential is estimated to be around 18,000 GWh per year, "BiH has available hydro energy potential of small water streams" (Gvero et al., 2010, 642; Knežević et al., 2013). All in all, "technical water power potential of 356 small and big hydro power plants (HPP) (which may be built) amounts to 23,395 GWh per year, out of which 2,599 GWh per year is in small HPP" (Gvero et al., 2010, 642).

Gvero et al., 2010 (648) highlight the benefits of hydro power utilization, and write: “if we suppose, that hydro potential for small HPP would be realized by 80 %, it means, it could be built ca. 800 small HPP with the potential installed capacity of 700 MW and possible annual energy production of 3600 GWh. Taking into account necessity of connection of small HPP with other economy activities as agriculture or tourism, it is obvious that this kind of business can be very promising, and first of all sustainable”. SHPPs could be used to create localized supply and demand networks that would optimize the operation of the grid.

It is sure that the development of hydropower plants “represents a promising source of renewable energy in Bosnia and Herzegovina” (Knežević et al., 2013, 22). Moreover, a move toward this would also offer “significant opportunities for ‘green economy’ development, with the potential involvement of small- and medium-sized enterprises (SMEs) in their construction and operation” (Knežević et al., 2013, 22).

In fact, “there has been a strong interest from domestic and international investors in the construction of SHPPs” and wind parks in Bosnia and Herzegovina in recent years. The development of SHPPs is most economically viable RES in Bosnia and Herzegovina at present. The current utilization degree of SHPP is 4.4 % of available power, or 5.7 % of the available energy. There are 30 SHPPs installed with a total capacity of approximately 40 MW and an annual electricity production of approximately 200 GWh” (Knežević et al., 2013, 63).

What was concluded is that reconstructing of hydro power plant of 6x25 MW power installed was the option with the highest sustainability index. The upgrading involves the installing of the newest Francis turbines and results in an “additional 30 MW of installed power, and an increase of efficiency by 4 % provided through the increasing of design head by 6 m, increasing of installed flow by 10 %” (Afgan, Begić, & Kazagić, 2007, 45).

Additionally, hydropower potentials are sensitive to climate change. It is established that climate change comes hand in hand with low river flows in the region. This could jeopardize energy that could be derived by hydro power plants and destabilize the net position of a country who is an electricity exporter and largely reliant on the utilization of its hydro-power. BiH would have to up its coal production to compensate – a move that is “neither economically viable or environmentally friendly” (Knežević et al., 2013, 23).

Again, this is another instance where environmental and energy goals go hand in hand. Thus reinforcing the idea that the move toward restructuring the energy sector in favor of clean energy solutions is the one that makes the sense for the country in a transitional period.

5.2 Wind Power

As with hydro-power, new methods to derive electricity from wind are gaining in popularity. To harness potential electricity from wind, “an appropriate incentive system to build wind power installations is [needs to be] introduced” (Gvero et al., 2010, 644, Softić & Glamočić, 2012; Knežević et al., 2013).

For reasons of operational security, “NOS BiH capped the capacity of wind farms to be connected to the grid” and “capacity is currently limited at a rather conservative level of 350 MW” (Energy Community, 2015, 68). Improvements on the stability and security of the transmission network are necessary to support these new electricity systems. There is limited grid access “to 350 MW for wind - 230 MW for the Federation of BiH and 120 MW for Republika Srpska” (CEE Bankwatch Network, 2016b, 6).

At present, “16 macro-locations (with 33 micro-locations) are marked as good potential. Total estimated installed capacity for these locations is 720 to 950 MW, implying annual production of 1440 to 1950 GWh. The infrastructure offers adequate conditions for connecting possible locations to the grid, as the high- and medium-voltage network is well developed” (Gvero et al., 2010, 644). The first commercial wind farm has been planned for years and just recently been given the go ahead (CEE Bankwatch Network, 2016b).

5.3 Solar Power

Similarly, incentive schemes are needed to encourage the development and the use of solar energy technology. Knežević (2009) points out that social and economic awareness of RES use is necessary to achieve greater overall potential of RES use. BiH, a naturally abundant country has smaller utilization because of this lack of socio-economic acceptance. Therefore, Knežević (2009) recommends that measures on increasing RES-use, focus on socio-economic awareness raising, and lowering market barriers. As figure 24 shows, this would elevate the nature of the market to a positive

one with various options to utilize this potential. Arguably, this model applies to all types of energy if we assume that increased awareness and interest leads to a future development of technologies that would allow greater efficiency of utilization, and also lead to economies of scale that would lower the price of the same technologies.

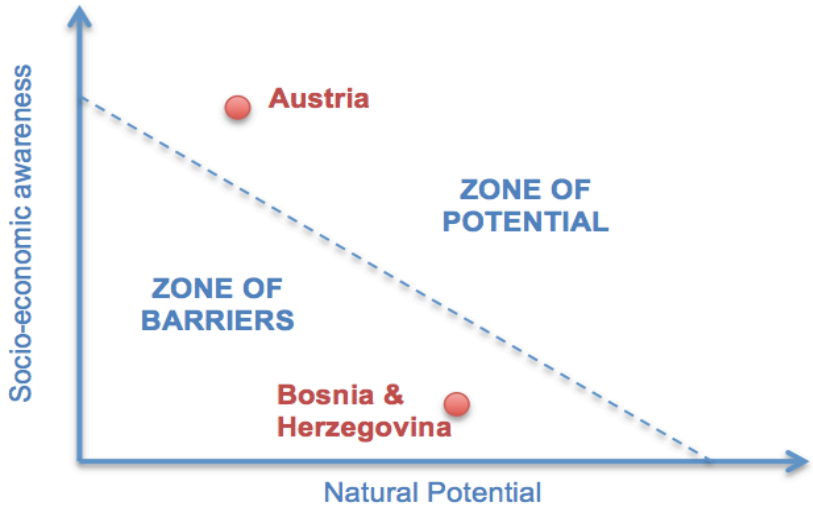

Figure 24 Socio-economic awareness of RES potential vs. natural potential (Knežević, 2009)

On average, solar radiation is about 40 % greater in Balkan states than the European average (Petrović et al., 2014, 32). The potential for use of solar energy on the territory of BiH ranges between 1,240 to 1,800 kWh/$m^{2,}$ as shown in figure 25 (Petrović et al., 2014, 28). The use of solar energy can be of great significance in BiH for its economy and environment.

Germany, a country with developed PV use and the most successful world-wide at that, has a yearly potential of about 850 kWh/kW_p which is 65 % less than that of Balkan states (Petrović et al., 2014, 32). In 1999 Germany has launched a program called 100,000 roofs´ that offered compensation for installed PV panels. The program was so successful that it was completed in 4 years (planned for a 10-year period).

The electric grid also benefited from this programme because some burden was taken off the grid during the most-intensive peak hours (Petrović et al., 2014). Investment was fostered with guaranteed compensation for produced energy. Today, Germany has the biggest number of PV producers and employs more than 20,000 people in this industry (Petrović et al., 2014, 32).

A similar situation can be observed in Austria, a country with a 30 % smaller solar potential than BiH, is a record-making country in the surface of installed solar collectors

per capita (Petrović et al., 2014, 32). Like Germany, Austria´s success can be attributed to the PV program called 200 kW_p roof program.

It is reasonable to assume that BiH could witness similar success if its government instated and supported similar programs. BiH has recently seen an influx of PV technologies, but this has not been accompanied with significant state planning. Petrović et al. (2014) point out that the lack of success to date is due to the lack of promotion of the benefits of PV systems, the existence of significant barriers to investment, and the limit to bank support for the purpose of RES project investments.

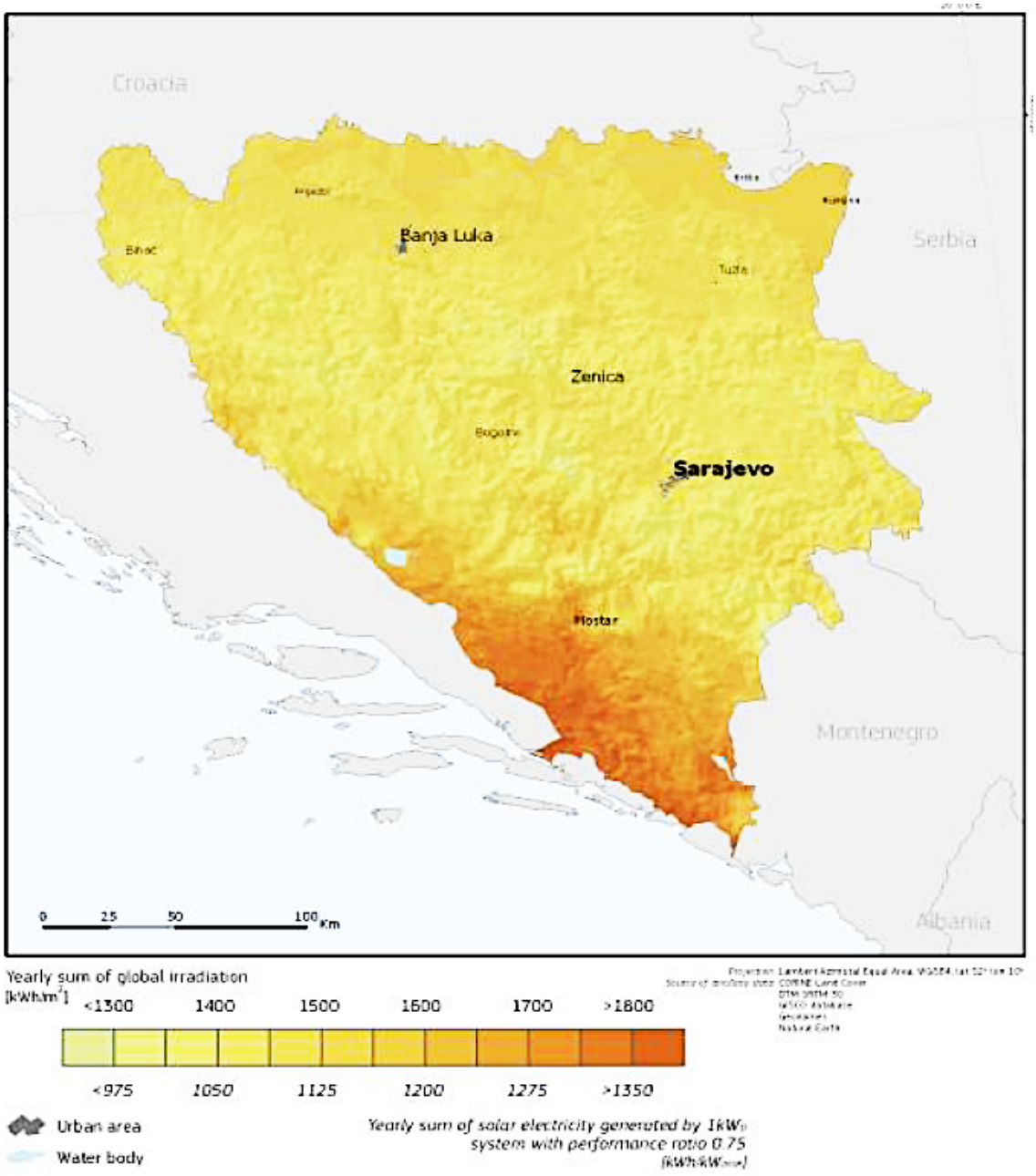

Figure 25 Solar potential of BiH (Petrović et al., 2014)

According to a study conducted by Greenpeace and EPIA, each MW of energy produced by a solar energy project creates 10 new employment opportunities, 33 new spots are created during the installation period, 3 to 4 sports during the sales and indirect delivery period, and 1 to 2 spots are opened in the research sector (Petrović et al., 2014, 99). Figure 26 is a visual representation of this data. For a country where employment is of great social significance, promotion of this sector would be of great benefit.

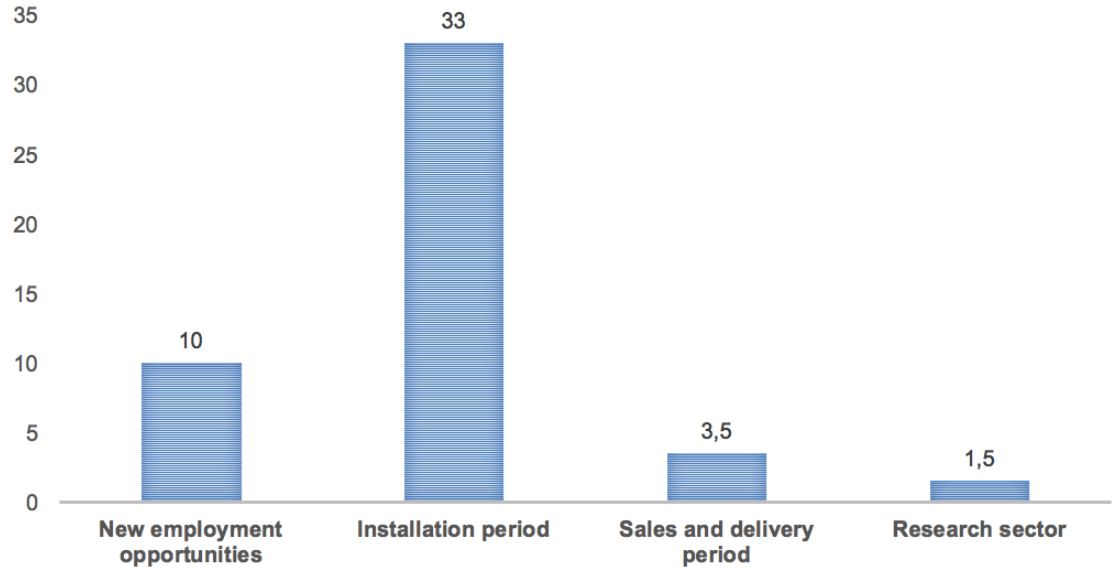

Figure 26 Potential employment benefits of a solar energy project (data: Petrović et al., 2014)

Further benefits would also extend past the employment sector and translate into less dependence on energy imports. PV systems can be of great benefit during high-temperature days, when the efficiency of hydro-electric dams is of lower efficiency because of lower stream levels. Use of these systems in tandem could complement each other. For BiH, a country that exports its electricity, this mechanism benefits the economy and takes pressure off during high-stress periods. Individual units can be used strategically in households throughout the day to power a variety of electric devices. Also, use of solar heaters and panels may substitute use of firewood and coal for household heating (Agency for Statistics of Bosnia and Herzegovina, 2015b).

BiH already has good foundations for the production of thermal solar systems, but these have not experienced commercialization (Petrović et al., 2014, 100). If the state chooses to support this move it could be a good step in the promotion of greater

energy efficiency and cleaner energy systems. Also, it would aid the long-term restructuring of the energy sector, with BiH becoming a producer of these systems for the wider region.

The EU Directive 2009/28/EZ on the promotion of renewable energy sources and installation capacity of these by the end of 2020 is in line with this investment scenario and would thus make sense for the state, not only of the economic level, but also of the political level in terms of regional cooperation and EU accession.

Measures that can be made in the short-run are the reduction of tax set on solar equipment as the current one is too high and therefore hinders their use; and later – the fostering of local measures of production with the aim to develop a local and regional market over the next 30 years (Petrović et al., 2014).

Assessment of already ongoing trends suggest that solar power utilization in BiH has a realistic future “in the period until 2020”, and it will have a “more significant application for production of electrical energy”, beyond “individual construction of low-power photovoltaic systems (negligible for the energy balance of BiH), and the same trend is to be expected even until 2030” (Gvero et al., 2010, 649). However, taking down obstacles in the form of incentives is absolutely necessary.

6 Summary and Conclusions

This paper has strived to answer the question on what the future landscape of Bosnia and Herzegovina´s energy sector in the context of EU accession might look like. The global trend of energy use in Europe is changing and Bosnia and Herzegovina has not been left immune to these winds of change. Questions on how renewable energy solutions may be implemented, how the current outdated energy sector might be reformed, and how environmental concerns will be addressed have created this new debate.

It is clear that Bosnia and Herzegovina has reached a metaphorical crossroad of sorts. How may its current carbon-intensive energy generation be coupled with the vision of Bosnia and Herzegovina in the EU, with EU´s 2020 energy targets? This thesis has found that it is possible to find common ground. Now is the time for Bosnia and Herzegovina to address its evolving energy demands, the state of its environment, and its political standing in regards to the EU. Implementing EU Directives is an action that would put Bosnia and Herzegovina on a faster track towards the EU. Luckily, these Directives address Bosnia and Herzegovina´s energy sector weaknesses and plays into its strengths.

Bosnia and Herzegovina is going down a path that it has never been on. It needs to develop a comprehensive, cohesive, and above all realistic short-, medium-, and long-run strategy to guide it toward its goals. This thesis has shown that this strategy needs to focus on the following key issues: forming a national-level strategy, full implementation of EU Directives, streamlining administrative and legislative processes, improvements of the electricity grid to combat technical losses, implementing mitigation measures, and creating incentive schemes that would foster renewable energy projects.

As was extensively discussed, Bosnia and Herzegovina faces many challenges with its transition toward an energy system more in line with that of the EU. There is a lack of vertical integration (between the Entities, districts, and municipalities) and horizontal integration (between the Entities and BD), coordination, and cooperation within the State´s administrative and legislative apparatus. The EU accession process is the main driving force toward reform because it motivates the state to strive to harmonize its laws with the *acquis communautaire*.

The Energy Community asks for more cooperation on the state level, as opposed on the entity level. Cooperation on the state level, in the form of a national strategy to approach efficiency and renewable energy challenges, would add a dose of security for reluctant investors who have been discouraged thus far because of the complexities of the current system that is stratified and divided between various layers of current (politically imposed) administrative and legislative barriers. Serious implementation of the remaining EU Directives and relevant international treaties also ties into this. It is necessary that this barrier be tackled as soon as possible. This thesis has shown that problems associated with this barrier connects to other issues as well. This strategy would also need to combat the insufficient private sector activity in the electricity sector.

Mitigation measures that increase efficiency of current hydro and coal-powered plants, and ensure cleaner combustion can be implemented immediately within the current framework. These mitigation measures will also lead to savings in energy expenditures. These savings may be invested elsewhere in the sector where needed. Importantly, the electricity grid needs a rejuvenation. The outdated infrastructure needs replacement. Many options hinge upon improvement of the grid. The grid must be able to accommodate new inputs from renewable energy producers.

Also, savings from the grid may be used to invest in making incentive schemes and promote the national strategy. Limited information, unreliable databases, and lack of awareness in general are an important barrier that needs to be overcome. This can be done with awareness-raising and education programmes that would translate into capacity building for the sector.

Laws and measures must be socially sensitive in regards to vulnerable customers. As this thesis has presented, households use a big chunk of gross final electricity and energy consumed. A strategy that envisions a new energy system must take this into account.

Developing strategic reserves for gas and oil are necessary for the short and medium-run, as argued in this paper. In the medium-run, problems associated with gas and oil security should be mitigated. Furthermore, Bosnia and Herzegovina´s sole refinery needs to update its operating model and efficiency. Then in the long-run, measures should be in place to slowly phase out use of non-environmentally friendly fuels. With

the development of a new strategy, the pressure set on using these traditional energy fuels will subside, but in the meantime, the vulnerable working class must be not be left vulnerable.

Overall, supporting RES use lessens the dependency on traditional energy fuels, and takes pressure off the electricity grid. This also improves the net position of Bosnia and Herzegovina as an electricity exporter, making it more competitive on international markets. This sort of approach also directly fosters foreign investment in domestic energy systems and creates a snowball effect on the greater economic, social, and political image of the whole of Bosnia and Herzegovina.

Renewables require no fuel and result in reduced energy expenditures in the long run. Another important benefit is eliminating health risks associated with fossil fuel burning and pollution. In the long run, Bosnia and Herzegovina should be able to see a positive impact of these policies on its citizens´ quality of life and employment choices, the health of its economy, the quality of its environment, lowered GHG emissions, and improved regional and international cooperation.

According to all that has been discussed and presented in this paper, renewable energy use, clean energy systems, and efficiency measures have significant climate change mitigation potential. Also, a move toward the use of the same will put Bosnia and Herzegovina closer toward its future political and economic goals, as it reaps the benefits of alternative development pathways. Implementation of RES projects are closely related to the economic sector. More research and studies should be conducted in specific applications of clean energy technologies and mitigation measures, as mentioned in this paper. Documentation of specific results should be meticulously documented, as this would be worthy to all future researches and policy shapers interested in this topic.

Steps toward reforming the energy sector that take into account the use of renewable energy sources, clean technologies, and mitigation measures make economic, social and political sense for Bosnia and Herzegovina and can greatly improve the situation in the state on all levels if implemented strategically, and in the best interest of the greater population.

Bibliography

Afgan N., Begić F., Kazagić A. (2007): *Multi-criteria sustainability assessment – a tool for evaluation of new energy system*. Thermal Science: Vol. 11, No. 3. pp 43-53.

Agency for Statistics of Bosnia and Herzegovina. (2015a): *Energy Statistics: Natural Gas.* Year VI. Number 6. Available from: http://www.bhas.ba/

Agency for Statistics of Bosnia and Herzegovina. (2015b): *Energy Statistics: Preliminary Results Survey on Household Energy Consumption*. Year I. Number 1. Available from: http://www.bhas.ba/

Agency for Statistics of Bosnia and Herzegovina. (2015c): *Energy Statistics: Electricity and Heat*. Year VII. Number 7. Available from: http://www.bhas.ba/

Agency for Statistics of Bosnia and Herzegovina. (2015d): *Energy Statistics: Short-term Indicators of Energy Statistics.* Year IV. Number 6. Available from: http://www.bhas.ba/

Agency for Statistics of Bosnia and Herzegovina. (2015e): *Energy Statistics: Coal.* Year VI. Number 6. Available from: http://www.bhas.ba/

Avdić, S. (2009): *An analysis of investing in increasing energy efficiency* (*Analiza investicije u povećanje energetske efikasnosti)*. Ceteror Sarajevo.

CEE Bankwatch Network. (2016a): *China-SEE energy projects update*. Available from:http://bankwatch.org/sites/default/files/briefing-China-SEEcoal08Oct2014.pdf

CEE Bankwatch Network. (2016b): *Western Balkans countries invest at least 2.4 times as much in coal as in wind power*. Available from: http://bankwatch.org/publications/western-balkans-countries-invest-least-24-times-much-coal-wind-power

Claussen, E. (1995): *Environment and Security: The challenge of integration*. ECSP Report 1: Feature Articles. [online]. pp. 40-43. [Accessed 30 Jul. 2015]. Available from: http://www.wilsoncenter.org/sites/default/files/report1a.pdf

Dabelko, G.D. and Dabelko D.D. (1995): *Environmental Security: Issues of Conflict and Redefinition*. ECSP Report 1: Feature Articles. pp. 3-13. [Accessed 30 Jul. 2015]. Available from: http://www.wilsoncenter.org/sites/default/files/report1a.pdf

Energy Charter Secretariat (2012): *PEEREA In-Depth Review of Energy Efficiency Policies and Programmes: Bosnia and Herzegovina*.

Energy Community (2015): *Annual Implementation Report*. Available from: https://www.energy-community.org/portal/page/portal/23B450386A075E64E053C92FA8C0F69F

European Commission (2014): *Bosnia and Herzegovina 2014 Progress Report*. Available from: http://ec.europa.eu/enlargement/countries/package/index_en.htm

European Commission (2015): *Bosnia and Herzegovina 2015 Report*. Available from: http://ec.europa.eu/enlargement/countries/package/index_en.htm

Forsund, F. R. (2007): *Hydropower Economics*. Springer Science+Business Media, LLC

GEA (2012): *Global Energy Assessment: Toward a sustainable future.* Cambridge University Press. Cambridge, UK.

Graeger, N. (1996): *Environmental Security?.* Journal of Peace Research, Vol. 33, No. 1 (Feb., 1996), pp. 109-116

Gromet, D. M., Kunreuther, H., and Larrick, R. P. (2013): *Political ideology affects energy-efficiency attitudes and choices.* Proceedings of the National Academy of Sciences, 110 (23), pp 9314-9319. Available from: http://www.pnas.org/content/110/23/9314.short

Gvero, P.M., Tica, G. S., Petrović, S. I., Papuga, S. V., Jaksić, B. M., Roljić, L. M. (2010): *Renewable Energy Sources and Their Potential Role in Mitigation of Climate Changes and as a Sustainable Development Driver in Bosnia and Herzegovina*. Thermal Science: Vol. 14, No. 3, pp. 641-654

Knežević, A. (2009): *Are non-carbon energy sources alternative sources? (Da li su nekarbonski izvori energije alternativni izvori?).* Ceteror Sarajevo.

Knežević, A., Kaplina, A., Husika, A., Carrington, D., Arnautović Aksić, D., Jordan, G., Trbić, G., Stritih, J., Tabaković, L. Kotur, M., Cupać, R. (2013): *Climate Change Adaptation and Low Emission Development Strategy for BiH.* Council of Ministers of Bosnia and Herzegovina.

Kopsakangas-Savolainen, M., Svento, R. (2012): *Modern Energy Markets: Real-time pricing, renewable resources and efficient distribution*. Springer-Verlag London.

Litfin, K.T. (1999): *Constructing environmental security and ecological interdependence*. Global Governance, 5(3), pp 359-377.

Malkočević, A. (2006): *Incentives and barriers for the development of renewable energy sources Bosnia and Herzegovina: country analysis*. Centar za ekologiju I energiju.

Matthew, R.A. (1995): *Environmental Security: Demystifying the concept, clarifying the stakes.* ECSP Report 1: Feature Articles. pp. 14-23. [Accessed 30 Jul. 2015]. Available from: http://www.wilsoncenter.org/sites/default/files/report1a.pdf

Mileusnić, D. (2015): *Beyond Borders: How Energy Union can turn the tide against coal in the Western Balkans.* CAN Europe.

Myers, N. (2002): *Environmental security: What´s new and different*. pp 1-14. [Accessed 31 July 2015]. Available from: http://www.envirosecurity.org/conference/working/newanddifferent.pdf

Pasic, L. (2011): *Sources of Energy in Bosnia and Herzegovina and Implication for Energy Security*. Balkan Analysis. [Accessed: 23.04.2016]. Available from: http://www.balkanalysis.com/bosnia/2011/05/09/sources-of-energy-in-bosnia-and-herzegovina-and-implications-for-energy-security

Petrović, M., Bolić, A., Sjenar, Z., Madesko, M., Kalco, M., Alomerović, A., Njego, A., Rodić, A., Ademović, A. (2014): *A study of the possibility of solar energy use with the purpose of gaining thermal and electric energy on the territory of the city of Bijeljina and the Bogatic municipality.* (*Studija izvodljivosti o mogucnosti koriscenja solarne energije za potrebe dobijanja toplotne I elektricne energije na podrucju grada Bijeljina I opstine Bogatic)*. Enova Consultants and Engineers.

Pidgeon, N., Demski C., Butler, C., Parkhill, K., and Spence, A. (2014): *Creating a national citizen engagement process for energy policy*. Proceedings of the National Academy of Sciences of the United States of America, 111(4), pp 13606-13613. Available from: http://www.pnas.org/content/111/Supplement_4/13606.full.pdf+html

Pleßmann, G., Erdmann, M., Hlusiak, M., and Breyer, C. (2014): *Global energy storage demand for a 100% renewable energy supply*. Energy Procedia, 46, pp 22-31. Available from: http://www.sciencedirect.com/science/article/pii/S1876610214001702

Salihović-Whalen, N. (2014): *CMS guide to electricity - Bosnia and Herzegovina*. [Accessed: 24.04.2016]. Available from: https://eguides.cmslegal.com/electricity/1.0/bosnia_and_herzegovina.html

Softić, A., Glamočić, Lj. (2012): *National background report on Energy for Bosnia and Herzegovina*. WBC-INCO.NET.

Trombetta, M.J. (2008): *Environmental security and climate change: Analyzing the discourse*. Cambridge Review of International Affairs, 21(4), pp 585-602. Available from: http://dx.doi.org/10.1080/09557570802452920

UNFCCC (2014): *First Biennial Update Report of Bosnia and Herzegovina under the United Nations Framework Convention on Climate Change*.

UNDP (2016): *Energy and Environment*. UNDP in Bosnia and Herzegovina. http://www.ba.undp.org/content/bosnia_and_herzegovina/en/home/ourwork/environmentandenergy/overview.html Accessed: 07 June 2016.

Weishaar, S.E., Madani, S. (2015): *Report on the long-term economic viability of constructing new electricity capacities for electricity exports in the Western Balkan countries.* Available from: http://bankwatch.org/publications/stranded-assets-western-balkans-report-long-term-economic-viability-new-export-capaciti

World Bank Group. (2015): *Bosnia and Herzegovina Partnership: Country Program Snapshot*. Available from: http://www.worldbank.org/eca/snapshots/bosniaandherzegovina/

Zibret, B., Haslauer, F., Simek, I., Lewe, T., Svrcek, M., Trajkocski, T. (2014): *Time to Develop an Energy Master Plan for Southeast Europe*. A.T. Kearney, Inc.

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