Report on the long-term economic viability of constructing new electricity capacities for electricity exports in the Western Balkan countries

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Inspiring Energy

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1. Introduction

The Western Balkans (Albania, Bosnia and Herzegovina, Kosovo[1], Macedonia[2], Montenegro and Serbia) is a region that has experienced significant economic development in the past decade. Economic development is fuelled by increased electricity[3] demand. Several countries in this region have been short on electricity production and experienced difficulties in satisfying their domestic demand. Almost all governments in the Western Balkans have plans to extend their electricity generation capacity to meet their demand, but they also demonstrate the ambition to become electricity exporters.

When countries expand their electricity generation capacity at the same time with a view to provide electricity to the region, this creates the clear and present danger of excess supply and stranded assets. Stranded assets are commonly conceptualized as assets that become uneconomic to operate. In the context of the energy industry Caldecott and McDaniels[4] define stranded assets as plants that became uneconomic to operate, since "their marginal cost of generation exceeds the price for electricity".

Several factors influence the creation of stranded assets. These include changes in regulation (for example the introduction of more stringent environmental production standards) and changes in the market (e.g. market increases in the costs of coal or a price decline due to strong competition).

This report analyses the long-term electricity supply and demand patterns of countries in the Western Balkans and examines their export prospects from a stranded assets perspective for each country (Albania, Bosnia and Herzegovina, Kosovo, Macedonia, Montenegro, Serbia). It does so by:

(1) comparing the current (and future) electricity production to the current (and future) electricity demand;
(2) examining peak electricity supply and demand;
(3) comparing the (expected) export capacity with the demand of potential customers in the (1) Western Balkans, (2) neighbouring countries, (3) the EU Member States, and (4) the EU Member States, Ukraine and Turkey.

This report consists of six independent country studies. Each country study therefore contains all relevant information, such as methodology, approach, data description etc.

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1 Throughout this report, this designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo declaration of independence

2 According to the UN, the official name for Macedonia is "The former Yugoslav Republic of Macedonia". In this study it is referred to as "Macedonia".

3 Electricity is frequently referred to as 'Energy'. This report only examines electricity. In this report these terms are used interchangeably

4 Ben Caldecott & Jeremy McDaniels: Stranded generation assets: Implications for European capacity mechanisms, Energy Markets and Climate Policy, Working Paper, January 2014, p. 5, http://www.smithschool.ox.ac.uk/research-programmes/stranded-assets/Stranded%20Generation%20Assets%20-%20Working%20Paper%20-%20Final%20Version.pdf

1.1 Management Summary

Countries in the Western Balkans (Albania, Bosnia and Herzegovina, Kosovo[5], Macedonia, Montenegro and Serbia) have frequently faced difficulties in satisfying domestic electricity demand. Almost all governments in the Western Balkans have plans to extend their electricity generation capacity to meet their demand but they also demonstrate strong export ambitions.

This report analyses the long-term electricity supply and demand patterns of countries in the Western Balkans and examines their export prospects from a stranded assets perspective for each country. It does so by:

(1) comparing the current (and future) electricity production to the current (and future) electricity demand;
(2) examining peak electricity supply and demand;
(3) comparing the (expected) export capacity with the demand of potential customers in the Western Balkans, neighbouring countries, the EU Member States, and (4) the EU Member States, Ukraine and Turkey.

The report shows that the countries will be short in electricity if they merely complete the ‘likely future capacity’ extensions. If they realize the ‘planned future capacity’ extensions, however, all countries and hence the region will be 56% long in 2024, entailing that the national plans demonstrate significant export ambitions. In particular Bosnia Herzegovina could turn into the largest exporter (up to 20.000 GWh), followed by Serbia (18.000 GWh). The other countries in the Western Balkans have a much lower contribution (Montenegro 2000 – 5000 GWh, Macedonia 2000 GWh, Albania 2000 GWh, Kosovo 2.500 GWh) to the overall long position of the region, but measured in terms of their domestic demand, their export potential is substantial.

In order to determine the long and short positions of the countries in the Western Balkans the electricity power balance has to be analysed. This balance examines the actual feed-in of electricity and the demand situation in the Western Balkans when the electricity feed-in reserves are at their presumed minimum and the electricity demand is at its presumed maximum. Subject to the caveat relating to the robustness of the underlying data, this enables the identification of critical electricity supply situations. The overall finding is that all countries are unable to satisfy their peak demand when considering existing capacity and ‘likely future capacity’ extensions. Only Bosnia and Herzegovina is temporarily able to do so. When ‘planned future capacity’ is considered, Bosnia and Herzegovina (as of 2018), Montenegro (as of 2021) and Serbia (as of 2022) are able to satisfy peak demand. Examining the Western Balkans jointly, the report shows that cooperation between the countries in the region can help to enhance supply security in the region.

Such significant electricity capacity expansions designed to meet export demand create the clear and present danger of becoming dependent upon the export market. The export analysis shows that there will not only be competition within the Western Balkans (here in particular between Serbia and Bosnia and Herzegovina) but also from other (supra-) regional competitors such Bulgaria, Romania and the EU. Given the expected excess supply in Europe, increased competition may put pressure on export prices and increase the risk of incurring stranded assets. For this reason, it is suggested to closely

5 Throughout this report, this designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo declaration of independence

examine investments that are directed to serve export markets and to also consider the trade-off of producing or buying electricity.

This report shows that countries in the Western Balkans do require good regional ties in the area of energy policy. The current infrastructure should therefore be examined from this perspective. Importantly this report shows that the examined countries do have strong electricity export ambitions that create the danger of stranded assets if the domestic electricity expansion decisions are made without taking due account of developments in other countries in the Western Balkans and beyond. Decisions to make or buy electricity should thus be taken in a strategic fashion that also takes due account of energy security considerations.

The table below summarizes key data of this report:

				Albania	Bosnia and Herzegovina	Kosovo	Macedonia	Montenegro	Serbia
Demand in 2024		Min	GWh	10.985	13.800	7.135	10.083	3.381	36.120
		Max	GWh	13.834	16.294	8.622	12.269	4.999	42.298
Supply in 2024		Min	GWh	6.292	15.583	4.114	8.356	2.429	34.127
		Max	GWh	12.779	33.061	9.611	14.617	5.393	52.796
Net Position in 2024		Min	GWh	-7.542	-3.028	-4.508	-3.913	-2.570	-8.171
		Max	GWh	1.794	19.260	2.467	4.534	2.013	18.671
Peak Demand in 2024		Min	MW	2.266	2.315	1.456	1.892	586	6.600
		Max	MW	2.746	2.734	1.679	2.302	815	7.354
Supply Capacity in 2024		Min	MW	711	2.096	523	636	460	5.064
		Max	MW	1.003	4.475	1.332	1.975	643	7.893
Export Potential	Western Balkan	Min	GWh	-46.955	-29.488	-46.273	-44.215	-46.736	-30.078
		Max	GWh	22.191	26.706	25.225	25.820	27.163	21.563
	Region	Min	GWh	-20.702	-3.235	-20.019	-17.961	-20.483	-3.824
		Max	GWh	48.445	52.959	51.479	52.074	53.417	47.816
	W. Balkan and EU	Min	GWh	-64.710	-47.243	-64.027	-61.969	-64.491	-47.832
		Max	GWh	4.437	8.951	7.471	8.066	9.409	3.808
	incl. UKR and TU	Min	GWh	-40.324	-22.857	-39.642	-37.584	-40.105	-23.447
		Max	GWh	60.318	64.832	63.352	63.947	65.290	59.689
Grid and Distribution Losses 2013			%	≈47	≈13	≈36	≈18	≈23	≈17
Renewables Share in 2024		Min	%	93	30	3	17	64	30
		Max	%	100	41	15	28	75	34

2. Country Report Montenegro

2.1 Introduction

This country report is a self-contained subset of the ‘Report on the long-term economic viability of constructing new electricity capacities for electricity exports in the Western Balkan countries’ that was commissioned by CEE Bankwatch and realized by the University of Groningen and The Advisory House.[6] The background of this study is that almost all governments in the Western Balkans[7] have plans to extend their electricity generation capacity to meet their demand, but they also demonstrate the ambition to become electricity exporters. Over investments in excess electricity generation capacity can give rise to stranded assets – assets that become uneconomic to operate since their marginal cost of generation exceeds the price for electricity. [8]

This country report examines Montenegro’s energy generation[9] and its import/export potential. It examines if a potential excess production of energy would be likely to be met by demand of potential buyers in the region and beyond. Moreover the study presents how the energy mix in Montenegro will develop over time.

This report is structured as follows: section 2 presents the approach and methodology. Section 3 presents the data. Section 4 presents the analysis and section 5 the conclusions.

Before commencing, a general caveat is in order. This report is based on official documents and predictions provided by the respective governments, power suppliers or network operators. Given the scope of this research, this report does not engage in the analysis of the legal framework, nor does it seek to determine future price levels[10]. Similarly, current transport and grid capacities do not fall within the scope of this study and we do not incorporate effects that may arise from grid or transport restrictions.

2.2 Approach and Methodology

In order to identify the long-term viability of the present and future electricity capacity changes in Montenegro and its export potential, this study

- compares the current (and future) electricity production to the current (and future) domestic electricity demand and identifies short and long positions (Analysis section 1); and

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6 Authors of this report are Stefan Weishaar, University of Groningen, and Sami Madani, The Advisory House

7 Countries belonging to the Western Balkans are: Albania, Bosnia and Herzegovina, Kosovo, Macedonia, Montenegro, Serbia

8 Ben Caldecott & Jeremy McDaniels: Stranded generation assets: Implications for European capacity mechanisms, Energy Markets and Climate Policy, Working Paper, January 2014, p. 5, http://www.smithschool.ox.ac.uk/research-programmes/stranded-assets/Stranded%20Generation%20Assets%20-%20Working%20Paper%20-%20Final%20Version.pdf

9 Electricity is frequently referred to as ‘Energy’. This report only examines electricity. In this report these terms are used interchangeably

10 This report does thus not extend to costs of energy production and input prices or wholesale prices or the like

- compares the (expected) export capacity with the demand of potential regional customers (countries in the Balkans, Ukraine, and Turkey) and supra-regional customers (EU Member States) (Analysis section 2).

The development of the energy mix is presented subsequently (Analysis section 3).

2.2.1 Montenegro's Supply/Demand analysis

Based upon Montenegro's specific historic production and import/export figures we determine the national net electricity supply/demand position. In order to account for future developments we also analyse the supply/demand position with regard to the generation capacity that is presently under construction or planned. Based on the current existing plants, current construction projects and construction projects that are planned we develop three electricity supply scenarios.

#	Scenario	Description
1	**Existing capacity**	Calculates the net position based on current supply and demand figures
2	**Likely future capacity**	Calculates the net position based on existing capacity (Scenario 1) and an estimation of additional supply facilities that are under full construction or near starting construction
3	**Planned future capacity**	Calculates the full net position based on Scenario 2 and includes the envisaged electricity production

Table 1 - Montenegro's electricity supply scenarios

CEE Bankwatch has established the differentiation between 'likely future capacity' and 'planned future capacity'. Determinants for differentiating between the two categories are whether construction permits have been granted, whether the constructors are identified and if the financing has been secured.

After obtaining results for electricity generation in Montenegro, we need to examine domestic demand before we can determine the national net long/short positions. We apply a robustness check in the form of three different electricity consumption scenarios. This robustness check is necessary since we seek to extrapolate electricity demand patterns over a period of 10 years and since changes in demand patterns severely affect Montenegro's ability to export electricity.

#	Scenario	Description
1	**Low**	Baseline growth scenario -1% growth rate
2	**Medium**	Baseline growth scenario (Energy Development Strategy of Montenegro until 2030 [ME-01] p. 47)
3	**High**	Baseline growth scenario +1% growth rate

Table 2 - Montenegro's electricity demand scenarios

The low and high scenarios of -1% and +1% above and below the baseline consumption growth scenario mentioned in the Energy Development Strategy of Montenegro until 2030 (2014) [ME-01] have been arbitrarily selected.

The net long/short position of Montenegro is calculated by subtracting high, medium and low consumption demand from each of the three electricity supply scenarios. Montenegro's exporting ability is thus determined for all nine combinations.

In the case of Montenegro, particular attention must be devoted to the KAP aluminium factory situated in Podgorica. KAP is a very sizeable consumer of electric power in the country. In the Energy Development Strategy of Montenegro until 2030 [ME-01] p. 47, it is assumed that KAP will work at half capacity (84 MWh/h) until 2030. Since closure of this factory is foreseen by external stakeholders such as the IMF Country Report No 13/271, [ME-02] p.58, we have included an additional baseline into each of the three electricity demand scenarios so as to enable an assessment of Montenegro's energy situation should KAP indeed cease operations.

In order to determine the long and short position of Montenegro we also analyse the electricity power balance. This balance examines the actual feed-in of electricity and the demand situation at a particular point in time when the electricity feed-in reserves are at their presumed minimum and the electricity demand is at its presumed maximum. Subject to the caveat relating to the robustness of the underlying data, this enables the identification of critical electricity supply situations. This method should thus be used as an indication only[11].

Data for the hourly peak demand (hourly load values) during the period 2007 – 2013 is taken from Entso-E [ME-03]. We determine the peak hourly demand for each year (2007 – 2013) and forecast the remaining years (2014 – 2024).

Because the values between the historic data (2007 – 2013) and the future data (2014 – 2024) can differ[12], we need a starting point for our peak demand forecast that also includes information from 2014. We therefore apply the following formula:

The peak load for 2014 is calculated as follows:

$$P_{2014} = \frac{D_{2014}}{Average(D_n, D_{n-1}, D_{n-2})} * Average(P_n, P_{n-1}, P_{n-2})$$

where:
D represents the demand in the given year,
P is the peak load
And n is the next year before 2014 where data is available, normally 2013.

The peak load for year n is calculated as follows

$$P_n = \frac{D_n}{D_{n-1}} * P_{n-1}$$

11 Net operators calculate the demand peaks in general for the 3rd Wednesday of each month. In our report, we deviate from this policy and determine the hourly peak demand on an annual basis

12 Historical data shows the actual produced electricity while the future data is based on planned volumes

where:
D represents the demand in the given year,
P is the peak load
And n is the year after 2014.

We multiply this ratio with the average peak of 2011 – 2013 to determine the hourly peak demand for 2014. The peak demand is then forecasted with the growth rate that underlies the low-, medium-, and high demand scenario.

The peak energy supply (for all of the above supply scenarios) is calculated by multiplying the electricity generation capacity of those power plants that are base load capable with a parameter that reflects the supply security and availability of the electricity generation capacity. The data we use applies an in-feed supply security of 99% as a critical benchmark.[13]

Due to lack of information regarding the particular power plants and electricity networks we are unable to account for required system reserves, revisions, and planned and unplanned outages and have to rely upon data from Germany.[14] Since for the purpose of this analysis the annual peak demand and peak supply is essential and only lasts for a short moment, we only consider the unplanned outages that cannot be time shifted beyond a period of 12 hours.[15] Based on historic supply statistics on these immediate unplanned outages in Germany we obtained parameters for expected base load supply.

Our data set does not distinguish between lignite and coal power plants. We selected the value for lignite since in the Balkans a lot of lignite is available.

Oil/Gas is presumed not to be base load capable because of practices of short term supply contracts and unpredictable policy developments that may endanger the supply security with gas. This may be reconsidered for the future when/if the Ionian Adriatic Pipeline and offshore production is operational.

The data for wind and solar power exhibit low values because these technologies are not base load capable.

Hydropower is regarded to only have a limited base load capacity. Despite significant historic variability in the hydropower electricity generation in the Balkans, it is evident that hydropower plants were able to produce electricity in a stable manner. We therefore do not follow the German report (prescribing 25%)[16] but use 40%.[17]

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13 Bericht der deutschen Uebertragungsnetzbetreiber zur Leistungsbilanz 2013 nach EnWG §12 Abs. 4 und 5, 30.09.2013, available at http://www.bmwi.de/BMWi/Redaktion/PDF/J-L/leistungsbilanzbericht-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

14 We thereby follow Bericht der deutschen Uebertragungsnetzbetreiber zur Leistungsbilanz 2013 nach EnWG §12 Abs. 4 und 5, 30.09.2013, available at http://www.bmwi.de/BMWi/Redaktion/PDF/J-L/leistungsbilanzbericht-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

15 We thereby follow Bericht der deutschen Uebertragungsnetzbetreiber zur Leistungsbilanz 2013 nach EnWG §12 Abs. 4 und 5, 30.09.2013, available at http://www.bmwi.de/BMWi/Redaktion/PDF/J-L/leistungsbilanzbericht-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

16 http://www.bmwi.de/BMWi/Redaktion/PDF/J-L/leistungsbilanzbericht-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

The net long/short position of peak hourly demand and supply for Montenegro is calculated by subtracting high, medium and low hourly demand from each of the peak electricity supply scenarios.

Type	Planned Availability
Lignite	93,5%
Coal	94%
Gas/Oil	0%
Biomass	65%
Wind	1%
Photovoltaic	0%
Hydropower	40% (instead of 25%)
Pump storage	80%

Table 3 - Estimated power plant planned availability per type

2.2.2 Montenegro's export analysis

The regional analysis examines export opportunities for electricity produced in the scenario countries. We thus compare the possible long position of Montenegro against the possible long/short positions of its trading partners.

The examined trading partners will be 1) in the Western Balkan region (i.e. the case study countries), 2) regional (i.e. countries adjacent to the case study countries) and supra-regional, i.e. other EU Member States (3) and in the EU, Ukraine and Turkey (4). In order to estimate the import potential of the recipient countries the long/short positions of these countries must be determined.

The following countries have been included in the export analysis:

#	Group	Countries included
1	**Western Balkans**	Albania*, Bosnia and Herzegovina*, Kosovo*, Macedonia*, Serbia*
2	**Region**	Group 'Western Balkans' and countries adjacent to the case study countries: Bulgaria, Croatia, Greece, Hungary, Italy, Romania, Slovenia
3	**Western Balkans and EU**	Group 'Western Balkans' and the EU-28 countries
4	**Western Balkan and EU incl. Ukraine and Turkey**	Group 'Western Balkans and EU' and Ukraine and Turkey*

*: Trading partners with different scenarios in this study

Table 4 – Export analysis' groups for Montenegro

17 We calculated the regional average of hydropower generation capacity (excluding pump storage plants) by dividing total hydro power supply 2014 by total installed hydropower capacity (excluding pump storage plants) multiplied by 24 (hours) and 365 (days) = 7297GWh / 25447GWh ≈ 40%

Data for the case study countries is based upon the net long and net short positions in the respective country analysis contained in this report. Data has been obtained from a Study of the European Commission[18], the Turkish Electrical Energy 10-Year Generation Capacity Projection (2009 – 2018)[19] and the IEA and the Energy Strategy of Ukraine.[20] Since the data in the EU report is based on PRIMES that models on the basis of 5 year intervals, we connected the interim years by means of linear approximation.

Given that any forecasting inherently involves uncertainty, we need to consider the range of possible outcomes – both at the supply side of Montenegro and its potential customers (group 1 to 4).

In order to reflect the range of possible import and export demand of the trading partners included in the respective analysis, we examine the lowest and the highest values for the respective years. In terms of the country analysis contained in this report we take the net long/short position of the 'current supply' (scenario 1) and 'high demand growth scenario' as a low estimate and the supply scenario 3 and low demand growth scenario w/o KAP' as an estimate for the high import/export value. For the EU and Ukraine we included one scenario each. For Turkey we included a high and low electricity demand scenario.

This approach enables us to identify possible trading partners in the various groups that would be in demand of the electricity produced by Montenegro. The analysis also offers an overview over the range of possible outcomes and hence allows decision makers to gain insights into the 'riskiness' of investments in the electricity sector. Hence this analysis enables an assessment of the potential risk that investments turn into 'stranded assets'.

Given that electricity investments are generally regarded as long term investments we have selected three evaluation points at the beginning (2014), in the middle (2019) and at the end (2024) of the period under examination to compare Montenegro's import/export capabilities with those of its trading partners.

2.2.3 Montenegro's energy mix

This section will present the evolution of the energy mix in Montenegro based on the electricity supply scenarios.

2.3 Data description

We obtained historic (2007 – 2013) production (total production) and consumption data (consumption total) for Montenegro from Entso-E's [ME-03] 'Detailed Monthly Production (in GWh)' data set.

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18 EU Commission, EU Energy, Transport and GHG Emissions Trends to 2050, Reference Scenario 2013, Appendix 2, p. 85 ff.

19 Turkish electricity Transmission Corporation, Turkish Electrical Energy 10-Year Generation Capacity Projection (2009 – 2018), 2009, Energy Demand Balance 2009-2018, (Case I-A) High Demand – Scenario 1, p. 44 and Project Generation Capacity and Energy Demand Balance 2009-2018 (Case II-A), Low Demand – Scenario 1. Approximation from 2018 onwards based on -9684,6x + 82780 (high demand) and -7259,3x + 77896, low demand (year 2009 represents 1)

20 IEA, Key World Energy Statistics, 2012, p. 27 and Energy Strategy of Ukraine for the period through 2035, p. 24, Annex 2. Since only values for 2012 and 2035 were available, values in between have been approximated linearly

Production forecasts for the period 2014 – 2024 for the various power plants were obtained from the Energy Development Strategy of Montenegro until 2030 [ME-01] particularly from p. 40, 46 and 47.

Data for small hydropower plants is taken from several sources. Data for 2014 has been taken from Montenegro Energy Strategy [ME-01] table on p.47, Table 10.4. Due to slight inconsistencies between the data contained in table 10.4 and the data contained on p. 46, the remaining data for small hydropower plants is taken from Informacija o izgradnji malih hidroelektrana, information presented at the government session 16.10.2014.[21] The following small hydropower plants are classified level 2 (Bistrica (Berane), Sekularska (Berane), Crnja (Kolasin), Babinopoljska (Plav), Trepacka Rijeka (Andrijevica), Vrelo (Bijelo Polje), Rastak (Kolasin), Bradavec (Andrijevica), Ljeviška Rijeka) and are assumed to commence operations by 2016. 80 GWh of these are already assumed to commence operations in 2015, in line with Energy Development Strategy of Montenegro until 2030 [ME-01] p. 46. The following small hydro plants are classified level 3[22]: Grlja (Plav), Murinska Rijeka (Plav), Komaraca (Plav), Bistrica-pritoka Ljuboviđe (Bijelo Polje), Đurička rijeka sa pritokama (Plav), Vrbnica (Pluzine), Kaludarska (Berane), Kutska rijeka (Andrijevica), Mojanska rijeka (Andrijevica), Rastak 2 (Kolasin), Reževića rijeka (Budva), Piševska rijeka (Andrijevica)). All are expected to linearly increase production.

Data for an incinerator of mixed municipal solid waste (70 GWh per year as of 2020) is taken from the Energy Development Strategy of Montenegro until 2030 [ME-01] p. 46.

The data for biomass electricity generation between p. 46 and 47 of the same report is inconsistent.[23] While p. 46 does not specify how quickly the biomass electricity generation increases, on p. 47 it is stated that in 2019 and 2020 65 GWh and 101 GWh would be produced respectively. The latter number, however, includes 70 GWh from the incinerators that commence operations in 2020. Consequently, the total biomass electricity in 2020 should be 31 GWh. Because no actual data is available before 2020, it is assumed that in 2015 only the landfill gas facility in Podgorica (1.1 GWh) is operational and that in subsequent years the biomass electricity generation increases linearly each year by 6 GWh (until 31GWh in 2020). After 2020 the table on p. 47 is relied upon.

The data for Pljevlja I is taken from the Energy Development Strategy of Montenegro until 2030 [ME-01] p. 47. There appear, however, a number of complexities that need to be pointed out. It has been suggested by CEE Bankwatch that the plant may not be compliant with Directive 2001/80/EC[24] that regulates NO_x and SO_2 emissions of large

21 See http://www.gov.me/sjednice_vlade/85

22 Informacija o izgradnji malih hidroelektrana, information presented at the government session 16.10.2014, available at http://www.gov.me/sjednice_vlade/85

23 See [ME-01]

24 Directive 2001/80/EC of the European Parliament and of the Council of 23 October 2001 on the limitation of emission s of certain pollutants into the air from large combustion plants. See also SEEC and Energy Community (2013), Study on the Need for Modernization of Large Combustion Plants in the Contracting Parties of the Energy Community in the context of the implementation of Directive 2001 /80/EC, November 2013, p. 29, available at https://www.energy-community.org/portal/page/portal/ENC_HOME/DOCS/2652179/LCP2-cover+report-final.pdf

combustion plants. Plants must be in compliance with this Directive by 1st January 2018.[25] Existing plants must be in compliance with this Directive or cease operations unless a written declaration is submitted to the competent authority by 31 December 2015 stating that the plant would not operate for more than 20.000 hours between 1st of January 2018 and 31 December 2023.[26] Subsequently the plant must be in full compliance with Part 2 of Annex V to Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control (recast)). According to the Energy Development Strategy of Montenegro until 2030 [ME-01] p. 47, Pljevlja I continues to produce the same level of production 1179 GWh in 2018 and 2019 and only subsequently starts to generate less (600 GWh). Also electricity generation continues beyond 2023. It is unclear how these production figures coincide with the 20.000 hour criterion or if a refurbishing of Pljevlja I will be undertaken in order to meet the production standards contained in of Directive 2010/75/EC.

We obtained the projected consumption demand from the Energy Development Strategy of Montenegro until 2030 [ME-01] p. 47. This data is used in the medium consumption scenario. We derived the high and low consumption scenario projections based on a +/-1% growth rate per year.

The aluminium factory KAP in Podgorica consumed 735 GWh in 2013 according to the Montenegro Energy Balance 2015 when it was running at approximately 84 MW. KAP is also assumed to operate in the Energy Strategy Energy Development Strategy of Montenegro until 2030 [ME-01] p. 47. The baselines indicating consumption demand in the eventuality that KAP ceases to operate thus lie 735 GWh below the specified consumption scenarios.

Data for the hourly peak demand (hourly load values) during the period 2007 – 2013 is taken from Entso-E [ME-03]. We determine the peak hourly demand for each year (2007 – 2013) and forecast the remaining years (2014 – 2024).

For the export analysis data has been obtained from several sources. For the case study countries data was obtained from this report. For the EU it has been taken from the EU Energy, Transport and GHG Emission Trends to 2050, from the Reference Scenario 2013, Appendix 2, p. 85 ff.. The data for Turkey is taken from the Turkish electricity Transmission Corporation’s report on the Turkish Electrical Energy 10-Year Generation Capacity Projection (2009 – 2018), 2009. In particular data is taken from the Energy Demand Balance 2009 – 2018, (Case I-A) High Demand – Scenario 1, p. 44 and Project Generation Capacity and Energy Demand Balance 2009 – 2018 (Case II-A), Low Demand – Scenario 1. It is adapted to suit our needs by means of an approximation from 2018 onwards based on -9684,6x + 82780 (high demand) and -7259,3x + 77896, low demand (year 2009 represents 1). Data for Ukraine is taken from the IEA’s Key World Energy Statistics, 2012, p. 27 and from the Energy Strategy of Ukraine for the period through 2035, p. 24, Annex 2. Because only values for 2012 and 2035 were available, they have been approximated in a linear fashion.

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25 See Article 4 Decision of the Ministerial Council of the Energy Community of 24 October 2013: On the implementation of Directive 2001/80/EC of the European Parliament and of the Council of 23 October 2001 on the limitation of emissions of certain pollutants into the air from large combustion plants

26 Directive 2001/80/EC of the European Parliament and of the Council of 23 October 2001 on the limitation of emission s of certain pollutants into the air from large combustion plants

2.4 Analysis

This section of the report describes relevant data observations and findings. First, the supply and demand analysis is presented (subsection 1). This section also examines the net long and short positions as well as peak electricity demand and supply. Subsection 2 presents the export analysis and subsection 3 presents the energy mix.

2.4.1 Supply and Demand

The figures below present the supply and demand patterns for Montenegro, showing the historic and future supply patterns (for existing capacity, likely future capacity and planned future capacity) in relation to each of the growth scenarios (low, medium and high growth).

Regarding the historical (2007 – 2013) supply and demand pattern it is evident that Montenegro has not been able to cover its demand and was always, besides 2010, strongly depending on energy imports. This is in part attributable to KAP, the large aluminium producer, which accounts for a sizeable portion of the country’s electricity demand.

At the low growth electricity consumption scenario Montenegro will remain dependent on energy imports in the case of the current capacity scenario (supply scenario 1) and in the case of currently constructed electricity generation capacity (supply scenario 2). The figure clearly shows that the downgrading of Pljevlja to 600 GWh[27] (according to the Energy Development Strategy of Montenegro until 2030 [ME-01]), will not be compensated and will render Montenegro to be even more dependent on energy imports. In supply scenario 3, the Moraca hydropower plant (616 GWh) and Pljevlja II lignite plant (1360 GWh) would commence operation in 2021. If these plans or other equivalent capacity are realised, Montenegro's demand will be covered even in the high consumption growth scenario.

Should the aluminium plant KAP be phased out, Montenegro’s electricity demand would be considerably reduced. Yet towards the end of this decade the country would become dependent on energy imports under supply scenarios 1 and 2.

27 As described earlier Pljevlja must comply with production standards set under the Energy Community Treaty and might be phased out earlier or later in case of refurbishment

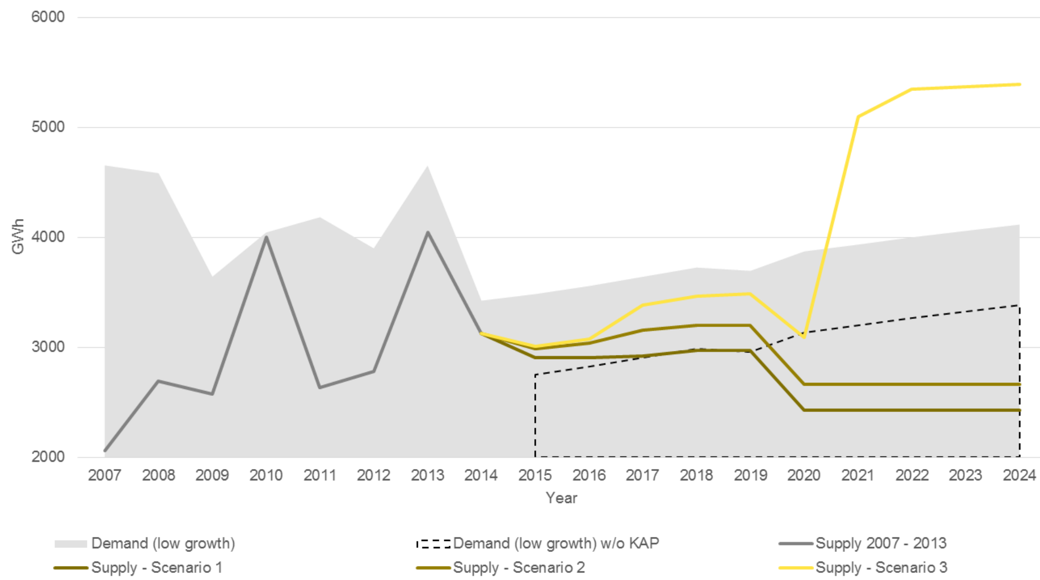

Figure 1 - Montenegro – Supply/Demand – Low Growth

In the case of medium consumption growth scenario Montenegro would need to produce around 450 GWh of additional electricity by 2024 in order to fulfil the additional needs in comparison to the low consumption growth scenario. As a result, the supply scenario 1 and 2 are only able to cover roughly half of Montenegro's electricity demand in 2024. Only in supply scenario 3 the demand may be covered as of 2020 – 2021.

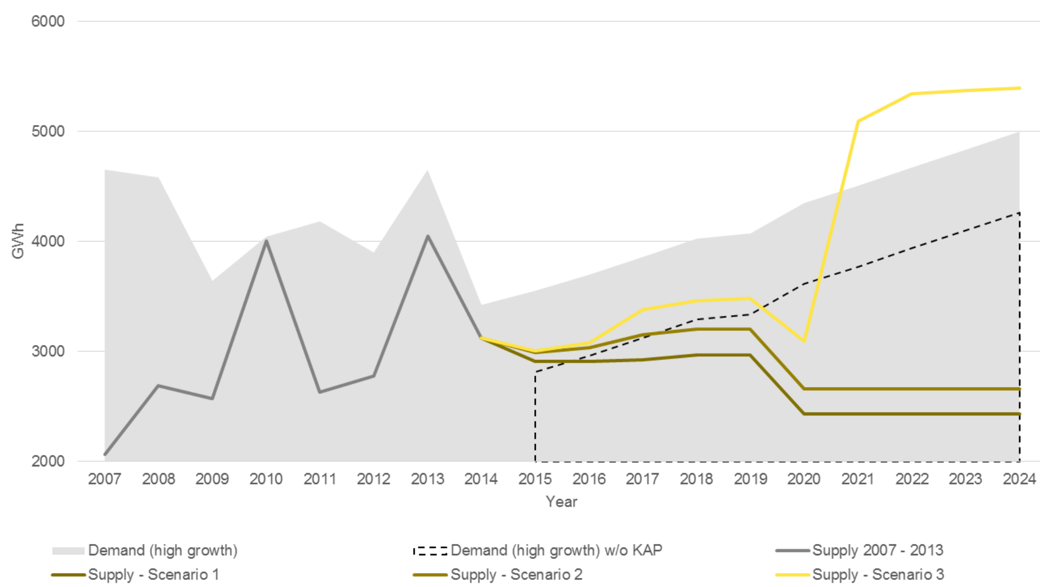

Figure 2 - Montenegro – Supply/Demand – Medium Growth

The figure presenting the high electricity consumption demand in Montenegro shows an expected demand in 2024 of around 5000 GWh which can only be covered in supply scenario 3 or comparable increases in the electricity generation capacity. In the alternative measures to reduce electricity losses or consumption could help to mitigate the electricity shortage. It can be seen that supply scenarios 1 and 2 are not sufficient to satisfy the electricity demand in the future, also not if KAP would cease production. This figure also shows that in the case of high domestic electricity consumption growth, the realization of all of future planned capacity expansions (or equivalent measures) would not result in the creation of a substantial export capacity.

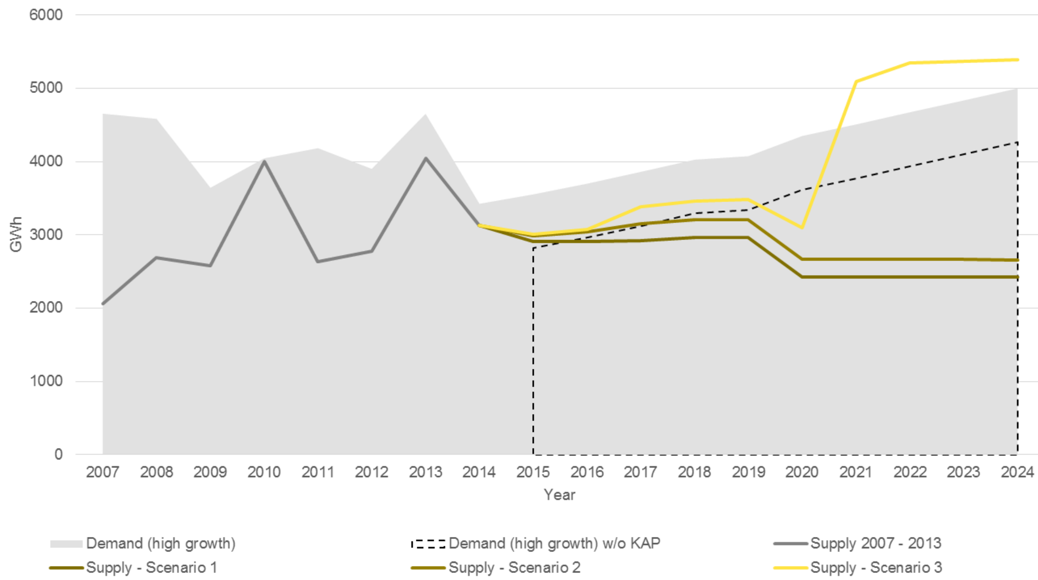

Figure 3 - Montenegro – Supply/Demand – High Growth

2.4.1.1 Net Position

After examining the general supply and demand patterns, we examine the net long and net short position of Montenegro. For each of the electricity consumption growth scenarios (low, medium and high growth) we examine the net positions in relation to the energy supply changes (existing capacity, likely future capacity and planned future capacity). The effect of KAP ceasing production are clearly depicted for each of the 3 supply scenarios.

In the past, Montenegro did not have a balanced position; it was, as described above, a net importer of energy. However, Montenegro was able to cover most of its electricity demand domestically in 2013.

In case of the low consumption growth scenario it is apparent that the electricity generation capacity declines, relating to the reduction of electricity generation capacity in the Pljevlja power plant.[28] This puts Montenegro in a short position, even if KAP would be phased out. The realization of the currently constructed generation capacity (supply scenario 2) is not sufficient for Montenegro to cover its electricity demand. Again, we observe that realizing all planned (or similar) projects (supply scenario 3) entails that Montenegro would get into a long position over the course of a few years and thus be able to export around 1200 GWh per year. It would even reach an export capacity of 2000 GWh if KAP would be phased out.

28 To continue production the power plant may need retrofitting to meet legal requirements (presented above)

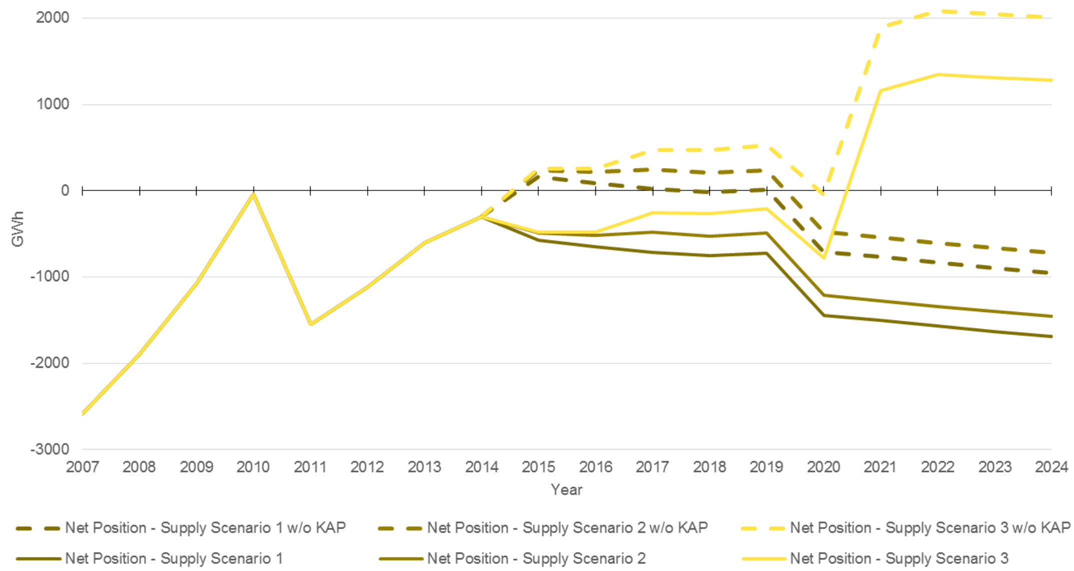

Figure 4 - Montenegro – Net Position – Low Growth

In the case of the medium electricity consumption growth scenario, it is evident that current efforts to meet Montenegro's electricity demand are insufficient. The country would maintain a slight deficit that would exacerbate as of 2019 (in the case of supply scenario 1 and 2). Therefore, as supply scenario 3 shows, at least some of the planned future capacity extensions (or equivalent capacity extensions) must be realized to secure self-sufficiency during the period of examination. If KAP would cease production Montenegro would have a more or less balanced energy trade balance until 2019.

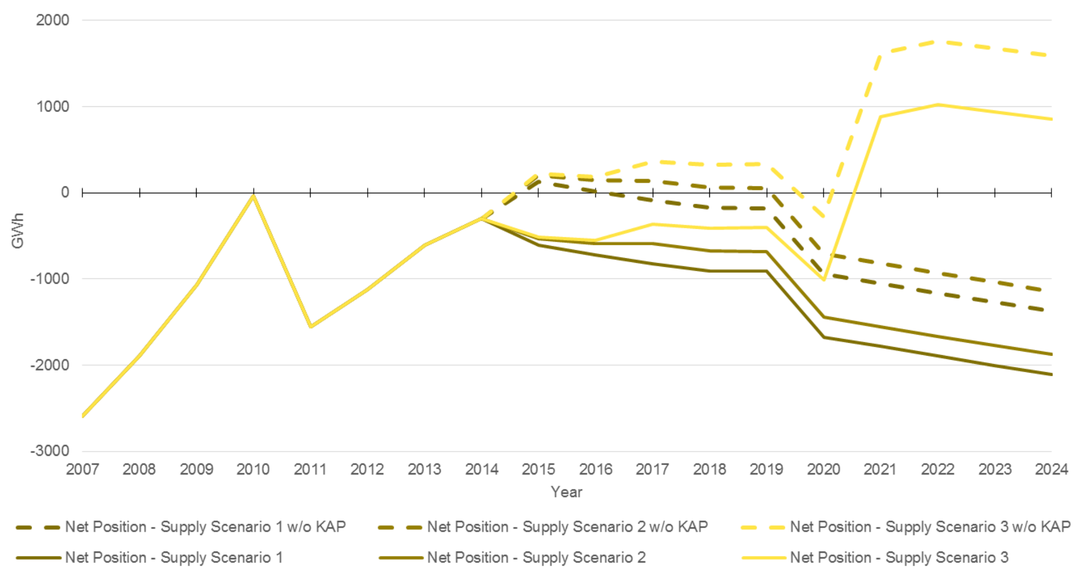

Figure 5 - Montenegro – Net Position – Medium Growth

The high electricity consumption growth scenario shows similar yet more severe findings to those described in the medium growth scenario above. Moreover, it indicates that significant generation capacity expansion may be required in order to maintain self-sufficiency, assuming a high electricity consumption growth.

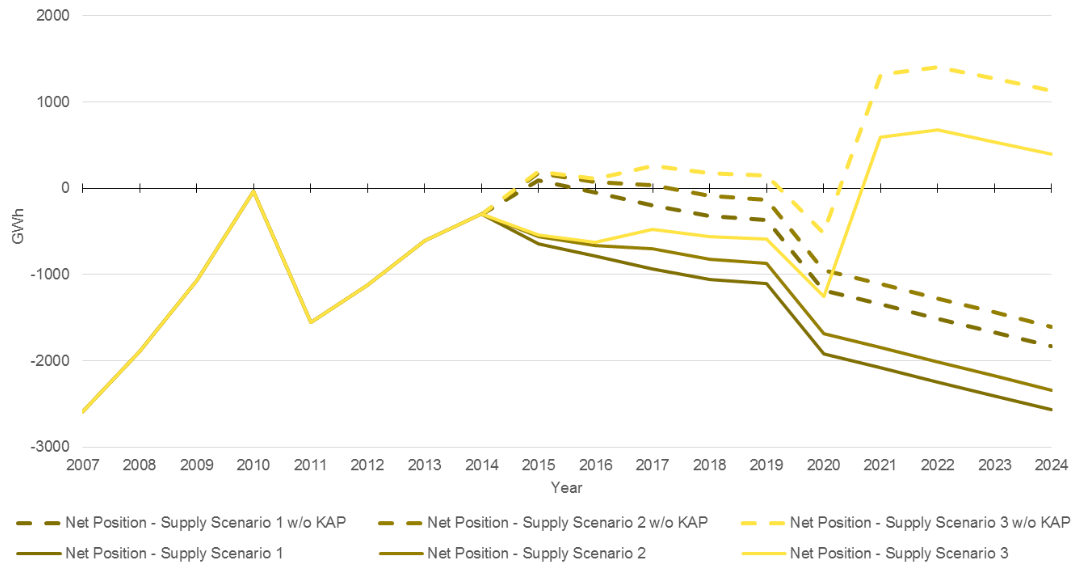

Figure 6 - Montenegro – Net Position – High Growth

2.4.1.2 <u>Peak supply / peak demand balance</u>

This balance examines the actual feed-in of electricity and the demand situation in Montenegro when the electricity feed-in reserves are at their presumed minimum and the electricity demand is at its presumed maximum. Subject to the caveat relating to the robustness of the underlying data, this enables the identification of critical electricity supply situations. This method should thus be interpreted with caution and viewed as an indication only.

The figure below shows that Montenegro will not be able to satisfy its peak demand in supply scenario 1 and 2. Supply scenario 1 and 2 are overlapping each other since there is only one wind power plant (Mozura) earmarked to fall under supply level 2. Wind power plants are assumed to only have a base load capacity of 1% and hence do not significantly influence the outcome. In supply scenario 3 Montenegro would be able to satisfy peak demand during the years 2021-2023 while in 2024 it would be enjoying a slight long position.

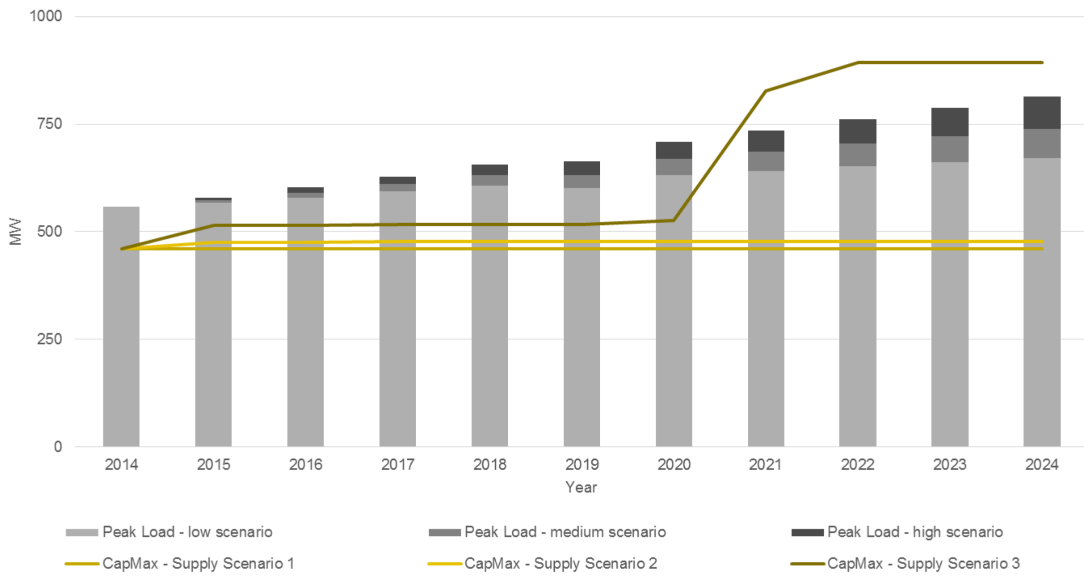

Figure 7 - Montenegro – Peak Supply/Demand Balance

The peak demand in Montenegro will also be impacted if the aluminium producer KAP would cease production. It is estimated that demand would fall by around 84 MW. The figure below describes how peak demand and supply would look like if KAP would cease production as of 2015. Similar to the situation above, Montenegro would be unable to meet its peak demand in supply scenarios 1 and 2 but would be able to do so in supply scenario 3 as of 2021.

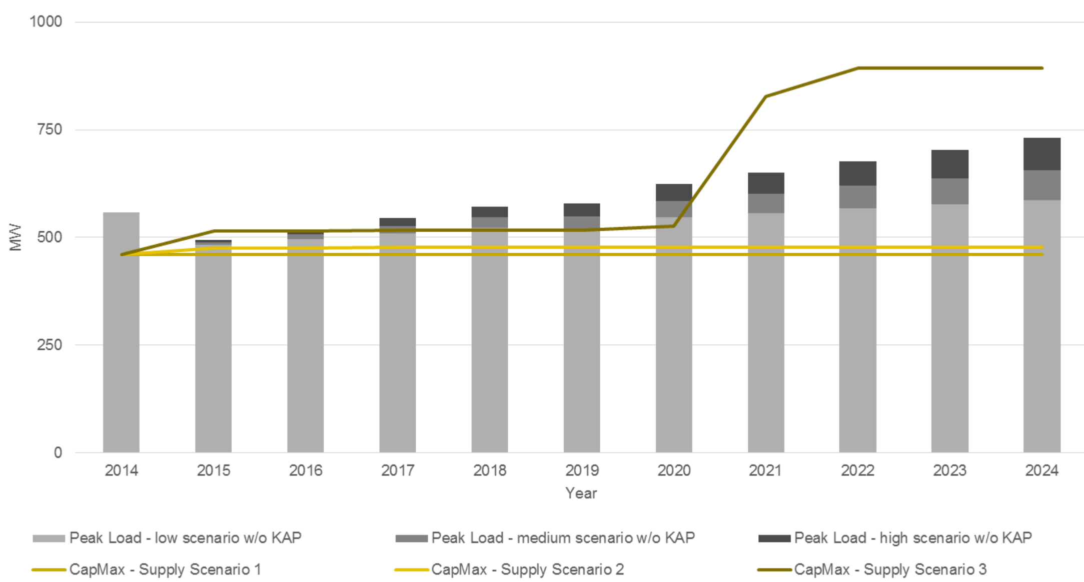

Figure 8 - Montenegro – Peak Supply/Demand Balance w/o KAP

2.4.2 Export analysis

This section of the report examines where energy produced in Montenegro could be exported. Potential trading partners can be found in the Western Balkans (i.e. in the other case study countries) (group 1), in the countries surrounding the Western Balkans (i.e. in the region) (group 2), or supra-regionally in the EU (group 3) or in the EU, Ukraine and Turkey (group 4). The export potential of Montenegro is thus compared to the net position in these scenarios.

Reflecting the range of outcomes in the supply and demand scenarios, the import/export capabilities of Montenegro and its trading partners are presented in the form of a range in the net exports, showing a minimum and a maximum value. Reflecting the underlying assumptions of the scenarios the range of possible outcomes widens over time.

In the figure below the import/export potential of Montenegro is shown in gold. Positive values denote Montenegro's export potential, while negative values denote its import needs. Positive values for the trading partners denote their demand for exports (short position) and negative numbers denote their export supply (long position). In the figure below export possibilities exist if there is a positive net position of Montenegro and positive export demand of the trading partners.

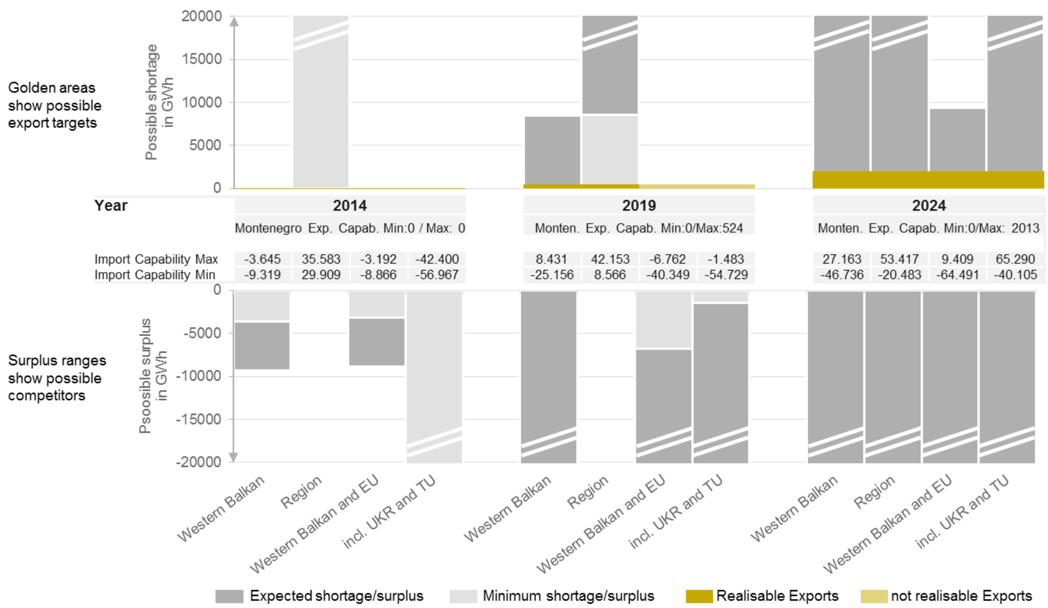

Figure 9 - Montenegro - Export Analysis

In 2014 Montenegro was in a short position of around 300 GWh. The case study countries (group 1) were in a net long position entailing that they could export electricity. Examining the Western Balkans and its immediate neighbours jointly (group 2), it is noteworthy that they are in a net short position requiring about 28000 to 35000 GWh of electricity. Widening the framework of reference to the Western Balkans and the EU (group 3) shows that the region is in a slight long position. Including also Ukraine and Turkey (group 4) shows that there is a significant amount of excess supply in 2014.

In 2019 Montenegro is in a net short or net long position. If KAP would be phased out the country would have a marginal export capacity of approximately 700 GWh (amounting to more than 10% of domestic demand). The case study countries (group 1) would be in a slight long or in a short position entailing that there might be a small export market for Montenegro electricity. However, given the range of the net position, it appears more likely that the case study countries will be striving to export electricity. Again the Western Balkans and its immediate neighbours considered jointly (group 2) are in a significant net short position and thus be importing electricity. Widening the framework of reference to the Western Balkans and the EU (group 3) shows, however, that there is no excess demand expected in 2019. Including also Ukraine and Turkey (group 4) into the analysis shows that there is a significant excess supply in 2019.

Also in 2024 Montenegro may be in a net long or short position. It might be able to export between 1200 GWh (with KAP) and 2000 GWh (without KAP) in case of low consumption growth and in case all electricity capacity extensions under supply scenario 3 (or equivalent) were realized. While these figures appear small for the region, this constitutes a very sizeable percentage (ca. 30% to 60%) of domestic demand (in case of low consumption growth).

The case study countries (group 1) will either be in a long or in a short position entailing that there might potentially be an export market for Montenegro's electricity. However, given the range of the net position, it appears more likely that the case study countries will be striving to export electricity. Again the Western Balkans and its immediate neighbours considered jointly (group 2) are in a significant net short position or in a net long position. It is thus unclear if they would be importers or exporters of electricity. Widening the framework of reference to the Western Balkans and the EU (group 3) shows, however, that it is unlikely that there will be a lot of excess demand in 2024. Including also Ukraine and Turkey (group 4) into the analysis, the figure shows the possibility of a significant excess demand (but also a long position) in 2024. The maximum value for export demand is strongly driven by the Turkish electricity demand figures that are based on an exponential forecasting function. If Turkey is considered as a potential market, the transport capacities (costs) need to be observed.

For the purpose of evaluating export potentials and stranded assets a number of relationships need to be described. Transporting electricity is costly: in particular transfer fees (within countries) and transmission fees (between countries) must be paid. Also electricity transportation requires infrastructure. While this report does not extend to these dimensions, we assume that the local electricity market in the Western Balkans and the surrounding states are the most important indicator if there is demand for Montenegro electricity. That the EU is in a long position indicates that there will at least be competition which can be expected to put pressure on the electricity price.

The above has shown that Montenegro is predominantly in a short position but may turn into an exporting country if all capacity extensions under supply scenario 3 (or equivalent) are realized and if KAP would cease production. Montenegro's total supply of exported electricity is relatively small. However, given that this constitutes a very significant amount in terms of domestic electricity demand, Montenegro may grow quickly dependent on its export markets. Given that future electricity markets are potentially long or might be supplied by other competitors, future electricity prices may be lower and hence give rise to stranded assets.

2.4.3 Energy Mix

The figures below present the changes in Montenegro's energy mix. The data from 2007 – 2013 present the energy mix on the basis of actual production figures. By contrast, the data from 2014 – 2024 show the energy mix based on the possible maximum electricity generation for fuel based power plants, while we assume a normal year for hydropower. This difference explains the temporary peaks in hydropower's share in the years 2010 and 2013.

The energy mix in Montenegro changes significantly, based on the underlying supply scenario. The share of hydropower changed minimally in the past from 63% (2007) to 68% (2013), while 2013 was a peak year for hydropower.

Supply scenario 1 shows that coal power plants will decrease its share significantly below 25% in 2024. The rest of the production will be covered by hydropower, which will put Montenegro into a position of strong import dependency in years of little rainfall.

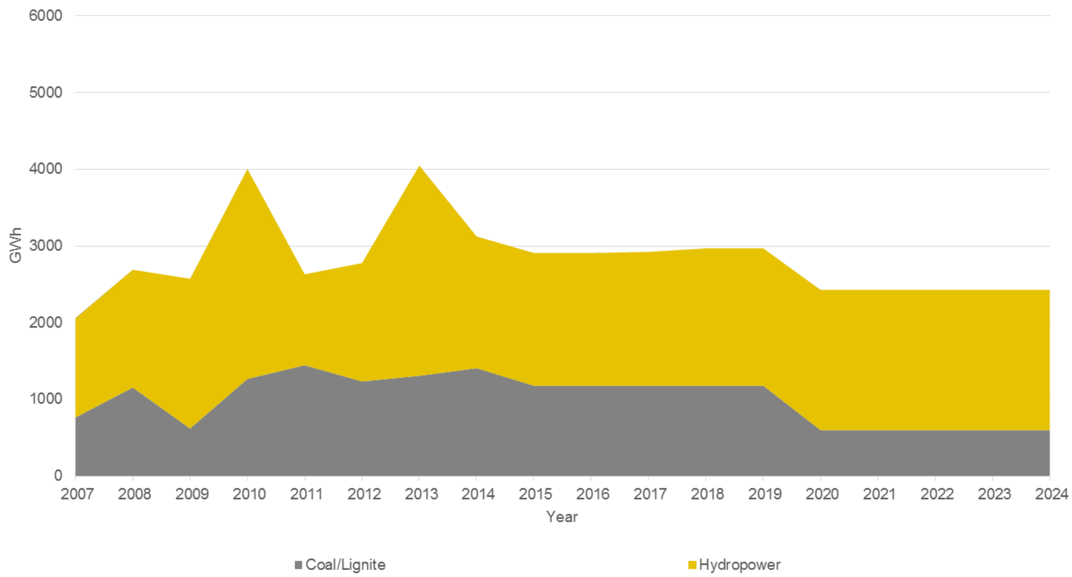

Figure 10 - Montenegro– Energy Mix Supply Scenario 1

If current construction projects are realized (supply scenario 2) the share of hydropower will increase to 73% and wind power comes into the energy mix and reaches 4% of total supply in 2024. This increase of the renewables is due to a loss of production capacity for conventional power plants.

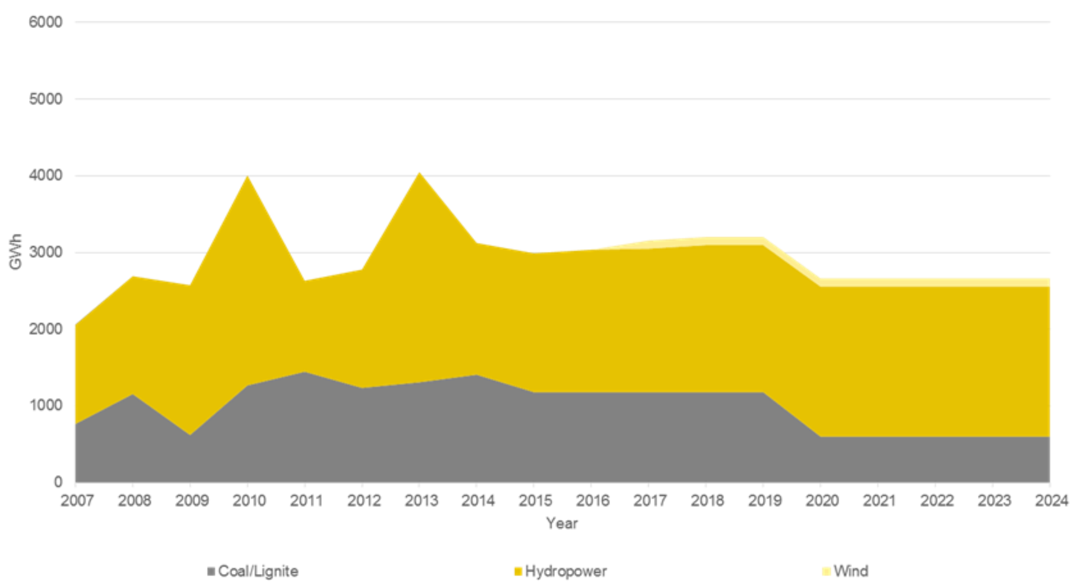

Figure 11 - Montenegro– Energy Mix Supply Scenario 2

If all projects that are currently planned would be realized until 2024, capacity will increase significantly. The share of coal/lignite power will reach 36% in 2024, after a temporary drop in 2020 to 19%. The share of hydropower would slightly decrease to 54%, wind will first peak at 11% in 2020 and subsequently decline to 6,5% in 2024.

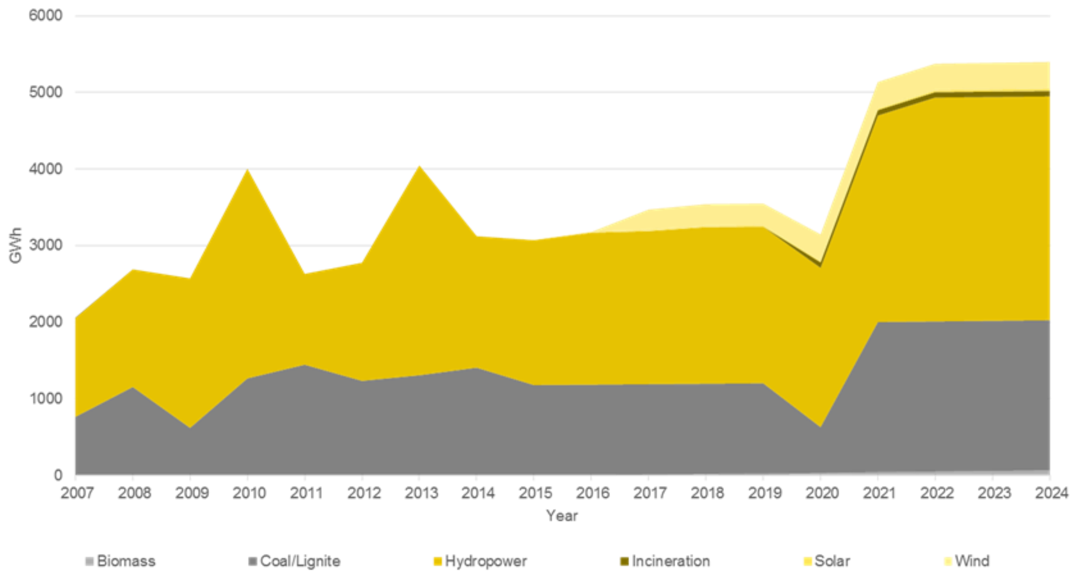

Figure 12 - Montenegro– Energy Mix Supply Scenario 3

2.5 Concluding remarks

This country report analyses the long-term electricity supply and demand pattern of Montenegro and examines its electricity export prospects from a stranded assets perspective.

The above analysis shows that in the course of the next decade Montenegro has the potential to turn from a strong energy importer that historically imported up to 50% of its electricity production to a self-sufficient country.

The amount of electricity that can be exported could reach up to 2.000 GWh in 2024 in case KAP would cease to operate. This constitutes a very sizeable amount if one takes the overall size of the country's demand into account (between 4.000 and 5.000 GWh in 2024).

This situation would give rise to a substantial dependency on the export market. The export analysis has shown that the case study countries are likely to compete for exporting electricity to the neighbouring countries. Competition may in particular come from EU Member States, namely Bulgaria and Romania, and possibly in the near future Ukraine and Turkey. A high dependency on the export market therefore exposes the country to create the risk of stranded assets. From this point of view, a make-or-buy decision should also be investigated prior to new investments.

Concerning the peak load demand and supply analysis, it bears mentioning that Montenegro is expected to remain vulnerable. Even if KAP would cease operations this vulnerability would remain in supply scenario 1 and 2, and in supply scenario 3 up until 2021.

The report shows a number of issues related to electricity supply. Montenegro is strongly depending on hydropower, which will not change in the future. It is noteworthy, that the electricity generated by hydropower plants has historically been volatile. In 2010 2,7 TWh were produced with hydropower while in 2011 only 1,1 TWh were produced. Such volatility may put Montenegro into a short position during prolonged periods of little rainfall.

The report also shows that capacity expansions may not be problem free. With regard to Pljevlja I, for example, there appear to be legal constraints under Article 4 of the Decision of the Ministerial Council of the Energy Community of 24 October 2013 relating to the implementation of Directive 2001/80/EC of the European Parliament and of the Council of 23 October 2001 on the limitation of emissions of certain pollutants into the air from large combustion plants. This stipulation restricts the maximum hours of operation during the years 2018 – 2023 and provides subsequent production standards. Besides legal constraints, there may also be economic ones. In the case of the Moraca hydropower plant, for example, a tender failed to attract any bids in 2011, reportedly due to the economic unfeasibility of the project[29].

It is not only the supply side that influences the long or short position of Montenegro, but also demand side. The phasing out of the aluminium plant KAP can significantly reduce electricity demand in the country.

A demand side issue that is not examined in the case study but should be mentioned are the transmission and distribution losses. In Montenegro the overall loss in transmission and distribution amount to around 23%.[30] An increased performance of the network will have a noticeable impact on the security of supply as well as on the net position without further additional generation capacities. Moreover, energy efficiency measures may lead to electricity savings and help to improve the country's net position.

This report shows that the country does require good regional ties in the area of energy policy. The current infrastructure should therefore be examined from this perspective. Importantly this report shows that the country has strong electricity export ambitions that create the danger of stranded assets if the domestic electricity expansion decisions are taken without taking due account of developments in other countries in the Western Balkans and beyond. Decisions to buy or produce electricity should thus be taken in a strategic fashion that also takes due account of energy security considerations. It can thus be concluded that integration and collaboration in the area of energy policy in the Western Balkans is vital for Montenegro.

<u>Sources</u>

[ME-01] Energy Development Strategy of Montenegro until 2030 (2014), Strategija razvoja energetike Crne Gore do 2030, available at

29 See also http://www.vijesti.me/ekonomija/propao-tender-za-izgradnju-hidroelektrana-na-moraci-40323

30 Around 142 GWh were lost in transmission and 480 GWh in distribution in 2013, see Energy Community Secretariat, Annual Implementation Report, August 2014, p. 139, available at: https://www.energy-community.org/pls/portal/docs/3356393.PDF

http://www.seaeds.me/mne/dokumenta

[ME-02] IMF (2013) Country Report, Montenegro 2013 Article IV Consultation, August 2013, IMF Country Report No 13/271, http://www.imf.org/external/pubs/ft/scr/2013/cr13271.pdf

[ME-03] Data provided by ENTSO-E, https://www.entsoe.eu

3. Country Report Bosnia and Herzegovina

3.1 Introduction

This country report is a self-contained subset of the 'Report on the long-term economic viability of constructing new electricity capacities for electricity exports in the Western Balkan countries' that was commissioned by CEE Bankwatch and realized by the University of Groningen and The Advisory House.[31] The background of this study is that almost all governments in the Western Balkans[32] have plans to extend their electricity generation capacity to meet their demand, but they also demonstrate the ambition to become electricity exporters. Over investments in excess electricity generation capacity can give rise to stranded assets – assets that become uneconomic to operate since their marginal cost of generation exceeds the price for electricity. [33]

This country report examines Bosnia and Herzegovina's energy generation[34] and its import/export potential. It examines if a potential excess production of energy would be likely to be met by demand of potential buyers in the region and beyond. Moreover the study presents how the energy mix in Bosnia and Herzegovina will develop over time.

This report is structured as follows: section 2 presents the approach and methodology. Section 3 presents the data. Section 4 presents the analysis and section 5 the conclusions.

Before commencing, a general caveat is in order. This report is based on official documents and predictions provided by the respective governments, power supplier or network operators. Given the scope of this research this report does not engage in the analysis of the legal framework nor does it seek to determine future price levels[35]. Similarly, current transport and grid capacities do not fall within the scope of this study and we do not incorporate effects that may arise from grid or transport restrictions.

3.2 Approach and Methodology

In order to identify the long-term viability of the present and future electricity capacity changes in Bosnia and Herzegovina and its export potential, this study

- compares the current (and future) electricity production to the current (and future) domestic electricity demand and identifies short and long positions (Analysis section 1); and

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31 Authors of this report are Stefan Weishaar, University of Groningen, and Sami Madani, The Advisory House

32 Countries belonging to the Western Balkans are: Albania, Bosnia and Herzegovina, Kosovo, Macedonia, Montenegro, Serbia

33 Ben Caldecott & Jeremy McDaniels: Stranded generation assets: Implications for European capacity mechanisms, Energy Markets and Climate Policy, Working Paper, January 2014, p. 5, http://www.smithschool.ox.ac.uk/research-programmes/stranded-assets/Stranded%20Generation%20Assets%20-%20Working%20Paper%20-%20Final%20Version.pdf

34 Electricity is frequently referred to as 'Energy'. This report only examines electricity. In this report these terms are used interchangeably

35 This report does thus not extend to costs of energy production and input prices or wholesale prices or the like

- compares the (expected) export capacity with the demand of potential regional customers (countries in the Balkans, Ukraine, and Turkey) and supra-regional customers (EU Member States) (Analysis section 2).

The development of the energy mix is presented subsequently (Analysis section 3).

3.2.1 Bosnia and Herzegovina's Supply/Demand analysis

Based upon Bosnia and Herzegovina's specific historic production and import/export figures we determine the national net electricity supply/demand position. In order to account for future developments we also analyse the supply/demand position with regard to the generation capacity that is presently under construction or planned. Based on the current existing plants, current construction projects and construction projects that are planned we develop three electricity supply scenarios.

#	Scenario	Description
1	**Existing capacity**	Calculates the net position based on current supply and demand figures
2	**Likely future capacity**	Calculates the net position based on existing capacity (Scenario 1) and an estimation of additional supply facilities that are under full construction or near starting construction
3	**Planned future capacity**	Calculates the full net position based on Scenario 2 and includes the envisaged electricity production

Table 5 - Bosnia and Herzegovina's electricity supply scenarios

The differentiation between 'likely future capacity' and 'planned future capacity' has been established by CEE Bankwatch. Determinants for differentiating between the two categories are whether construction permits have been granted, whether the constructors are identified and if the financing has been secured.

After obtaining results for electricity generation in Bosnia and Herzegovina, we need to examine domestic demand before we can determine the national net long/short positions. We apply a robustness check in the form of three different electricity consumption scenarios. This robustness check is necessary since we seek to extrapolate electricity demand patterns over a period of 10 years and since changes in demand patterns severely affect Bosnia and Herzegovina's ability to export electricity.

#	Scenario	Description
1	**Low**	1,5% (low consumption scenario[36]) NOSBIH [BiH-01] p. 27 ff.
2	**Medium**	2,6% (realistic consumption scenario) NOSBIH [BiH-01] p. 27 ff.

36 [BiH-01] refers to it as 'pessimistic consumption scenario'

3	**High**	3,2% (high consumption scenario[37]) NOSBIH [BiH-01] p. 27 ff.

Table 6 - Bosnia and Herzegovina's electricity demand scenarios

We selected these scenarios to provide for comparability between our report and existing reports and to enhance stakeholder acceptability. We linearly extended the growth scenarios from 2023 to 2024.

The net long/short position of Bosnia and Herzegovina is calculated by subtracting high, medium and low consumption demand from each of the three electricity supply scenarios. Bosnia and Herzegovina's exporting ability is thus determined for all nine combinations.

In order to determine the long and short position of Bosnia and Herzegovina we also analyse the electricity power balance. This balance examines the actual feed-in of electricity and the demand situation at a particular point in time when the electricity feed-in reserves are at their presumed minimum and the electricity demand is at its presumed maximum. Subject to the caveat relating to the robustness of the underlying data, this enables the identification of critical electricity supply situations. This method should thus be used as an indication only[38].

Data for the hourly peak demand (hourly load values) during the period 2007 – 2013 is taken from Entso-E [BiH-02]. We determine the peak hourly demand for each year (2007 – 2013). The forecast for the medium scenario (2014 – 2023) is taken from Statement on Security of Energy Supply of Bosnia and Herzegovina [BiH-03] p. 20. Data for 2024 has been linearly approximated in accordance with the table above. The high and the low scenarios were calculated on the basis of the growth ratios of the forecasted electricity demand figures presented in the table above.

The peak energy supply (for all of the above supply scenarios) is calculated by multiplying the electricity generation capacity of those power plants that are base load capable with a parameter that reflects the supply security and availability of the electricity generation capacity. The data we use applies an in-feed supply security of 99% as a critical benchmark.[39]

Due to lack of information regarding the particular power plants and electricity networks, we are unable to account for required system reserves, revisions, and planned and unplanned outages and have to rely upon data from Germany.[40] Since for the purpose of this analysis the annual peak demand and peak supply is essential and only last for a

37 [BiH-01] refers to it as 'optimistic consumption scenario'

38 Net operators calculate the demand peaks in general for the 3rd Wednesday of each month. In our report, we deviate from this policy and determine the hourly peak demand on an annual basis

39 Bericht der deutschen Uebertragungsnetzbetreiber zur Leistungsbilanz 2013 nach EnWG §12 Abs. 4 und 5, 30.09.2013, available at http://www.bmwi.de/BMWi/Redaktion/PDF/J-L/leistungsbilanzbericht-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

40 We thereby follow Bericht der deutschen Uebertragungsnetzbetreiber zur Leistungsbilanz 2013 nach EnWG §12 Abs. 4 und 5, 30.09.2013, available at http://www.bmwi.de/BMWi/Redaktion/PDF/J-L/leistungsbilanzbericht-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

short moment, we only consider the unplanned outages that cannot be time shifted beyond a period of 12 hours.[41] Based on historic supply statistics on these immediate unplanned outages in Germany we obtained parameters for expected base load supply.

Our data set does not distinguish between lignite and coal power plants. We selected the value for lignite since in the Balkans a lot of lignite is available.

Oil/Gas is presumed not to be base load capable because of practices of short term supply contracts and unpredictable policy developments that may endanger the supply security with gas. This may be reconsidered for the future when/if the Ionian Adriatic Pipeline and offshore production is operational.

The data for wind and solar power exhibit low values because these technologies are not base load capable.

Hydropower is regarded to only have a limited base load capacity. Despite significant historic variability in the hydropower electricity generation in the Balkans, it is evident that hydropower plants were able to produce electricity in a stable manner. We therefore do not follow the German report (prescribing 25%)[42] but use 40%.[43]

The net long/short position of peak hourly demand and supply for Bosnia and Herzegovina is calculated by subtracting high, medium and low hourly demand from each of the peak electricity supply scenarios.

Type	Planned Availability
Lignite	93,5%
Coal	94%
Gas/Oil	0%
Biomass	65%
Wind	1%
Photovoltaic	0%
Hydropower	40% (instead of 25%)
Pump storage	80%

Table 7 - Estimated power plant planned availability per type

3.2.2 Bosnia and Herzegovina’s export analysis

The regional analysis examines export opportunities for electricity produced in the scenario countries. We thus compare the possible long position of Bosnia and Herzegovina against the possible long/short positions of its trading partners.

41 We thereby follow Bericht der deutschen Uebertragungsnetzbetreiber zur Leistungsbilanz 2013 nach EnWG §12 Abs. 4 und 5, 30.09.2013, available at http://www.bmwi.de/BMWi/Redaktion/PDF/J-L/leistungsbilanzbericht-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

42 http://www.bmwi.de/BMWi/Redaktion/PDF/J-L/leistungsbilanzbericht-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

43 We calculated the regional average of hydropower generation capacity (excluding pump storage plants) by dividing total hydro power supply 2014 by total installed hydropower capacity (excluding pump storage plants) multiplied by 24 (hours) and 365 (days) = 7297GWh / 25447GWh ≈ 40%

The examined trading partners will be 1) in the Western Balkan region (i.e. the case study countries), 2) regional (i.e. countries adjacent to the case study countries) and supra-regional, i.e. other EU Member States (3) and in the EU, Ukraine and Turkey (4). In order to estimate the import potential of the recipient countries the long/short positions of these countries must be determined.

The following countries have been included in the export analysis:

#	Group	Countries included
1	**Western Balkans**	Albania*, Kosovo*, Macedonia*, Montenegro*, Serbia*
2	**Region**	Group 'Western Balkans' and countries adjacent to the case study countries: Bulgaria, Croatia, Greece, Hungary, Italy, Romania, Slovenia
3	**Western Balkans and EU**	Group 'Western Balkans' and the EU-28 countries
4	**Western Balkan and EU incl. Ukraine and Turkey**	Group 'Western Balkans and EU' and Ukraine and Turkey*

*: Trading partners with different scenarios in this study

Table 8 – Export analysis' groups for Bosnia and Herzegovina

Data for the case study countries is based upon the net long and net short positions in the respective country analysis contained in this report. Data has been obtained from a Study of the European Commission[44] the Turkish Electrical Energy 10-Year Generation Capacity Projection (2009 – 2018)[45] and the IEA and the Energy Strategy of Ukraine.[46] Since the data in the EU report is based on PRIMES that models on the basis of 5 year intervals, we connected the interim years by means of linear approximation.

Given that any forecasting inherently involves uncertainty we need to consider the range of possible outcomes – both at the supply side of Bosnia and Herzegovina and its potential customers (group 1 to 4).

In order to reflect the range of possible import and export demand of the trading partners included in the respective analysis, we examine the lowest and the highest values for the respective years. In terms of the country analysis contained in this report we take the net long/short position of the 'current supply' (scenario 1) and 'high demand growth scenario' as a low estimate and the supply scenario 3 and low demand growth scenario as an estimate for the high import/export value. For the EU and Ukraine we included one scenario each. For Turkey we included a high and low electricity demand scenario.

44 EU Commission, EU Energy, Transport and GHG Emissions Trends to 2050, Reference Scenario 2013, Appendix 2, p. 85 ff.

45 Turkish electricity Transmission Corporation, Turkish Electrical Energy 10-Year Generation Capacity Projection (2009 – 2018), 2009, Energy Demand Balance 2009-2018, (Case I-A) High Demand – Scenario 1, p. 44 and Project Generation Capacity and Energy Demand Balance 2009-2018 (Case II-A), Low Demand – Scenario 1. Approximation from 2018 onwards based on -9684,6x + 82780 (high demand) and -7259,3x + 77896, low demand (year 2009 represents 1)

46 IEA, Key World Energy Statistics, 2012, p. 27 and Energy Strategy of Ukraine for the period through 2035, p. 24, Annex 2. Since only values for 2012 and 2035 were available, values in between have been approximated linearly

This approach enables us to identify possible trading partners in the various groups that would be in demand of the electricity produced by Bosnia and Herzegovina. The analysis also offers an overview over the range of possible outcomes and hence allows decision makers to gain insights into the ‘riskiness’ of investments in the electricity sector. Hence this analysis enables an assessment of the potential risk that investments turn into ‘stranded assets’.

Given that electricity investments are generally regarded as long term investments we have selected three evaluation points at the beginning (2014), in the middle (2019) and at the end (2024) of the period under examination to compare Bosnia and Herzegovina’s import/export capabilities with those of its trading partners.

3.2.3 Bosnia and Herzegovina’s energy mix

This section will present the evolution of the energy mix in Bosnia and Herzegovina based on the electricity supply scenarios.

3.3 Data description

We obtained historic (2007 – 2013) production (total production) and consumption data (consumption total) for Bosnia and Herzegovina from Entso-E’s ‘Detailed Monthly Production (in GWh)’ data set [BiH-02].

Data for the period 2014 – 2024 2014 – 2024 was obtained from NOSBIH [BiH-01] and enriched by data from EPBiH long-term plan [BiH-04] where possible. As described below occasionally data had to be adapted or taken from other sources.

A number of plants merit particular attention:
Data for Tuzla G3, G4, G5, G6, Kakanj G5, G6 and G7, we obtained from EPBiH long term plan [BiH-04] p. 231. We checked for the highest electricity generation and assumed that this could be maintained during the operation period.

The power plant Tuzla 7 was scheduled to commence operations in 2018 (NOSBIH [BiH-05] p. 57). Since the investor has only recently been selected and the contract has not yet been signed nor a construction permit been issued[47], we assume power generation to commence only in 2019. This is in accordance with the EPBIH long-term plan [BiH-04] p. 231. Since the maximum production is listed with 2604 GWh in 2024, we assume that Tuzla 7 will be able to run at this capacity already in 2020. Data is obtained from EPBIH long-term plan [BiH-04] p. 231.

The power plant Kakanj 8 was scheduled to commence operations in 2019 (NOSBIH [BiH-05] p. 57) Since there is currently no contractor, no construction permit and no financing[48], we assume power generation to commence only in 2023, in accordance with the EPBiH long-term plan [BiH-04] p.142 and p. 231. We consequently obtain our data for Kakanj 8 from the EPBIH long-term plan [BiH-04] p. 231 and assume that as of 2024 it runs at full capacity (1820 GWh as indicated for 2025).

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47 See http://www.elektroprivreda.ba/stranica/blok-7-te-tuzla,
http://www.elektroprivreda.ba/novost/14784/potpisan-memorandum-o-razumijevanju-o-finansiranju-izgradnje-bloka-7-

48 http://www.elektroprivreda.ba/stranica/blok-8-te-kakanj

Data for Gacko and Ugljevik was obtained from NOSBIH [BiH-05] p. 56. Data for 2024 is presumed to be the same as 2023. Regular generation downturns (every 4 years) in the case of Gacko and Ugljevik is assumed away so as to maintain consistency with the remaining data.

The electricity generation should start at Banovici in 2019. This information was obtained from the project promoter's webpage[49].

The gas power plant KTG Zenica is assumed to operate 7000h per annum and thus generate 2593,2 GWh[50]. Because financing is supposed to come from China but is not yet finalized, and given that construction has not started, commencing full production in 2017 seems too ambitious. In this report we therefore assume that it will commence electricity generation in 2018. This approach and the figures contrast NOSBIH [BiH-01] p. 31 where the KTG Zenica is expected to produce 3250 GWh as of 2017.

Data obtained for the wind farms Podvelezje, Vlasic, Bitovnja and Zukica Kosa, is based on maximum values contained in the production scenario. Since no absolute capacity data was obtainable, we rely on these data (see EPBiH long-term plan [BiH-04] p.231).

The wind farm Mesihovina is presented with an estimated capacity range of 128 to 146 GWh[51]. Because we are interested in maximum capacities for determining potential excess energy supply, we use 146 GWh for our computations. The project is delayed and presumed to start in 2018.[52]

The hydropower plants Dub and Ustipraca were scheduled for operation in 2014 (see NOSBIH [BiH-05] 56 and the Statement on Security of Energy Supply of Bosnia and Herzegovina [BiH-03] p. 16). Yet, works only began in 2014 and should take 2.5 years[53]. We therefore assume that operations only commence in 2017, as is also envisaged in NOSBIH [BiH-01] p. 31.

The hydropower plant Ulog was scheduled for operation in 2015 (See NOSBIH [BiH-05] p. 56 and the Statement on Security of Energy Supply of Bosnia and Herzegovina [BiH-03] p. 16). This seems optimistic as preparatory works stopped in 2013 after landslides killed some workers. EFT's 2013/2014 annual report states that the project will be put into operation November 2018. Therefore 2019 will be the first year of operation.[54] This is one year later than expected by NOSBIH [BiH-01] p. 31.

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49 http://rmub.ba/termoelektrana/

50 This data is taken from http://www.tuzlanskisajam.ba/media/sajam2014/2014_prezentacije_pdf/12_06-Gas_rudarstvo/13_30_Kombinovana_toplana_elektrana_na_plin.pdf, p. 19

51 EPHZHB website at http://www.ephzhb.ba/projekti/

52 See Ekapija: Oko 100 mil EUR uloženo u obnovljive resurse u BiH - Hercegovina dobija prvu vjetroelektranu već 2015. godine, 29.11.2014 http://www.ekapija.com/website/bih/page/1026400/Oko-100-mil-EUR-ulo%C5%Beeno-u-obnovljive-resurse-u-BiH-Hercegovina-dobija-prvu-vjetroelektranu-ve%C4%87-2015-godine

53 See http://058.ba/2014/11/izgradnja-mhe-na-praci-izmedu-mesica-i-ustiprace/ and http://www.rogatica.com/index.php/vijesti/rogatica/2666-pocela-izgradnja-mh-ustipraca

54 EFT Group, www.eft-group.net/themes/front/assets/annualreport/2013-2014.pdf, p. 28

The Sutjeska mini-hydropower plants were scheduled for operations in 2014 (See NOSBIH [BiH-05] p. 56 and the Statement on Security of Energy Supply of Bosnia and Herzegovina [BiH-03] p. 16). The EIA is, however, being challenged in court and there is no construction permit yet, though there is an investor.[55] We therefore assume that operations will commence in 2017 at the earliest, as is also described in NOSBIH [BiH-01] p. 31.

The Dabar hydropower plant was scheduled for operations in 2018 (See NOSBIH [BiH-05] p. 56 and Statement on Security of Energy Supply of Bosnia and Herzegovina [BiH-03] p. 16). Dabar has a construction permit since September but no main contractor or obvious financing.[56] We therefore assume operations are delayed by one year and that Dabar is to commence operations in 2019 (see NOSBIH [BiH-01] p. 31.

The Ustikolina hydropower plant was scheduled for operations in 2018 (See NOSBIH (2013), p. 56 and the Statement on Security of Energy Supply of Bosnia and Herzegovina [BiH-03] p. 16). Given that the plant does only have a construction permit since September 2014, but no contractor nor clear financing[57], we assume a delay of 3 years, i.e. we assume that electricity generation commences in 2021, see also NOSBIH [BiH-01] p. 31.

The Vranduk hydropower plant was scheduled for operations in 2016 (See NOSBIH [BiH-05] 56 and the Statement on Security of Energy Supply of Bosnia and Herzegovina [BiH-03] p. 16). Although financing exists from the EBRD and EIB, there are currently no results from the tender procedure nor has a construction permit been granted.[58] Operations in 2016 are thus unlikely. According to the EPBiH long-term plan' [BiH-04] p.143, and the NOSBIH [BiH-01] p. 31, operations will commence in 2018. This is the starting date we assume in our data set.

The electricity generation capacity of a group of existing small hydropower plants (Modrac, Bogatići, Una Kostela, Bihać, Krušnica, Osanica, Snježnica) has been approximated by taking the 2014 production data as a basis. The data was obtained from EPBiH long-term plan [BiH-04] p. 156.

For a group of new small hydropower plants (Neretvica, Una Anex, Catici-Kakanj, Kljajici) we observed inconsistencies between data presented in the on EPBiH long-term plan [BiH-04] on p. 146 and 156. While the end points are identical, the growth rates differ. Since there is no additional information explaining these differences, we selected the data on p. 146.

55 This information is corroborated by Natasa Crnkovic, Center for Environment, Banja Luka. This organisation follows the project development closely.

56 See http://www.poslovni.hr/svijet-i-regija/uskoro-gradnja-tunela-za-he-dabar-278666

57 See http://www.elektroprivreda.ba/stranica/hidroelektrana-ustikolinaa and http://www.poslovni.hr/svijet-i-regija/uskoro-gradnja-tunela-za-he-dabar-278666

58 See http://www.elektroprivreda.ba/stranica/hidroelektrana-vranduk and http://www.ebrd.com/news/2013/ebrd-finances-expansion-of-hydro-power-generation-in-bosnia-and-herzegovina.html

It is presumed that the prospective hydropower plants Bileca/Nevesinje will not be producing energy until 2024 as there appears to be a general doubt that they will be ready by 2024, see [BiH-06] p. 602-3.

The HPPs of Srednja Drina (Dubravica, Tegare, Rogacica) will share their electricity generation equally between Bosnia and Herzegovina and Serbia.[59] These power plants are projected to commence construction in 2014 and commence operations towards the end of 2020-2023.[60] Because the project does not have funding, and has no strategic investor and no permits we selected 2023 as a starting date. Even if the NOSBIH development plan does not seem to expect it before 2024, we include these power plants to be in line with Serbia.

Similarly the HPPs of Donja Drina (Kozluk, Drina I, II and III) will share its electricity generation equally between Bosnia and Herzegovina and Serbia.[61] The generation capacity has been taken from the list of electricity projects proposed as DNV KEMA, REKK, EIHP, The Development and Application of a Methodology to Identify Projects of Energy Community Interest (2013).[62] The date for commencing electricity generation was estimated to fall within 2018-2020: we selected the mid-term value, 2019, as a starting date.

Data for small hydropower plants in the Republika Srpska, the HPPs at Upper Drina (Foca, Paunci, Buk Bijela, Sutjeska), and the HPP Mrsovo was taken from the Strategy for energy development in Republika Srpska until 2030 [BiH-06]. The document shows three scenarios – high GDP, high GDP with measures, and low GDP. The 'high GDP' scenario is the middle one and gives 26.3 GWh in 2015, 52.6 in 2020 and 105.1 in 2025 on p. 52 for small HPPs. We have calculated numbers between these values for the intervening years with linear approximation.

For Upper Drina, the report lists on p. 186 783 GWh per year and gives varying dates for start of operations, but even the latest one, 2020 on p. 597 appears optimistic since no investor has been found yet. Consequently we assume 2021 to be the starting date. HPP Mrsovo is listed in the Energy Strategy of Republika Srpska [BiH-06] on p. 103 with 165,1 GWh and as commencing operation in 2020, see p. 603.

The Energy Strategy of Republika Srpska [BiH-06] p. 603 states 2020 as the finishing date for a second unit at Ugljevik. It bears mentioning that in this report the plant is referred to as Ugljevik 2 rather than Ugljevik 3. However, Unit 2 has not been completed and construction work has been stopped as it is subject to an arbitration dispute with

59 See http://www.vienna-economic-forum.com/uploads/media/Glamocic_Prezentacija_razvojni_projekti.pdf, p. 11

60 Presentation of energy projects by Minister of Energy, Development and Environmental Protection, December 2012, p. 20 available at http://www.mzv.sk/App/WCM/Aktualit.nsf/vw_ByID/ID_D54591C5BB38AEF9C1257ADA00561AD3_SK

61 See http://www.vienna-economic-forum.com/uploads/media/Glamocic_Prezentacija_razvojni_projekti.pdf, p. 11

62 DNV KEMA, REKK, EIHP, The Development and Application of a Methodology to Identify Projects of Energy Community Interest (2013), https://www.energy-community.org/portal/page/portal/ENC_HOME/DOCS/2558181/0633975AD4927B9CE053C92FA8C06338 p. 78

Slovenia. We therefore presume that this report is referring to what is now widely known as Ugljevik 3.

Although it has been reported that constructions for Ugljevik 3 will begin in Spring 2015, with a duration of 36-40 months (indicating completion in 2018), the same sources indicate that price negotiations with the main contractor are still on-going, that a financing contract is yet to be signed, and that only a partial construction permit has been obtained so far.[63] Hence, a construction start in Spring 2015 seems ambitious. Since a testing period is required after completion a starting date for operations towards the end of 2019 or in 2020 appears more feasible. In this report we assume Ugljevik 3 to commence operations in 2020.

All projections for the three consumption demand scenarios were obtained from the Statement on Security of Energy Supply of Bosnia and Herzegovina [BiH-03].

As described above, data for the hourly peak demand (hourly load values) during the period 2007 – 2013 is taken from Entso-E [BiH-02]. We determine the peak hourly demand for each year (2007 – 2013). The forecast for the medium scenario (2014 – 2023) is taken from Statement on Security of Energy Supply of Bosnia and Herzegovina [BiH-03] p. 20. Data for 2024 has been linearly approximated in accordance with the table above. The high and the low scenarios were calculated on the basis of the growth ratios of the forecasted electricity demand figures presented in the table above.

For the export analysis data has been obtained from several sources. For the case study countries data was obtained from this report. For the EU it has been taken from the EU Energy, Transport and GHG Emissions Trends to 2050, from the Reference Scenario 2013, Appendix 2, p. 85 ff.. The data for Turkey is taken from the Turkish electricity Transmission Corporation's report on the Turkish Electrical Energy 10-Year Generation Capacity Projection (2009 – 2018), 2009. In particular data is taken from the Electricity demand Balance 2009 – 2018, (Case I-A) High Demand – Scenario 1, p. 44 and Project Generation Capacity and Electricity demand Balance 2009 – 2018 (Case II-A), Low Demand – Scenario 1. It is adapted to suit our needs by means of an approximation from 2018 onwards based on -9684,6x + 82780 (high demand) and -7259,3x + 77896, low demand (year 2009 represents 1). Data for Ukraine is taken from the IEA's Key World Energy Statistics, 2012, p. 27 and from the Energy Strategy of Ukraine for the period through 2035, p. 24, Annex 2. Because only values for 2012 and 2035 were available, they have been approximated in a linear fashion.

3.4 Analysis

This section of the report describes relevant data observations and findings. First, the supply and demand analysis is presented (subsection 1). This section also examines the net long and short positions as well as peak electricity demand and supply. Subsection 2 presents the export analysis and subsection 3 presents the energy mix.

63 http://www.capital.ba/prolongiran-pocetak-izgradnje-te-ugljevik-3/ , http://www.energetika.ba/termoenergija/6935-ponovo-odgodjen-pocetak-izgradnje-termoelektrane-ugljevik-3.html and http://www.poslovni.hr/svijet-i-regija/ponovno-odgoeni-radovi-na-te-ugljevik-3-283239

3.4.1 Supply and Demand

The figures below present the supply and demand patterns for Bosnia and Herzegovina, showing the historic and future supply patterns (for existing capacity, likely future capacity and planned future capacity) in relation to each of the growth scenarios (low, medium and high growth).

Regarding the historical (2007 – 2013) supply and demand pattern, it is evident that Bosnia and Herzegovina has been able to cover its demand and has been able to export electricity.

At the low growth electricity consumption scenario Bosnia and Herzegovina will be able to maintain excess capacity and hence export electricity up until 2023/2024 if no additional generation capacity would be realized (only supply scenario 1). Thereafter it would turn into a net importer. The reason for this is the marked downturn in electricity generation capacity that stems from the phasing out of the Tuzla G3, Tuzla G4, and Kakanj G5 power plants. The power plants that are currently under construction (scenario 2) are in part compensating for this phase out of production capacity. This would enable Bosnia and Herzegovina to (barely) meet its electricity demand beyond 2024. If by contrast all planned future capacity (scenario 3) or equivalent was built, Bosnia and Herzegovina would not only maintain its position as a net exporter in the region but would significantly increase its export capacity (the country would have an export capacity of more than double its projected demand). An increased system efficiency that reduces distribution losses may decrease the demand furthermore, enabling Bosnia and Herzegovina to strengthen its position as a net exporter.

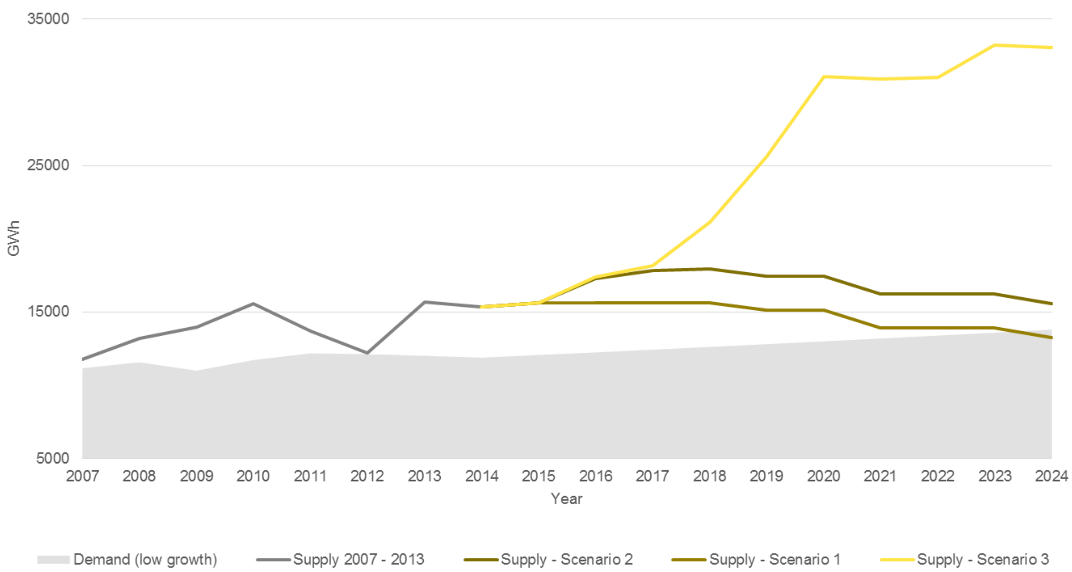

Figure 13 - Bosnia and Herzegovina – Supply/Demand – Low Growth

In the case of medium consumption growth, Bosnia and Herzegovina would still turn into a significant exporter of electricity if all planned future capacity (production scenario 3) was realized. The completion of the currently constructed plants (supply scenario 2) would entail that Bosnia Herzegovina would have a balanced demand and supply pattern up to 2024 and become a net importer thereafter. Under supply scenario 1, the country would turn into a net importer in 2021.

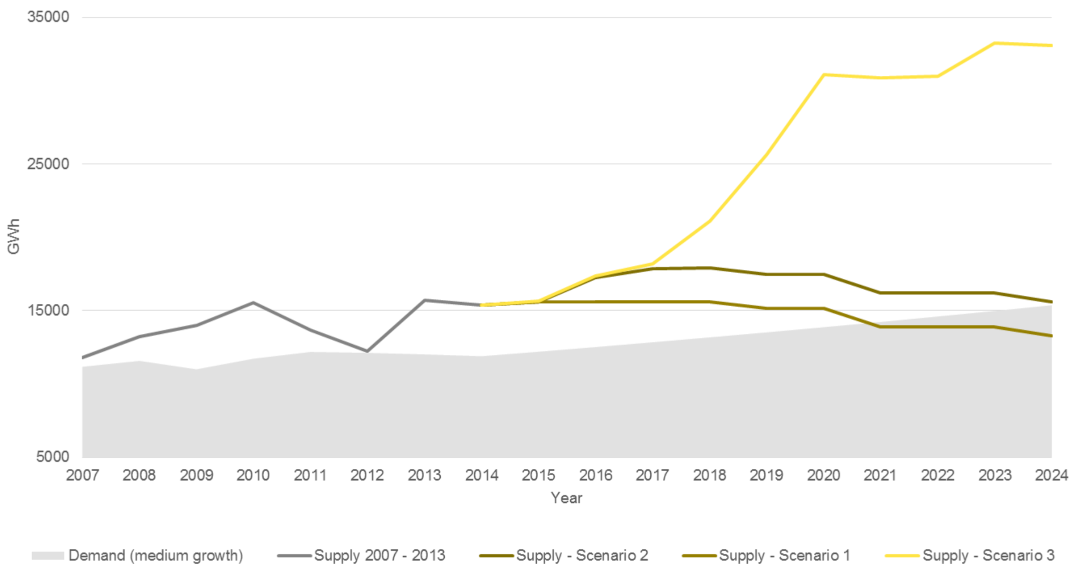

Figure 14 - Bosnia and Herzegovina – Supply/Demand – Medium Growth

In the figure presenting high electricity consumption demand in Bosnia and Herzegovina, it can clearly be seen that production scenarios 1 and 2 are not sufficient for maintaining Bosnia and Herzegovina's position as an exporter. This figure also shows that even in the case of high domestic electricity consumption growth, the realization of all of the future planned capacity expansions would lead to a substantial increase in its exporting capacity (the country could export the equivalent of ca. 110% of its national demand).

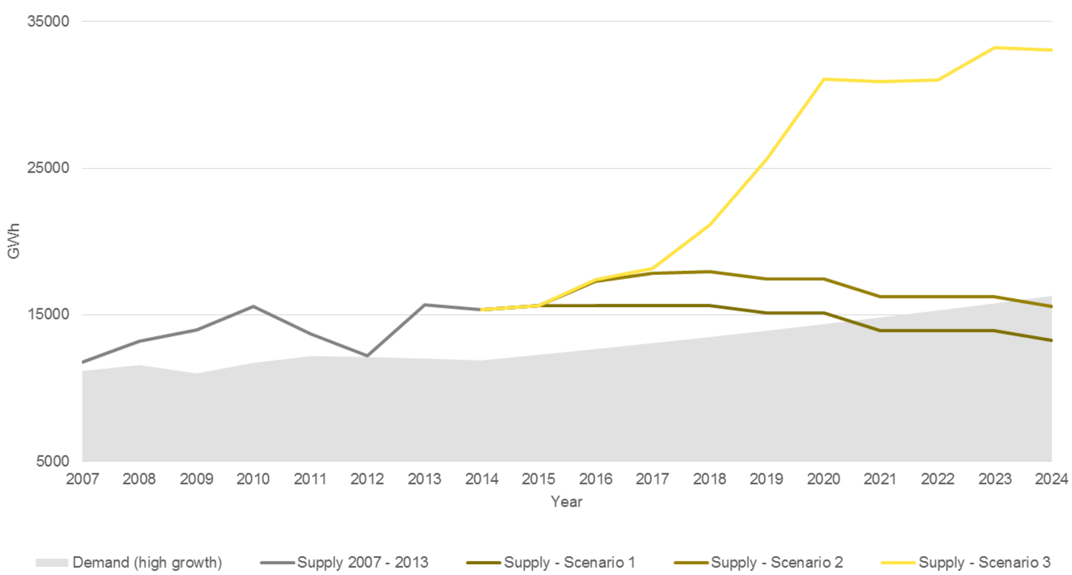

Figure 15 - Bosnia and Herzegovina – Supply/Demand – High Growth

3.4.1.1 Net Position

After examining the general supply and demand patterns, we examine the net long and net short position of Bosnia and Herzegovina. For each of the electricity consumption growth scenarios (low, medium and high growth) we examine the net positions in relation to the energy supply changes (existing capacity, likely future capacity and planned future capacity).

In case of the low consumption growth scenario it is apparent that the electricity generation capacity decline relating to the phase out of production in the Tuzla G3, Tuzla G4, and Kakanj G5 power plants, turns Bosnia and Herzegovina from a net exporter into a country with a balanced position up until 2024 (supply scenario 1). If the currently constructed generation capacity (supply scenario 2) is being realized, the decline is cushioned and Bosnia and Herzegovina retains export potential throughout the period of examination. Again we observe that the realization of all planned projects (supply scenario 3) would entail that Bosnia and Herzegovina would more than treble its exporting capacity over the course of a few years (during the period 2017-2024).

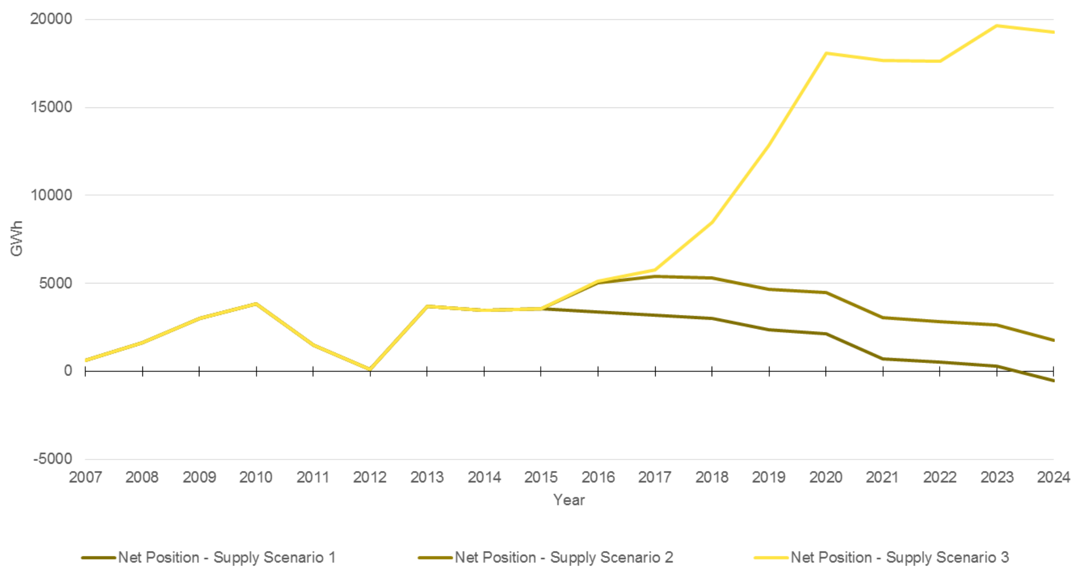

Figure 16 - Bosnia and Herzegovina – Net Position – Low Growth

In the case of the medium electricity consumption growth scenario it is evident that the current efforts to meet Bosnia and Herzegovina's electricity demand are insufficient. As of 2021 (in the case of production scenario 1) and 2024/2025 (in case of production scenario 2) the country would turn into a net importer of electricity. Therefore at least some capacity extensions must be realized to secure self-sufficiency during the period of examination.

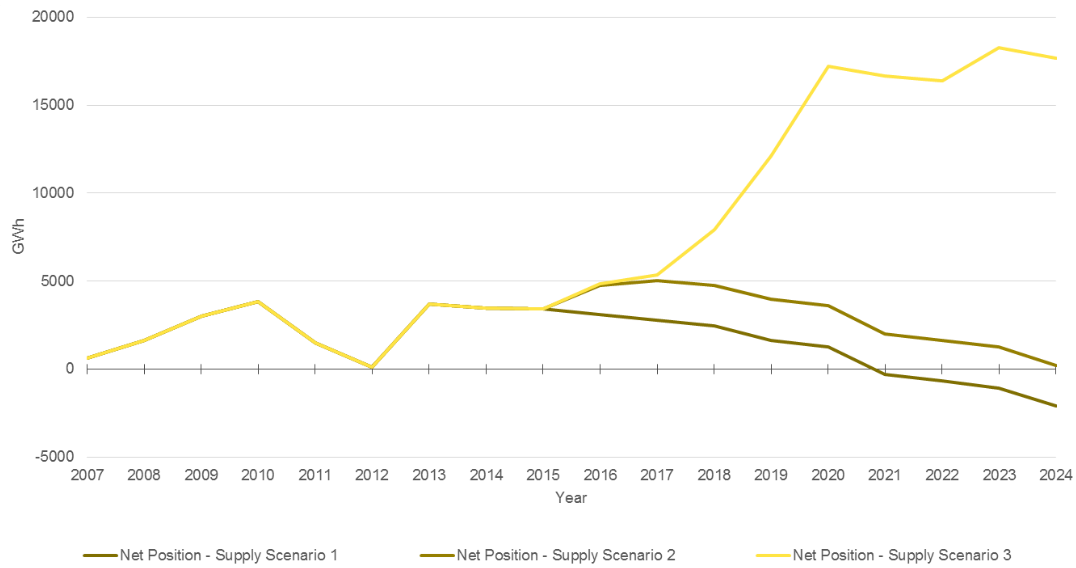

Figure 17 - Bosnia and Herzegovina – Net Position – Medium Growth

The high electricity consumption growth scenario shows similar but more severe findings to those described in the medium growth scenario above.

As of 2020/2021 (in the case of production scenario 1) and 2023/2024 (in case of production scenario 2) the country would turn into a net importer of electricity, underlining that more generation capacity and/or energy saving measures are required to maintain self-sufficiency.

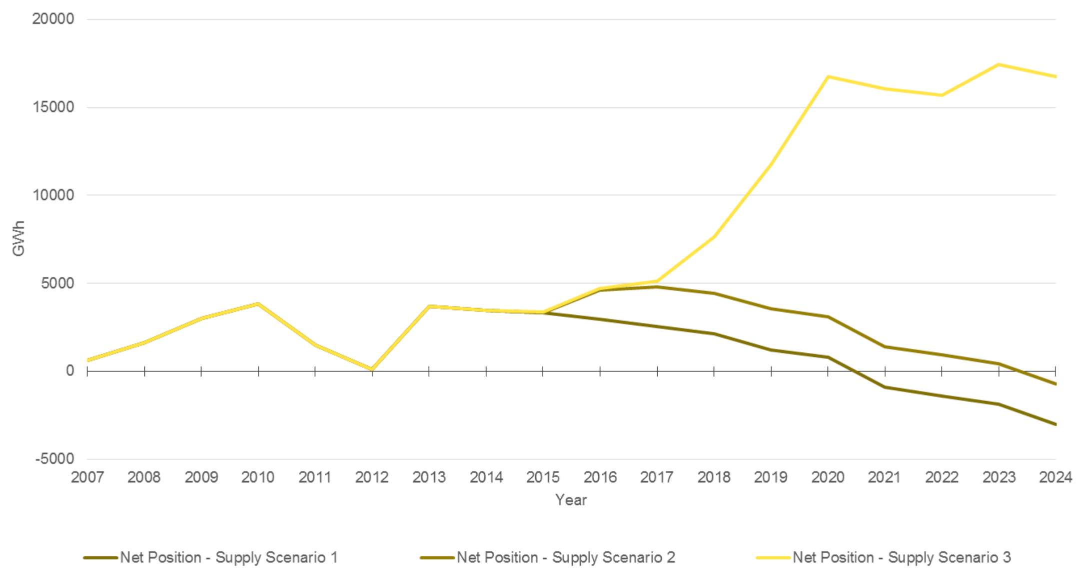

Figure 18 - Bosnia and Herzegovina – Net Position – High Growth

3.4.1.2 <u>Peak supply / peak demand balance</u>

This balance examines the actual feed-in of electricity and the demand situation in Bosnia and Herzegovina when the electricity feed-in reserves are at their presumed minimum and the electricity demand is at its presumed maximum. Subject to the caveat relating to the robustness of the underlying data, this enables the identification of critical electricity supply situations. This method should thus be interpreted with caution and viewed as an indication only.

Based on the available information the figure below shows that peak supply in supply scenario 1 outpaces peak demand up until 2018. Subsequently supply security cannot be safeguarded in the high growth scenario in 2019 and in the low growth scenario as of 2021.

We observe a similar development in supply scenario 2 during the years 2021-2023. Peak supply only considerably outstrips peak demand in scenario 3 during the period of examination.

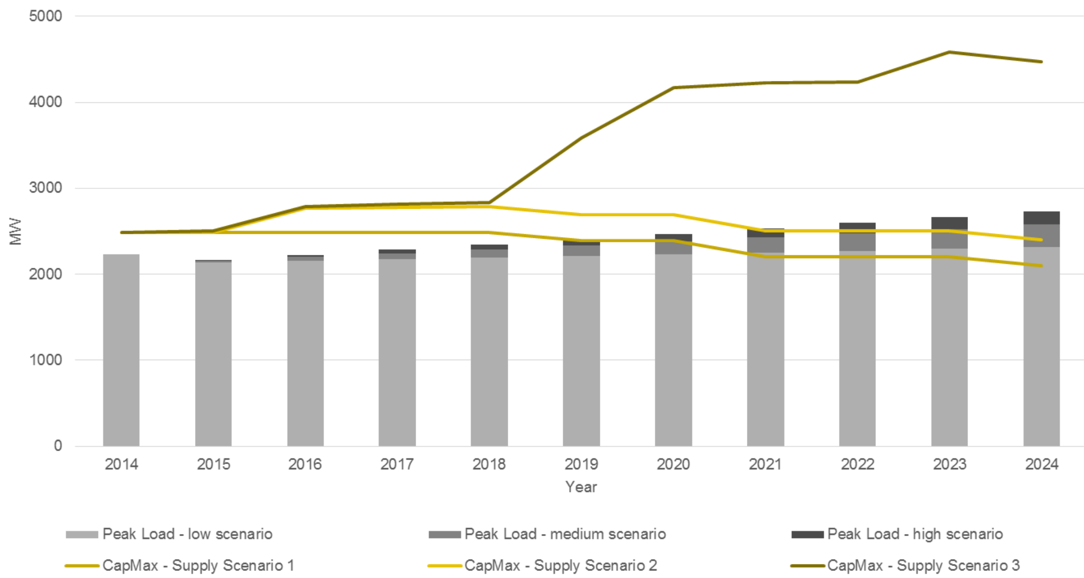

Figure 19 - Bosnia and Herzegovina– Peak Supply/Demand Balance

3.4.2 <u>Export analysis</u>

This section of the report examines where energy produced in Bosnia and Herzegovina could be exported. Potential trading partners can be found in the Western Balkans (i.e. in the other case study countries) (group 1), in the countries surrounding the Western Balkans (i.e. in the region) (group 2), or supra-regionally in the EU (group 3) or in the EU, Ukraine and Turkey (group 4). The export potential of Bosnia and Herzegovina is thus compared to the net position in these groups.

Reflecting the range of outcomes in the supply and demand scenarios the import/export capabilities of Bosnia and Herzegovina and its trading partners are presented in the form of a range in the net exports, showing a minimum and a maximum value. Reflecting the underlying assumptions of the scenarios the range of possible outcomes widens over time.

In the figure below the import/export potential of Bosnia and Herzegovina is shown in golden. Positive values denote Bosnia and Herzegovina's export potential, while negative values denote its import needs. Positive values for the trading partners denote their demand for exports (short position) and negative numbers denote their export supply (long position). In the figure below export possibilities exist if there is a positive net position of Bosnia and Herzegovina and positive export demand of the trading partners.

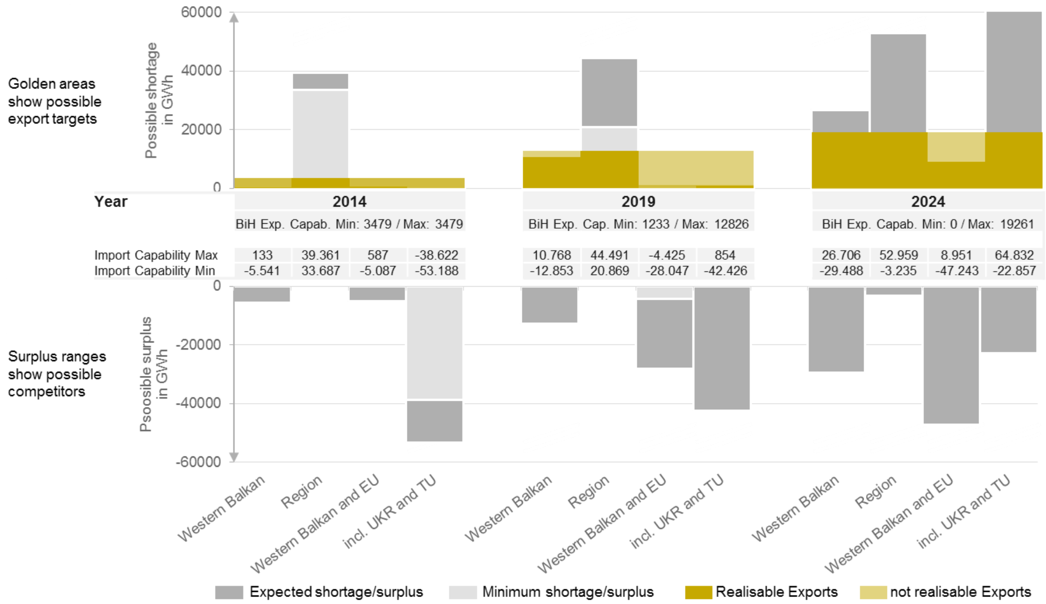

Figure 20 - Bosnia and Herzegovina - Export Analysis

In 2014 Bosnia and Herzegovina is in a long position. The case study countries (scenario 1) were in a net long position entailing that they could export electricity. Examining the Western Balkans and its immediate neighbours jointly (scenario 2), it is noteworthy that they are in a net short position requiring about 28000 to 35000 GWh of electricity, which is mostly driven by Italy. Widening the framework of reference to the Western Balkans and the EU (scenario 3) shows that the region is in a slight long position. Including also Ukraine and Turkey (scenario 4) shows that there is a significant about of excess supply in 2014.

In 2019, the case study countries (scenario 1) will be in a slight long or in a short position entailing that there might be an export market for Bosnia and Herzegovina's electricity while the supply-demand scenarios indicate that Bosnia and Herzegovina might be in a long position of around 13.000 GWh. The Western Balkans and its immediate neighbours considered jointly (scenario 2) are in a significant net short position and thus be importing electricity. Widening the framework of reference to the Western Balkans and the EU (scenario 3) shows, however, that there is no excess demand expected in 2019. Including also Ukraine and Turkey (scenario 4) into the analysis shows that there is a significant excess supply in 2019.

In 2024 Bosnia and Herzegovina is most likely in a net long position up to around 19.000 GWh and thus able to export electricity. The case study countries (scenario 1) would be in a long or in a short position entailing that there might potentially be an export market for Bosnia and Herzegovina's electricity. However, given the range of the net position, it is not clear whether the case study countries will import or export electricity. Again, the Western Balkans and its immediate neighbours considered jointly (scenario 2) are in a significant net short position; this is mostly driven by Italian power demand. Widening the framework of reference to the Western Balkans and the EU (scenario 3) shows, however, that it is unlikely that there will be a lot of excess demand in 2024. Including also Ukraine and Turkey (scenario 4) into the analysis, the figure shows the possibility of a significant excess demand (but also a long position) in 2024. The maximum value for export demand is strongly driven by the Turkish electricity demand figures that are based on an exponential forecasting function. Even If Turkey is considered as a potential market, the transport capacities (costs) need to be observed.

For the purpose of evaluating export potentials and stranded assets a number of relationships need to be described. Transporting electricity is costly: in particular transfer fees (within countries) and transmission fees (between countries) must be paid. Also electricity transportation requires infrastructure. While this report does not extend to these dimensions, we assume that the local electricity market in the Western Balkans and the surrounding states are the most important indicator if there is demand for Bosnia and Herzegovina's electricity. In the region, Bosnia and Herzegovina is directly in competition with Serbia, which has most likely also a long position and will put pressure on the electricity price.

That the EU is in a long position indicates that there will also be other competitors, which can be expected to put pressure on the electricity price, especially for imports into EU. Given that Serbia is most likely in a long position and most likely to export electricity into the Western Balkan neighbourhood, Bosnia and Herzegovina might be likely be at risk of incurring stranded assets if other Western Balkan countries do realize most of their planned projects. For that reason, it might be appropriate to take a closer look at the feasibility of investments that are undertaken to satisfy export demand.

3.4.3 Energy Mix

The figures below present the changes in Bosnia and Herzegovina's energy mix. The data from 2007 – 2013 present the energy mix based on actual production figures. By contrast, the data from 2014 – 2024 show the energy mix based on the maximum likely electricity generation capacity. This difference may explain the temporary decline in hydropower's share in the years 2010 until 2013.

The energy mix in Bosnia and Herzegovina is relatively stable over time with hydropower increasing its production share from 35% in 2014 to 40% in 2024.

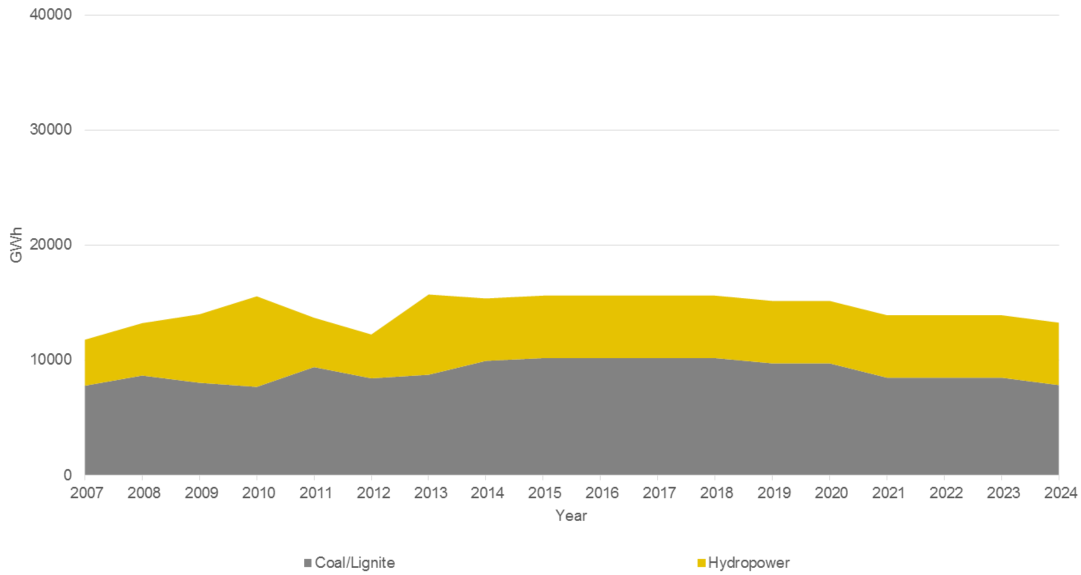

Figure 21 - Bosnia and Herzegovina– Energy Mix Supply Scenario 1

If the current construction projects are being realized the share of hydropower roughly remains stable at 35% (though it temporarily falls by 4%) and wind power comes into the energy mix and reaches 1% of total supply in 2024. Despite a temporary increase of coal/lignite production (by 3%), the absolute share of coal/lignite is roughly the same in 2014 and 2024: 63%.

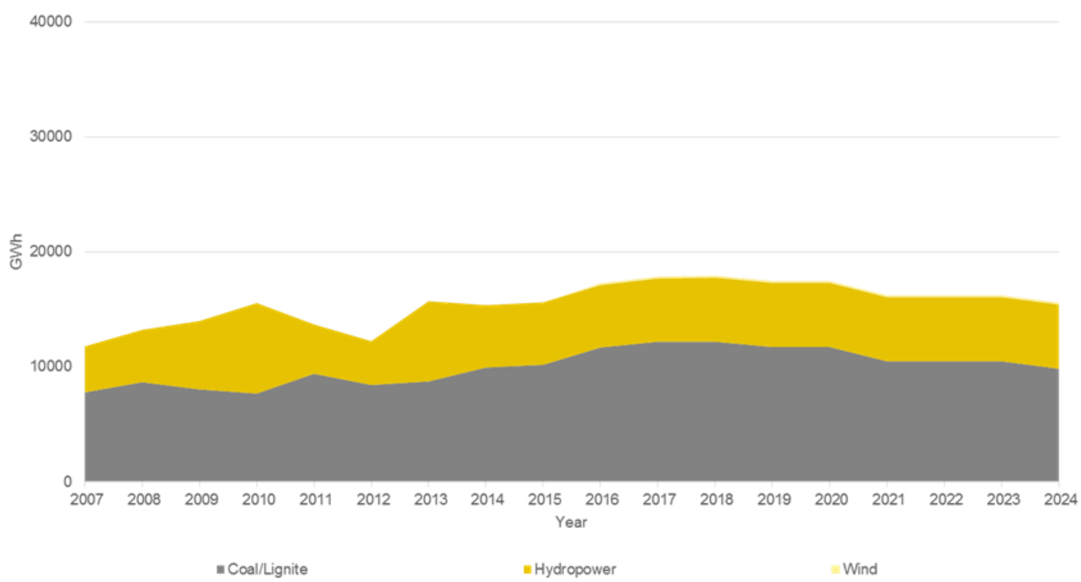

Figure 22 - Bosnia and Herzegovina– Energy Mix Supply Scenario 2

It is in the planned future capacity scenario (supply scenario 3) where the energy mix of Bosnia and Herzegovina changes. The share of Coal/lignite power fluctuates around 65%. Hydropower generation declines from 35% in 2014 to 28% in 2024. Wind enters the energy mix in 2016 and slowly extends its share to 2% in 2024. Gas enters the energy mix in 2018 (12%) but its relative share in the energy mix declines to around 8% in 2024. The above indicates that the planned future capacity is to a large extent biased towards coal and lignite power sources.

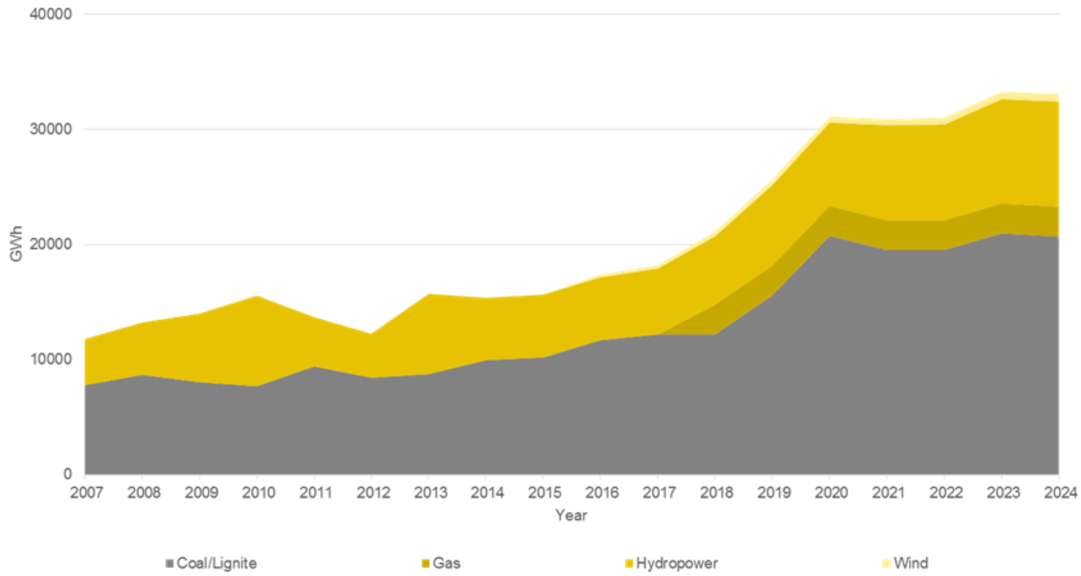

Figure 23 - Bosnia and Herzegovina– Energy Mix Supply Scenario 3

3.5 Concluding remarks

This country report analyses the long-term electricity supply and demand pattern of Bosnia and Herzegovina and examines its electricity export prospects from a stranded assets perspective.

The analysis shows that in the course of the next decade Bosnia and Herzegovina will be turning from a strong energy exporter that historically exported up to 20% of its electricity production to an importer, if it does not pursue additional investments in electricity generation (scenario 3 or equivalent measures) or energy conservation measures. If scenario 3 or equivalent measures were realised, the country would have an export capacity ranging between 17.000 to 20.000 GWh in 2024. If Bosnia Herzegovina realized all of its currently planned capacity extension projects or equivalent, the country would extend its export capacity beyond double its domestic demand in 2024 in a high consumption demand scenario. Based on the current government policies it appears that Bosnia and Herzegovina is preparing to significantly strengthen its position as an energy exporter.

This situation would give rise to a substantial dependency on the export market. The export analysis has shown that the case study countries are likely to compete for exporting electricity to the neighbouring countries. Bosnia and Herzegovina will be in direct competition with Serbia for export markets. Strong competition may in particular come from EU Member States, namely Bulgaria and Romania, and possibly in the near future Ukraine and Turkey. A high dependency on the export market therefore exposes the country to create the risk of stranded assets. Determinants of competitiveness should therefore be closely examined. From this point of view, a make-or-buy decision should also be investigated prior to new investments.

Concerning the peak load demand and supply analysis, it bears mentioning that Bosnia and Herzegovina is expected to remain vulnerable. In supply scenario 1 and 2 Bosnia and Herzegovina would also have difficulty to satisfy peak demand.

In the case of Bosnia and Herzegovina a few demand side issues merit particular mentioning. A demand side issue that is not examined in the case study but should be mentioned are the transmission and distribution losses. In Bosnia and Herzegovina the overall loss in transmission and distribution amount to around 13%[64]. An increased performance of the network will have an impact on the security of supply as well as on the net position without further additional generation capacities. Moreover, energy efficiency measures may lead to electricity savings and help to improve the country's net position.

This report shows that the country does require good regional ties in the area of energy policy. The current infrastructure should therefore be examined from this perspective. Importantly this report shows that Bosnia and Herzegovina have strong electricity export ambitions, potentially making it one of the largest exporters in the Western Balkans. This accentuates the danger of stranded assets if the domestic electricity expansion decisions are taken without taking due account of developments in other countries in the Western Balkans and beyond. Decisions to buy or produce electricity should thus be taken in a strategic fashion that also takes due account of energy security considerations. It can thus be concluded that integration and collaboration in the area of energy policy in the Western Balkans is vital for Bosnia and Herzegovina.

64 Around 343 GWh were lost in transmission and 1105 GWh in distribution in 2013, see Energy Community Secretariat, Annual Implementation Report, August 2014, p. 49, available at: https://www.energy-community.org/pls/portal/docs/3356393.PDF

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[BiH-02] Data provided by ENTSO-E, https://www.entsoe.eu

[BiH-03] Statement on Security of Energy Supply of Bosnia and Herzegovina, July 2013, http://www.energy-community.org/portal/page/portal/ENC_HOME/DOCS/2422180/SOS_Bosnia_and_Herzegovina_2013.pdf

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[BiH-06] Energy Development Plan of Republika Srpska until 2030 (latin alphabet version), Zagreb/Banja Luka, August 2010. http://www.vladars.net/sr-sp-cyrl/vlada/ministarstva/mper/Documents/plan%20razvoja%20energetike%20rs%20do%202030%20-%20latinica.pdf

4. Country Report Macedonia

4.1 Introduction

This country report is a self-contained subset of the 'Report on the long-term economic viability of constructing new electricity capacities for electricity exports in the Western Balkan countries' that was commissioned by CEE Bankwatch and realized by the University of Groningen and The Advisory House.[65] The background of this study is that almost all governments in the Western Balkans[66] have plans to extend their electricity generation capacity to meet their demand, but they also demonstrate the ambition to become electricity exporters. Over investments in excess electricity generation capacity can give rise to stranded assets – assets that become uneconomic to operate since their marginal cost of generation exceeds the price for electricity. [67]

This country report examines Macedonia's energy generation[68] and its import/export potential. It examines if a potential excess production of energy would be likely to be met by demand of potential buyers in the region and beyond. Moreover the study presents how the energy mix in Macedonia will develop over time.

This report is structured as follows: section 2 presents the approach and methodology. Section 3 presents the data. Section 4 presents the analysis and section 5 the conclusions.

Before commencing, a general caveat is in order. This report is based on official documents and predictions provided by the respective governments, power supplier or network operators. Given the scope of this research this report does not engage in the analysis of the legal framework nor does it seek to determine future price levels[69]. Similarly, current transport and grid capacities do not fall within the scope of this study and we do not incorporate effects that may arise from grid or transport restrictions.

4.2 Approach and Methodology

In order to identify the long-term viability of the present and future electricity capacity changes in Macedonia and its export potential, this study

- compares the current (and future) electricity production to the current (and future) domestic electricity demand and identifies short and long positions (Analysis section 1); and

65 Authors of this report are Stefan Weishaar, University of Groningen, and Sami Madani, The Advisory House

66 Countries belonging to the Western Balkans are: Albania, Bosnia and Herzegovina, Kosovo, Macedonia, Montenegro, Serbia

67 Ben Caldecott & Jeremy McDaniels: Stranded generation assets: Implications for European capacity mechanisms, Energy Markets and Climate Policy, Working Paper, January 2014, p. 5, http://www.smithschool.ox.ac.uk/research-programmes/stranded-assets/Stranded%20Generation%20Assets%20-%20Working%20Paper%20-%20Final%20Version.pdf

68 Electricity is frequently referred to as 'Energy'. This report only examines electricity. In this report these terms are used interchangeably

69 This report does thus not extend to costs of energy production and input prices or wholesale prices or the like

- compares the (expected) export capacity with the demand of potential regional customers (countries in the Balkans, Ukraine, and Turkey) and supra-regional customers (EU Member States) (Analysis section 2).

The development of the energy mix is presented subsequently (Analysis section 3).

4.2.1 Macedonia’s Supply/Demand analysis

Based upon Macedonia’s specific historic production and import/export figures we determine the national net electricity supply/demand position. In order to account for future developments we also analyse the supply/demand position with regard to the generation capacity that is presently under construction or planned. Based on the current existing plants, current construction projects and construction projects that are planned, we develop four electricity supply scenarios. The first three scenarios are based on current official reports. Scenario 4 is based on a current Draft Energy Strategy of Macedonia until 2035 [MK-01] which had to be included into the analysis because there are substantial differences in the planned future capacity extensions (see data description).

#	Scenario	Description
1	**Existing capacity**	Calculates the net position based on current supply and demand figures
2	**Likely future capacity**	Calculates the net position based on existing capacity (Scenario 1) and an estimation of additional supply facilities that are under full construction or near starting construction
3	**Planned future capacity**	Calculates the full net position based on Scenario 2 and includes the envisaged electricity production.
4	**Draft projections**	Supply scenario based on the Draft Energy Strategy of Macedonia until 2035 [MK-01]

Table 9 – Macedonia’s electricity supply scenarios

The differentiation between ‘likely future capacity’ and ‘planned future capacity’ has been established by CEE Bankwatch. Determinants for differentiating between the two categories are whether construction permits have been granted, whether the constructors are identified and if the financing has been secured.

After obtaining results for electricity generation in Macedonia, we need to examine domestic demand before we can determine the national net long/short positions. We apply a robustness check in the form of three different electricity consumption scenarios. This robustness check is necessary since we seek to extrapolate electricity demand patterns over a period of 10 years and since changes in demand patterns severely affect Macedonia’s ability to export electricity.

#	Scenario	Description
1	**Low**	According to the strengthened Energy efficiency scenario the consumption growth in Macedonia growth

		until 2020 with an average annual rate of 2.2%, Strategy for Energy Development in the Republic of Macedonia until 2030 [MK-02] p.7
2	**Medium**	Base scenario based on final electricity consumption growth until 2002 with an average annual rate of 2.64%, Strategy for Energy Development in the Republic of Macedonia until 2030 [MK-02] p.7
3	**High**	The high growth scenario is based on the medium growth scenario to which the difference between the low and medium scenario was added

Table 10 – Macedonia's electricity demand scenarios

The low and medium scenarios were selected to provide for comparability between our report and existing reports and to enhance stakeholder acceptability. The high consumption growth scenario was selected with the same range between the low demand growth and the baseline scenario to allow for a robust energy policy in case of high consumption demand growth.

The net long/short position of Macedonia is calculated by subtracting high, medium and low consumption demand from each of the four electricity supply scenarios. Macedonia's exporting ability is thus determined for all twelve combinations.

In order to determine the long and short position of Macedonia we also analyse the electricity power balance. This balance examines the actual feed-in of electricity and the demand situation at a particular point in time when the electricity feed-in reserves are at their presumed minimum and the electricity demand is at its presumed maximum. Subject to the caveat relating to the robustness of the underlying data, this enables the identification of critical electricity supply situations. This method should thus be used as an indication only[70].

Data for the hourly peak demand (hourly load values) during the period 2007 – 2013 is taken from Entso-E [MK-03]. We determine the peak hourly demand for each year (2007 – 2013) and forecast the remaining years (2014 – 2024).

Because the values between the historic data (2007 – 2013) and the future data (2014-2024) can differ[71] we need a starting point for our peak demand forecast that also includes information from 2014. We therefore apply the following formula:

The peak load for 2014 is calculated as follows:

$$P_{2014} = \frac{D_{2014}}{Average(D_n,D_{n-1},D_{n-2})} * Average(P_n, P_{n-1}, P_{n-2})$$

where:
D represents the demand in the given year,
P is the peak load
And n is the next year before 2014 where data is available, normally 2013.

70 Net operators calculate the demand peaks in general for the 3rd Wednesday of each month. In our report, we deviate from this policy and determine the hourly peak demand on an annual basis

71 Historical data shows the actual produced electricity while the future data is based on planned volumes

The peak load for year n is calculated as follows

$$P_n = \frac{D_n}{D_{n-1}} * P_{n-1}$$

where:
D represents the demand in the given year,
P is the peak load
And n is the year after 2014.

We multiply this ratio with the average peak of 2011 – 2013 to determine the hourly peak demand for 2014. The peak demand is then forecasted with the growth rate that underlies the low-, medium-, and high demand scenario.

The peak energy supply (for all of the above supply scenarios) is calculated by multiplying the electricity generation capacity of those power plants that are base load capable with a parameter that reflects the supply security and availability of the electricity generation capacity. The data we use applies an in-feed supply security of 99% as a critical benchmark.[72]

Due to lack of information regarding the particular power plants and electricity networks, we are unable to account for required system reserves, revisions, and planned and unplanned outages and have to rely upon data from Germany.[73] Since for the purpose of this analysis the annual peak demand and peak supply is essential and only lasts for a short moment, we only consider the unplanned outages that cannot be time shifted beyond a period of 12 hours.[74] Based on historic supply statistics on these immediate unplanned outages in Germany we obtained parameters for expected base load supply.

Our data set does not distinguish between lignite and coal power plants. We selected the value for lignite since in the Balkans a lot of lignite is available.

Oil/gas is presumed not to be base load capable because of practices of short term supply contracts and unpredictable policy developments that may endanger the supply security with gas.

The data for wind and solar power exhibit low values because these technologies are not base load capable.

Hydropower is regarded to only have a limited base load capacity. Despite significant historic variability in the hydropower electricity generation in the Balkans, it is evident

72 Bericht der deutschen Uebertragungsnetzbetreiber zur Leistungsbilanz 2013 nach EnWG §12 Abs. 4 und 5, 30.09.2013, available at http://www.bmwi.de/BMWi/Redaktion/PDF/J-L/leistungsbilanzbericht-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

73 We thereby follow Bericht der deutschen Uebertragungsnetzbetreiber zur Leistungsbilanz 2013 nach EnWG §12 Abs. 4 und 5, 30.09.2013, available at http://www.bmwi.de/BMWi/Redaktion/PDF/J-L/leistungsbilanzbericht-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

74 We thereby follow Bericht der deutschen Uebertragungsnetzbetreiber zur Leistungsbilanz 2013 nach EnWG §12 Abs. 4 und 5, 30.09.2013, available at http://www.bmwi.de/BMWi/Redaktion/PDF/J-L/leistungsbilanzbericht-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

that hydropower plants were able to produce electricity in a stable manner. We therefore do not follow the German report (prescribing 25%)[75] but use 40%.[76]

The net long/short position of peak hourly demand and supply for Macedonia is calculated by subtracting high, medium and low hourly demand from each of the peak electricity supply scenarios.

Type	Planned Availability
Lignite	93,5%
Coal	94%
Gas/Oil	0%
Biomass	65%
Wind	1%
Photovoltaic	0%
Hydropower	40% (instead of 25%)
Pump storage	80%

Table 11 – Estimated power plant planned availability per type

4.2.2 Macedonia's export analysis

The regional analysis examines export opportunities for electricity produced in the scenario countries. We thus compare the possible long position of Macedonia against the possible long/short positions of its trading partners.

The examined trading partners will be 1) in the Western Balkan region (i.e. the case study countries), 2) regional (i.e. countries adjacent to the case study countries) and supra-regional, i.e. other EU Member States (3) and in the EU, Ukraine and Turkey (4). In order to estimate the import potential of the recipient countries the long/short positions of these countries must be determined.

The following countries have been included in the export analysis:

#	Group	Countries included
1	**Western Balkans**	Albania*, Bosnia and Herzegovina*, Kosovo*, Montenegro*, Serbia*
2	**Region**	Group 'Western Balkans' and countries adjacent to the case study countries: Bulgaria, Croatia, Greece, Hungary, Italy, Romania, Slovenia
3	**Western Balkans and EU**	Group 'Western Balkans' and the EU-28 countries
4	**Western Balkans and EU incl. Ukraine and Turkey**	Group 'Western Balkans and EU' and Ukraine and Turkey*

*: Trading partners with different scenarios in this study

Table 12 – Export analysis' groups for Macedonia

75 http://www.bmwi.de/BMWi/Redaktion/PDF/J-L/leistungsbilanzbericht-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

76 We calculated the regional average of hydropower generation capacity (excluding pump storage plants) by dividing total hydro power supply 2014 by total installed hydropower capacity (excluding pump storage plants) multiplied by 24 (hours) and 365 (days) = 7297GWh / 25447GWh ≈ 40%

Data for the case study countries is based upon the net long and net short positions in the respective country analysis contained in this report. Data has been obtained from a Study of the European Commission[77] the Turkish Electrical Energy 10-Year Generation Capacity Projection (2009 – 2018)[78] and the IEA and the Energy Strategy of Ukraine.[79] Since the data in the EU report is based on PRIMES that models on the basis of 5 year intervals, we connected the interim years by means of linear approximation.

Given that any forecasting inherently involves uncertainty we need to consider the range of possible outcomes – both at the supply side of Macedonia and its potential customers (group 1 to 4).

In order to reflect the range of possible import and export demand of the trading partners included in the respective analysis, we examine the lowest and the highest values for the respective years. In terms of the country analysis contained in this report we take the net long/short position of the 'current supply' (scenario 1) and 'high demand growth scenario' as a low estimate and the supply scenario 3 and low demand growth scenario as an estimate for the high import/export value.[80] For the EU and Ukraine we included one scenario each. For Turkey we included a high and low electricity demand scenario.

This approach enables us to identify possible trading partners in the various groups that would be in demand of the electricity produced by Macedonia. The analysis also offers an overview over the range of possible outcomes and hence allows decision makers to gain insights into the 'riskiness' of investments in the electricity sector. Hence this analysis enables an assessment of the potential risk that investments turn into 'stranded assets'.

Given that electricity investments are generally regarded as long term investments we have selected three evaluation points at the beginning (2014), in the middle (2019) and at the end (2024) of the period under examination to compare Macedonia's import/export capabilities with those of its trading partners.

4.2.3 Macedonia's energy mix

This section will present the evolution of the energy mix in Macedonia based on the electricity supply scenarios.

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77 EU Commission, EU Energy, Transport and GHG Emissions Trends to 2050, Reference Scenario 2013, Appendix 2, p. 85 ff.

78 Turkish electricity Transmission Corporation, Turkish Electrical Energy 10-Year Generation Capacity Projection (2009 – 2018), 2009, Energy Demand Balance 2009-2018, (Case I-A) High Demand – Scenario 1, p. 44 and Project Generation Capacity and Energy Demand Balance 2009-2018 (Case II-A), Low Demand – Scenario 1. Approximation from 2018 onwards based on -9684,6x + 82780 (high demand) and -7259,3x + 77896, low demand (year 2009 represents 1)

79 IEA, Key World Energy Statistics, 2012, p. 27 and Energy Strategy of Ukraine for the period through 2035, p. 24, Annex 2. Since only values for 2012 and 2035 were available, values in between have been approximated linearly

80 We use supply scenario 3 because supply scenario 4 lies below scenario 3

4.3 Data description

We obtained historic (2007 – 2013) production (total production) and consumption data (consumption total) for Macedonia from Entso-E's [MK-03] 'Detailed Monthly Production (in GWh)' data set.

Production forecasts for the period 2014-2023 for the various power plants were obtained from the Statement on Security of Supply – Republic of Macedonia [MK-04] and from ELEM [MK-05]. Data for 2024 is prolonged based on 2023 data.

The lignite thermal power plants (Bitola 1, 2, 3 and Oslomej) and the heavy crude oil thermal power plant TPP Negotino are about to enter their final period of their life cycle of around 40 years and consequently this should also be reflected in our data set (see Strategy for Energy Development in the Republic of Macedonia until 2030 [MK-02] p. 14 and Statement on security of supply – Republic of Macedonia [MK-04] p. 29 and 30). However, due to inconsistencies within the Strategy for Energy Development in the Republic of Macedonia until 2030 [MK-02] on p. 111ff. and 161 ff., where the Oslomej plant continues to generate electricity till 2022, we assume that the Oslomej plant will not be decommissioned before 2022. The energy strategy has apparently been adapted. Similarly according to the Strategy for Energy Development in the Republic of Macedonia until 2030 [MK-02] p. 159 ff. the plant Bitola 1's decommissioning is time shifted from 2021 to 2023. This is reflected in the data set[81].

TPP Negotino II is expected to be reconstructed and it is envisaged to produce different and increasing quantities of electricity in accordance with various scenarios contained in the Strategy for Energy Development in the Republic of Macedonia until 2030 [MK-02] p. 161. For 2030 TPP Negotino II is reported to be able to produce 2132 GWh in 2030. We assume that the power plant will already be able to produce 2132 GWh in 2024, which is the year it is envisaged to commence operations.

Using the same logic, we expect TPP Negotino to deliver up to 1308 GWh (Strategy for Energy Development in the Republic of Macedonia until 2030 [MK-02] p. 111'), TPP Mariovo II to produce 2137 GWh (Strategy for Energy Development in the Republic of Macedonia until 2030 [MK-02] 161 ff.) and Bitola 4 to produce 2210 GWh (Strategy for Energy Development in the Republic of Macedonia until 2030 [MK-02] 161 ff.).

The construction of HPP Boskov Most appears to be delayed. It was originally envisaged to be operational by 2015, and then rescheduled to 2017 or early 2018. Since it is expected to take 4 years for construction and works have not yet commenced, we assume operation will only start in 2019 (see Strategy for Energy Development in the Republic of Macedonia until 2030 [MK-02] p. 39).

HPP Cebren is part of a pump storage complex and we assume it produces on average 54 GWh net (840 GWh of turbine minus 786 GWh of pump) electricity annually during peak demand as of 2019 (see Strategy for Energy Development in the Republic of Macedonia until 2030 [MK-02] p. 39).

The HPPs in the Vardar valley (Babuna, Zgropolci, Gradsko, Kukurecani, Krivolak, Dubrovo, Demir Kapija, Miletkovo, Gavato, Gevgelija) appear to be at the pre-feasibility study stage of the project development cycle and are not contained in the Strategy for

81 According to Draft energy strategy of Macedonia until 2035 [MK-01] TPP Negotino and TPP Oslomej will be decommissioned on a later date. This is not taken into account in this study

Energy Development in the Republic of Macedonia until 2030 [MK-02]. We therefore assume that the realization of any power plant would take at least 5 years. The HPPs would thus not commence operations before 2020.

The TPP Oslomej has been reported to generate 500 GWh per year between 2014 – 2019 (see Statement on Security Supply – Republic of Macedonia [MK-04] p. 30). Yet in the Strategy for Energy Development in the Republic of Macedonia until 2030 [MK-02] p. 111 ff., the Oslomej power plant is reported to be capable of producing up to 677 GWh. We therefore use this figure in our report.

CHP Energetika Skopje is reported to produce 160 GWh (see Statement on Security Supply – Republic of Macedonia [MK-04] p. 31). However, in the Strategy for Energy Development in the Republic of Macedonia until 2030 [MK-02] p. 160, it is reported that CHP Energetika is capable of producing 2197 GWh. We included this figure in our data set.

Data for wind park Bogdanci was taken from ELEM[82].

We obtained the projected consumption demand from the Strategy for Energy Development in the Republic of Macedonia until 2030 [MK-02] p. 102 and p. 159. We used the baseline scenario as the medium growth scenario and the 'strengthened Energy Efficiency' (Strategy for Energy Development in the Republic of Macedonia until 2030 [MK-02] p. 104 and p. 160) as our low growth scenario. We derived the high cost scenario by computing the annual differences between the low growth and medium growth scenario and adding these to the medium growth scenario.

Supply scenario 4 had to be included because the Draft Energy Strategy of Macedonia until 2035 [MK-01] differs in several respects from the currently available official reports.

The Draft Energy Strategy of Macedonia until 2035 [MK-01] p. 44 and 77 reports that HPP Crn Kamen and other small hydropower plants will generate 106 GWh as of 2020. We included this in supply scenario 4.

HPP Boskov Most is presumed to commence operations one year later, thus in 2020 rather than 2019 (See Draft Energy Strategy of Macedonia until 2035 [MK-01] (p. 47).

The hydropower plants Gradec, Cebren and Veles are reported to commence operations several years later. Gradec and Cebren will commence in 2033, and Veles in 2027 (See Draft Energy Strategy of Macedonia until 2035 [MK-01] p. 65). The TPP Bitola 4 and Mariovo will commence operations only in 2033 (See Draft Energy Strategy of Macedonia until 2035 [MK-01] p. 45, p. 74 following). TPP Negotino 2 is not mentioned at all in the Draft Energy Strategy of Macedonia until 2035 [MK-01].

It also bears mentioning that the latest Draft Energy Strategy of Macedonia until 2035 [MK-01] presents on p. 46, 62 and 63 several new wind power, CHP biomass, TPP biogas, geothermal and photovoltaic energy capacity extensions. These do, however, only have an indication as to the installed capacity in MW but not to the electricity that will be produced per annum. We are therefore unable to incorporate these in our data

82 ELEM (2012), Windpark Project, p. 4, available at
http://www.elem.com.mk/images/stories/objekti/1_Windpark_Ang.pdf

set. Given that the total amount of installed capacity is limited, we do not expect that this will impair the general findings of this report.

Electricity supply scenario 4 is based on the Draft energy strategy of Macedonia until 2035. Because the time shifting of the HPPs and TPPs significantly reduces the electricity generation capacity of Macedonia, supply scenario 4 lies below supply scenario 3.

We obtained the projected consumption demand from the Strategy for Energy Development in the Republic of Macedonia until 2030 [MK-02] p.7, taking the strengthened energy efficiency scenario as a low growth scenario and the base scenario as our medium growth scenario. The high consumption growth scenario was selected with the same range between the low demand growth (2.2%) and the baseline scenario (2.64%) to allow for a robust energy policy in case of high consumption demand growth.

As described above, data for the hourly peak demand (hourly load values) during the period 2007 – 2013 is taken from Entso-E [MK-03]. We determine the peak hourly demand for each year (2007 – 2013) and forecast the remaining years (2014 – 2024).

For the export analysis data has been obtained from several sources. For the case study countries data was obtained from this report. For the EU it has been taken from the EU Energy, Transport and GHG Emissions Trends to 2050, from the Reference Scenario 2013, Appendix 2, p. 85 ff.. The data for Turkey is taken from the Turkish electricity Transmission Corporation’s report on the Turkish Electrical Energy 10-Year Generation Capacity Projection (2009 – 2018), 2009. In particular data is taken from the Electricity demand Balance 2009 – 2018, (Case I-A) High Demand – Scenario 1, p. 44 and Project Generation Capacity and Electricity demand Balance 2009 – 2018 (Case II-A), Low Demand – Scenario 1. It is adapted to suit our needs by means of an approximation from 2018 onwards based on -9684,6x + 82780 (high demand) and -7259,3x + 77896, low demand (year 2009 represents 1). Data for Ukraine is taken from the IEA’s Key World Energy Statistics, 2012, p. 27 and from the Energy Strategy of Ukraine for the period through 2035, p. 24, Annex 2. Because only values for 2012 and 2035 were available, they have been approximated in a linear fashion.

4.4 Analysis

This section of the report describes relevant data observations and findings. First, the supply and demand analysis is presented (subsection 1). This section also examines the net long and short positions as well as peak electricity demand and supply. Subsection 2 presents the export analysis and subsection 3 presents the energy mix.

4.4.1 Supply and Demand

The figures below present the supply and demand patterns for Macedonia, showing the historic and future supply patterns (for existing capacity, likely future capacity, planned future capacity and the draft projections) in relation to each of the growth scenarios (low, medium and high growth).

Regarding the historical (2007 – 2013) supply and demand pattern, it is evident that Macedonia has not covered its demand domestically and has been importing significant amounts of energy. At times only 20% of its energy consumed has been imported (e.g. in 2009) while in other years imports amounted to 30% (in 2013).

A significant difference between the actual historical data (2007 – 2013) and the installed production capacity in Macedonia (as of 2014) can be observed. Possible domestic energy supply more than doubles from 2013 to 2014. This strong increase is explained by the difference between actual production presented by the historic data and the maximum capacity considered as of 2014. Specifically, this marked increase is largely attributable to the gas power plants ENERGETIKA Skopje (2197 GWh per year) and the Combined Cycle Cogeneration Power Plant TE-TO – Skopje (2011) (1800 GWH). But also the capacity increase of the Bogdanci wind park (100 GWh as of 2015) contributes to this increase.

This marked increase transforms Macedonia from a large energy importer to a country with tremendous energy export capacity (more than 40% of its own electricity consumption in 2014 in case of the low consumption demand scenario).

Due to the decommissioning of the TPP Negotino oil power plant after 40 years of operation, 1308 GWh of production capacity is phased out in 2018. The lignite power plants Oslomej (677 GWh) and Bitola 1 (1467 GWh) will be phased out and not be in operation in 2023 and 2024 respectively. This explains the downturn in the projected energy supply of Macedonia in those years.

It also bears mentioning that the supply scenarios 1 (existing capacity) is very comparable to supply scenario 2 (likely future capacity) because only the Wind Park Bogdanci phase 2 (installed 13.8 MW) is currently being planned (37 GWh as of 2016).

At the low growth electricity consumption scenario Macedonia will be able to maintain excess capacity and hence export electricity up until 2023 in supply scenarios 1 (current capacity) and 2 (currently under construction). If, by contrast, all planned future capacity (scenario 3) would be built, Macedonia would strongly increase its export capacity. In scenario 4, however, Macedonia would be in a short position as of 2024.

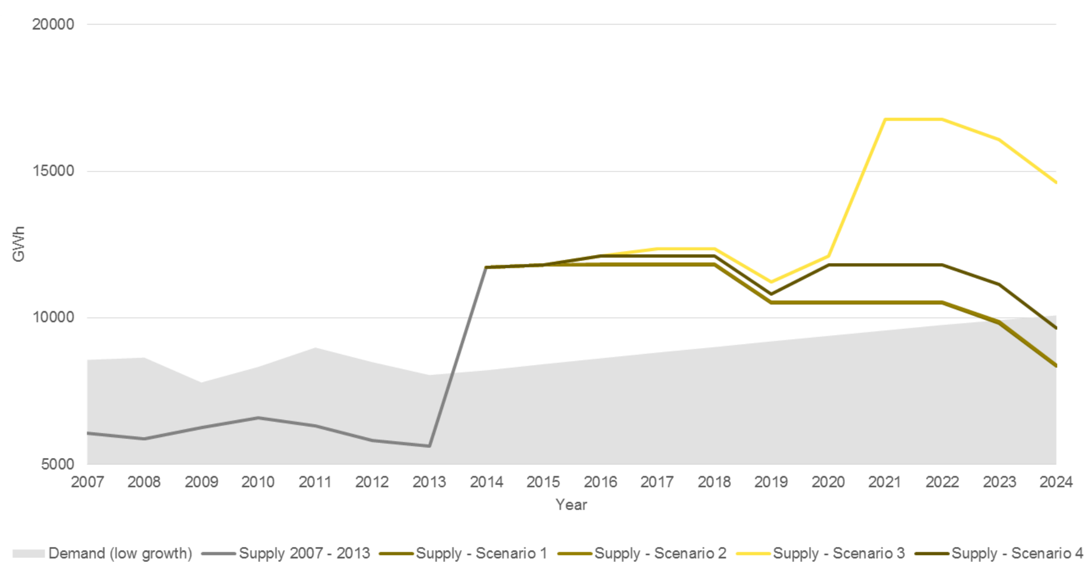

Figure 24 – Macedonia – Supply/Demand – Low Growth

Also in the case of medium consumption growth, Macedonia would turn into a significant exporter of electricity if all planned future capacity (supply scenario 3) was realized. The completion of the currently constructed plants (supply scenario 2) would entail that Macedonia would have a balanced demand and supply pattern during the years 2019 – 2021 and would become a net importer of energy as of 2021/2022. In case none of the power plants currently under construction were to be realized (supply scenario 1), Macedonia would turn into an energy importer in 2021 and in case of supply scenario 4 the country would turn into an importer as of 2023.

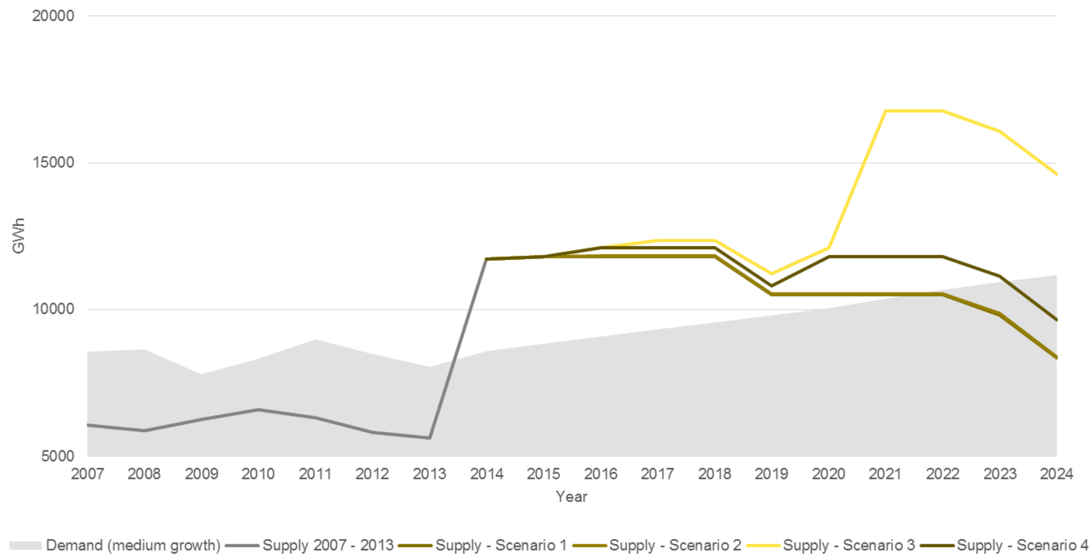

Figure 25 – Macedonia – Supply/Demand – Medium Growth

In the figure presenting high electricity consumption demand in Macedonia, it can clearly be seen that production scenarios 1 and 2 are not sufficient for satisfying Macedonia's electricity demand beyond 2019/2020. In the case of scenario 4 (based on the Draft Energy Strategy of Macedonia until 2035 [MK-01]), Macedonia would be net-short as of 2022/2023. This figure also shows that even in the case of high domestic electricity consumption growth, the realization of all of future planned capacity expansions (or equivalent capacity extensions) would lead to a substantial increase of its exporting capacity after 2020.

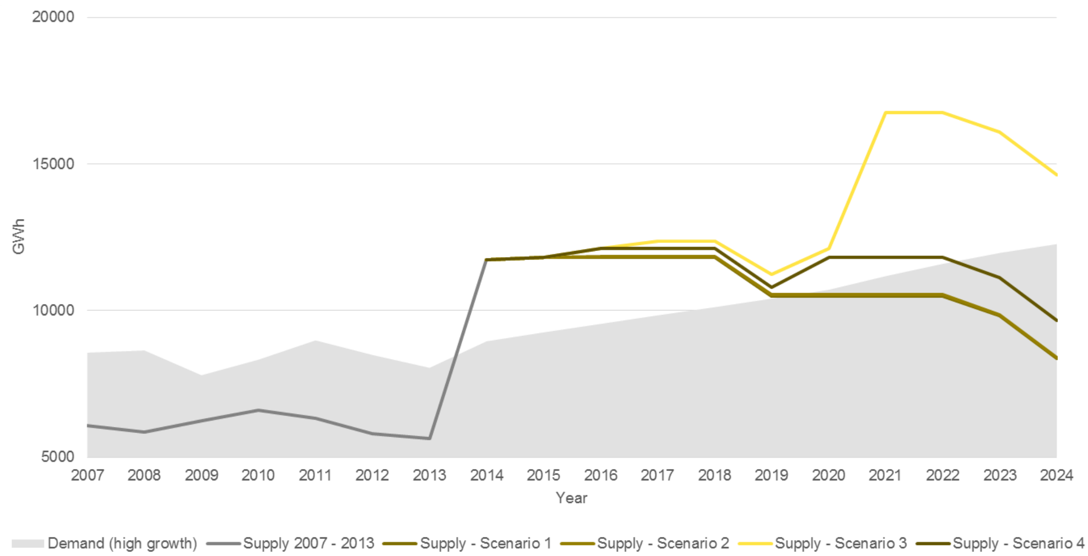

Figure 26 – Macedonia – Supply/Demand – High Growth

4.4.1.1 Net Position

After examining the general supply and demand patterns, we examine the net long and net short position of Macedonia. For each of the electricity consumption growth scenarios (low, medium and high growth) we examine the net positions in relation to the energy supply changes (existing capacity, likely future capacity, planned future capacity and the draft projections).

The marked difference between actual historic production figures (2007 – 2013) and maximum production capacity (2014 and beyond) can clearly be seen in the figures below. As indicated above, this increase is largely attributable to the gas power plants ENERGETIKA Skopje (2197GWh per year) and the Combined Cycle Cogeneration Power Plant TE-TO – Skopje (2011) (1800 GWH) as well as to the Bogdanci wind park (100 GWh as of 2015).

In case of the low consumption growth scenario it is apparent that the electricity generation capacity decline relating to the decommissioning of the TPP Negotino oil power plant (1308GWh) in 2018, the lignite power plants Oslomej (677 GWh) in 2023 and Bitola 1 (1467 GWh) in 2024, strongly contribute to Macedonia turning into an importer towards the end of the examined period. The net import figure clearly shows that the current plant construction (production scenario 2) is insufficient to overpower the effect of this phase out of production capacity. Realizing all of the planned capacity expansions (supply scenario 3) (or comparable electricity production capacity measures) would lead to a strong over-compensation of the generation capacity decline due to the decommissioning of plants and would entail that Macedonia maintains a large exporting capacity of around 44% of its projected demand in 2024. If the draft capacity extensions in the Draft Energy Strategy of Macedonia until 2035 [MK-01] were realised (scenario 4), Macedonia would not be an exporting country but a net importer in 2024.

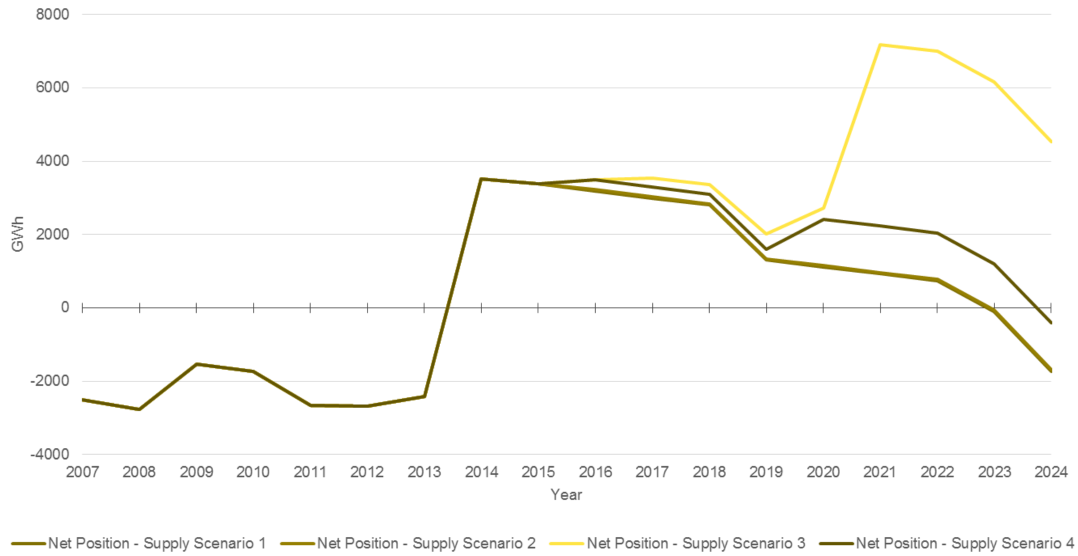

Figure 27 – Macedonia – Supply/Demand – Low Growth

In the case of the medium electricity consumption growth scenario it is evident that current efforts to meet Macedonia's electricity demand are insufficient to keep it self-sufficient. As of 2022 (in the case of supply scenario 1 and scenario 2) the country would turn (again) into a net importer of electricity. Therefore, at least some of the planned future capacity extensions (or equivalent projects) in scenario 3 would need to be realized to secure self-sufficiency during the period of examination. In supply scenario 4, Macedonia would not be able to satisfy its electricity demand.

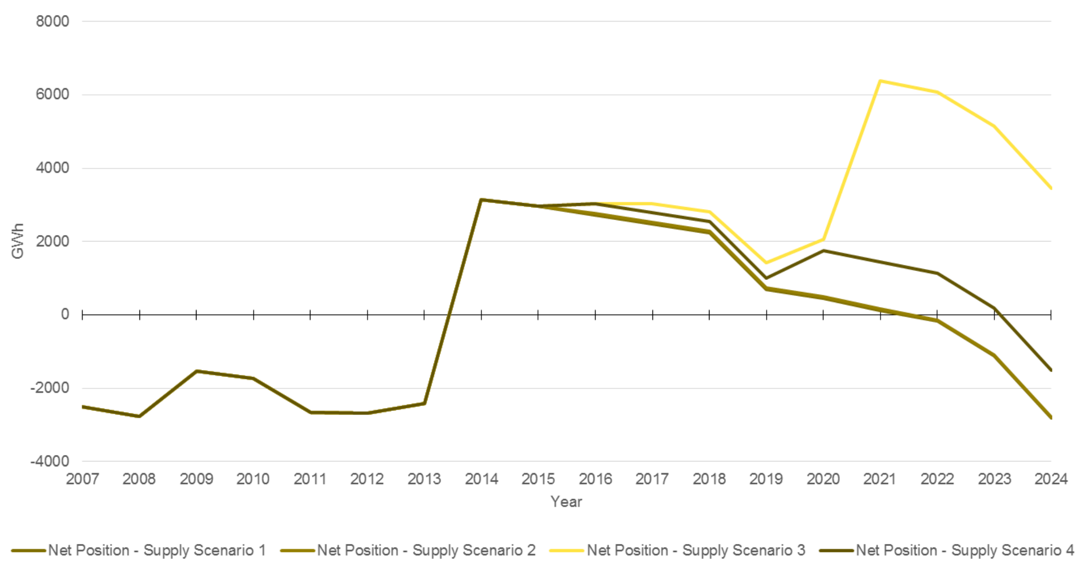

Figure 28 – Macedonia – Supply/Demand – Medium Growth

The high electricity consumption growth scenario shows similar findings to those described in the medium growth scenario above. As of 2019/2020 (in the case of supply scenario 1 and 2) the country would turn into a net importer of electricity, underlining that more generation capacity is required to maintain self-sufficiency. In case of the projections of the Draft energy Strategy of Macedonia until 2034 (supply scenario 4) Macedonia would turn into an energy importer as of 2022.

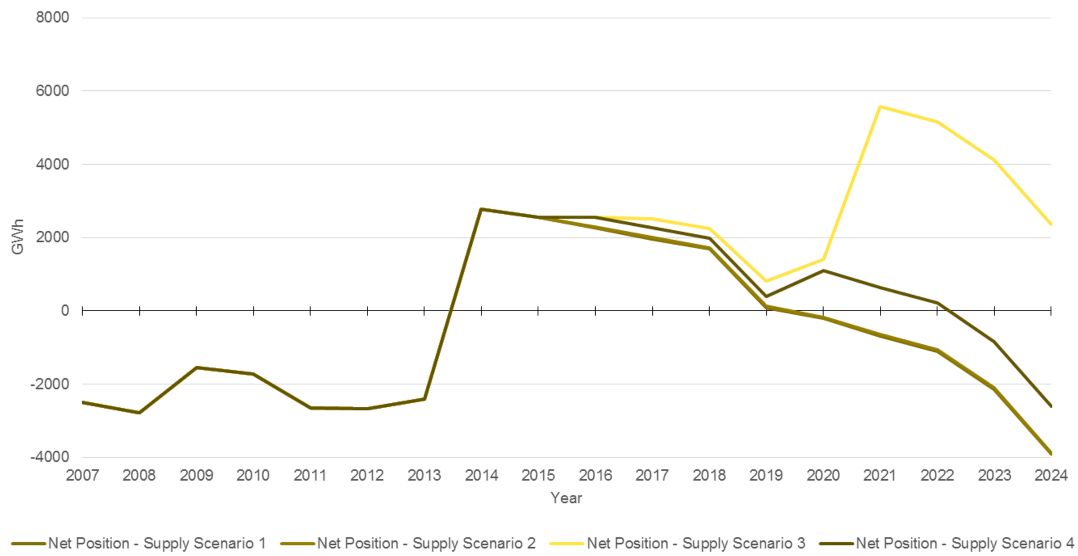

Figure 29 – Macedonia – Supply/Demand – High Growth

4.4.1.2 Peak supply / peak demand balance

This balance examines the actual feed-in of electricity and the demand situation in Macedonia when the electricity feed-in reserves are at their presumed minimum and the electricity demand is at its presumed maximum. Subject to the caveat relating to the robustness of the underlying data, this enables the identification of critical electricity supply situations. This method should thus be interpreted with caution and viewed as an indication only.

Based on the available information the figure below clearly shows that peak demand for all demand scenarios severely outpaces the available peak supply in supply scenarios 1 and 2. In fact, supply scenario 2 is identical to scenario 1 because the Wind Park Bogdanci and Photovoltaic with PT are not base load capable and a TPP biogas with PT is not expected to commence operations in time. In supply scenario 3, however, peak electricity demand can be satisfied for the low and sometimes for the medium electricity demand scenario. In supply scenario 4 in particular a number of lignite power plants (TPP Mariovo, TPP Bitola 4, TPP Negotino 2) are presumed not to operate, explaining the weaker ability to satisfy peak demand.

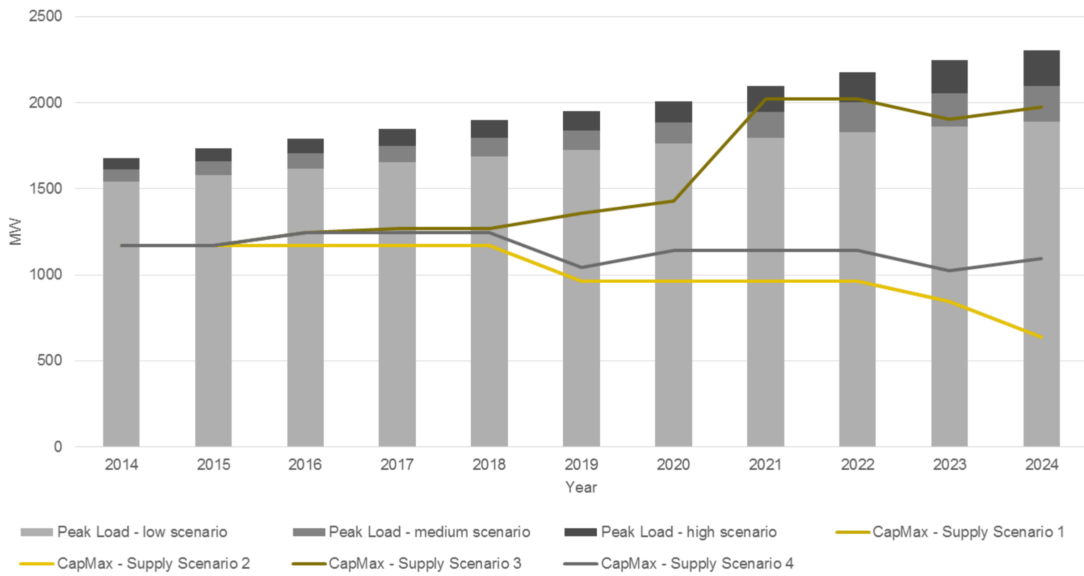

Figure 30 - Macedonia – Peak Supply/Demand Balance

4.4.2 <u>Export analysis</u>

This section of the report examines where energy produced in Macedonia could be exported. Potential trading partners can be found in the Western Balkans (i.e. in the other case study countries) (group 1), in the countries surrounding the Western Balkans (i.e. in the region) (group 2), or supra-regionally in the EU (group 3) or in the EU, Ukraine and Turkey (group 4). The export potential of Macedonia is thus compared to the net position in these scenarios.

Reflecting the range of outcomes in the supply and demand scenarios, the import/export capabilities of Macedonia and its trading partners are presented in the form of a range in the net exports, showing a minimum and a maximum value. Reflecting the underlying assumptions of the scenarios the range of possible outcomes widens over time.

In the figure below the import/export potential of Macedonia is shown in gold. Positive values denote Macedonia's export potential, while negative values denote its import needs. Positive values for the trading partners denote their demand for exports (short position) and negative numbers denote their export supply (long position). In the figure below export possibilities exist if there is a positive net position of Macedonia and positive export demand of the trading partners.

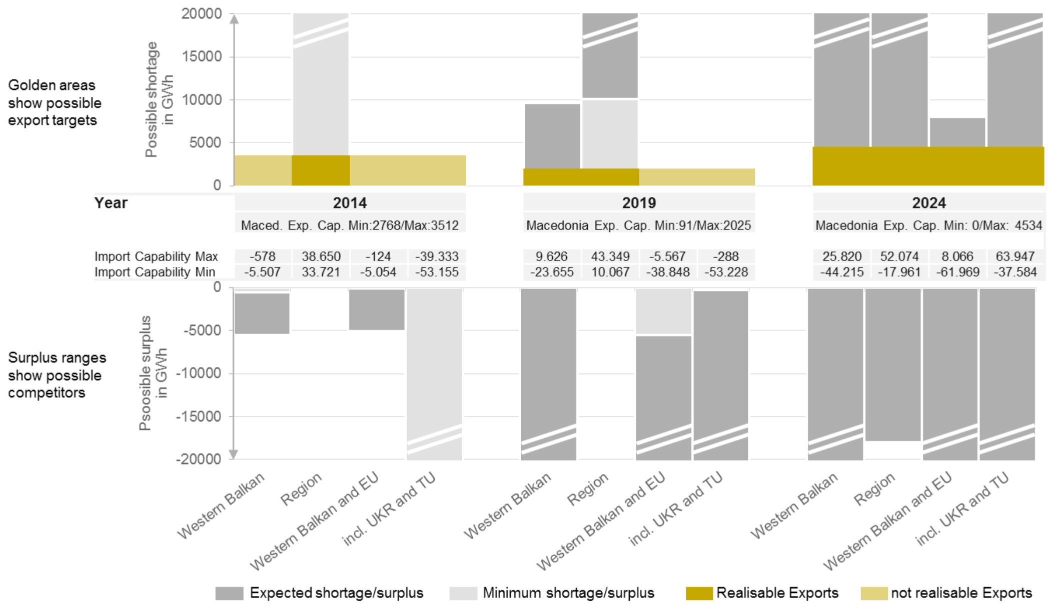

Figure 31 – Macedonia - Export Analysis

In 2014 Macedonia is in a long or short position. In case of a low consumption growth scenario Macedonia would be able to export up to 42% of its domestic demand (ca. 3500 GWh). The case study countries (group 1) were in a net long position entailing that they could export electricity. Examining the Western Balkans and its immediate neighbours jointly (group 2), it is noteworthy that they are in a net short position requiring about 28000 to 35000 GWh of electricity. Widening the framework of reference to the Western Balkans and the EU (group 3) shows that the region is in a slight long position. Including also Ukraine and Turkey (group 4) shows that there is a significant amount of excess supply in 2014.

In 2019 Macedonia is in a net long or slightly short position. If Macedonia is long, it could export up to 22% of its domestic demand (in case of the low consumption growth scenario). The case study countries (group 1) would be in a slight long or in a short position entailing that there might be a small export market for Macedonia electricity. However, given the range of the net position, it appears more likely that the case study countries will be striving to export electricity. Again the Western Balkans and its immediate neighbours considered jointly (group 2) are in a significant net short position and thus be importing electricity. Widening the framework of reference to the Western Balkans and the EU (group 3) shows, however, that there is no excess demand expected in 2019. Including also Ukraine and Turkey (group 4) into the analysis shows that there is a significant excess supply in 2019.

In 2024 Macedonia can be in a significantly long or in a significantly short position. In terms of domestic demand (low demand growth scenario) it might be able to export up to 45% of its total domestic electricity demand. The case study countries (group 1) will either be in a long or in a short position entailing that there might potentially be an export market for Macedonia's electricity. However, given the range of the net position, it appears more likely that the case study countries will be striving to export electricity. Again the Western Balkans and its immediate neighbours considered jointly (group 2) are in a significant net short position or in a net long position. It is thus unclear if they would be importers or exporters of electricity. Widening the framework of reference to the Western Balkans and the EU (group 3) shows, however, that it is unlikely that there will be a lot of excess demand in 2024. Including also Ukraine and Turkey (group 4) into the analysis, the figure shows the possibility of a significant excess demand (but also a long position) in 2024. The maximum value for export demand is strongly driven by the Turkish electricity demand figures that are based on an exponential forecasting function. If Turkey is considered as a potential market, the transport capacities (costs) need to be observed.

For the purpose of evaluating export potentials and stranded assets a number of relationships need to be described. Transporting electricity is costly: in particular transfer fees (within countries) and transmission fees (between countries) must be paid. Also electricity transportation requires infrastructure. While this report does not extend to these dimensions, we assume that the local electricity market in the Western Balkans and the surrounding states are the most important indicator if there is demand for Macedonia electricity. That the EU is in a long position indicates that there will at least be competition which can be expected to put pressure on the electricity price.

The above has shown that Macedonia may be either in a long or a short position. If it turns into an exporting country the potential export capacity (measured in terms of domestic demand) is tremendous – both in case of a low demand growth scenario, but also in case of a high domestic demand scenario. Macedonia's maximum export capacity ranges between 2000 GWh and 4500 GWh and may therefore be felt in the region. Given that this constitutes a very significant amount in terms of domestic electricity demand, Macedonia may grow quickly dependent on its export markets. Given that future electricity markets are potentially long or might be supplied by other competitors, future electricity prices may be lower and hence give rise to stranded assets.

4.4.3 Energy Mix

The figures below present the changes in Macedonia's energy mix. The data from 2007 – 2013 present the energy mix based on actual production figures. By contrast, the data from 2014 – 2024 show the energy mix based on the maximum likely electricity generation capacity. This difference may explain the temporary decline in hydropower's share in the years 2010 until 2013.

Based on installed capacity, the energy mix in Macedonia (2014 – 2024) is generally quite stable. Coal/lignite (43%) and gas (34%) represent the largest share of installed capacity. This is followed by hydropower and oil with around 11% each, and wind power (ca. 1%). The energy mix changes in the years 2023 and 2024 due to generation capacity phase-outs. In 2024 Coal/lignite accounts for 35%, gas for 48%, hydropower for 16% and wind for a little over 1%. Oil is no longer part of the energy mix.

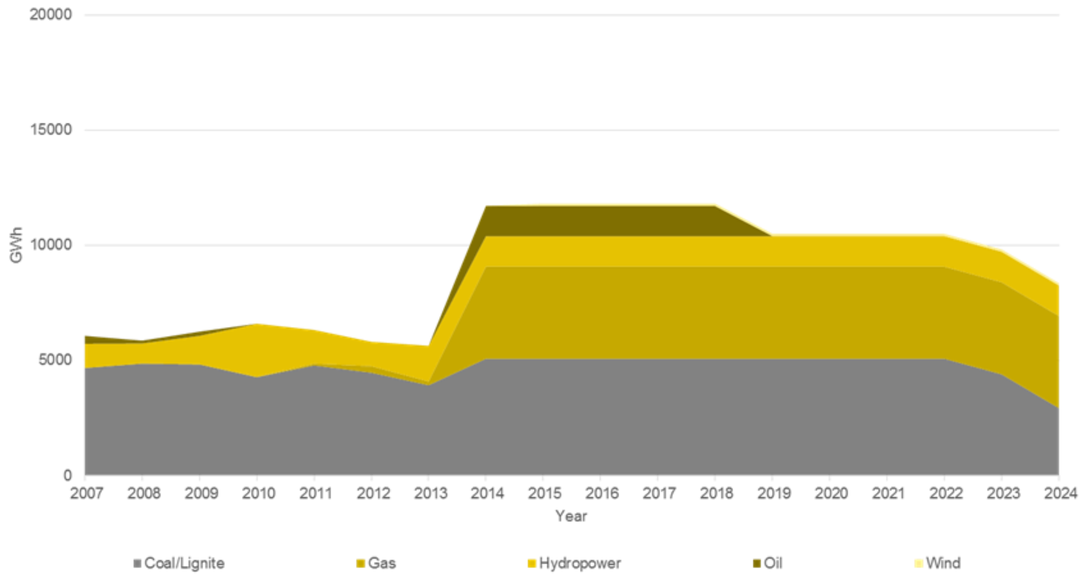

Figure 32 – Macedonia– Energy Mix Supply Scenario 1

If the current construction projects are being realized, the share of hydropower increases from 11% in 2014 to 16% in 2024. Over the same period the share of coal/lignite falls from 43% to 35%. This is attributable to the decommissioning of TPP Oslomej (677 GWh) in 2023. The share of oil (TPP Negotino) accounts for about 11% of the electricity production during the years 2014 to 2018.

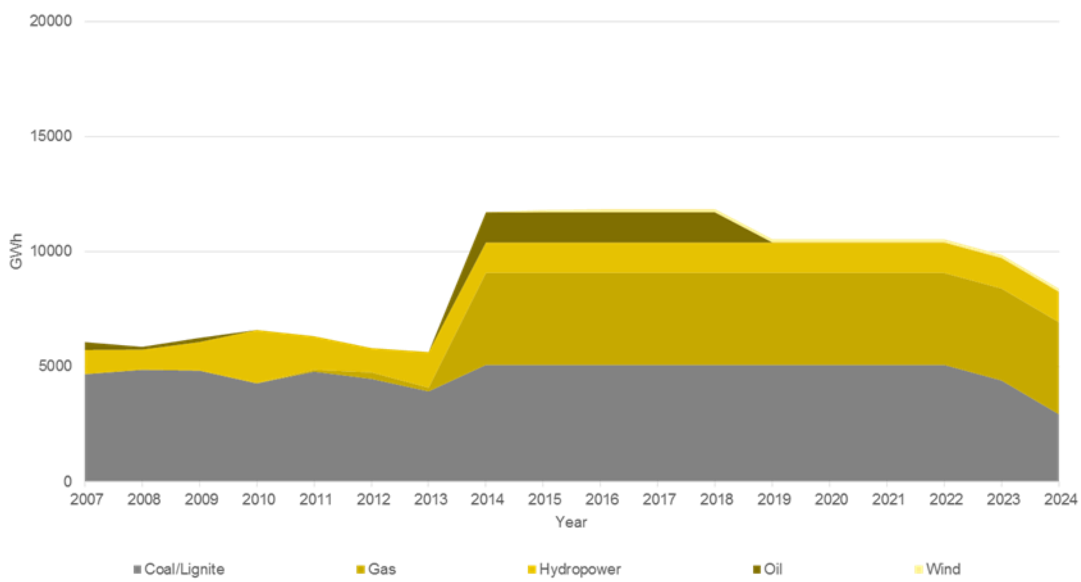

Figure 33 – Macedonia– Energy Mix Supply Scenario 2

In the planned future capacity scenario (supply scenario 3), the energy mix of Macedonia changes significantly. The marked increase of coal/lignite power plants from 43% in 2020 to 56% in 2021 is apparent and attributable to the power plants Mariovo (2137 GWh) and Bitola 4 (2210 GWh). The share of hydropower generation doubles over time. In 2024 coal/lignite account for 50%, gas for 27%, hydropower for 22% and wind for 1% of the total electricity generation capacity in Macedonia. This suggests that the planned future capacity extension is to a very large extent biased towards coal and lignite power sources.

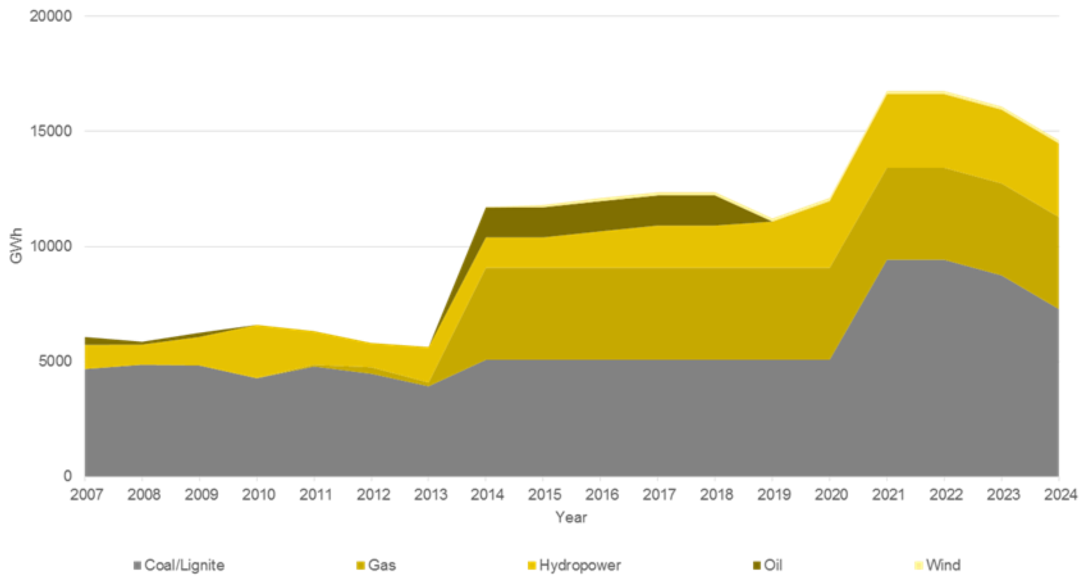

Figure 34 – Macedonia– Energy Mix Supply Scenario 3

In supply scenario 4 the share of coal/lignite declines from 43% in 2014 to 30% in 2024. The share of hydropower increases during the same period from 11 to 27%. Gas becomes the most important energy source of Macedonia. Whereas in 2014 the share was 24%, in 2024 it rises to 41%. This marked increase is not related to generation capacity extensions but can be explained by the decline in other electricity generation.

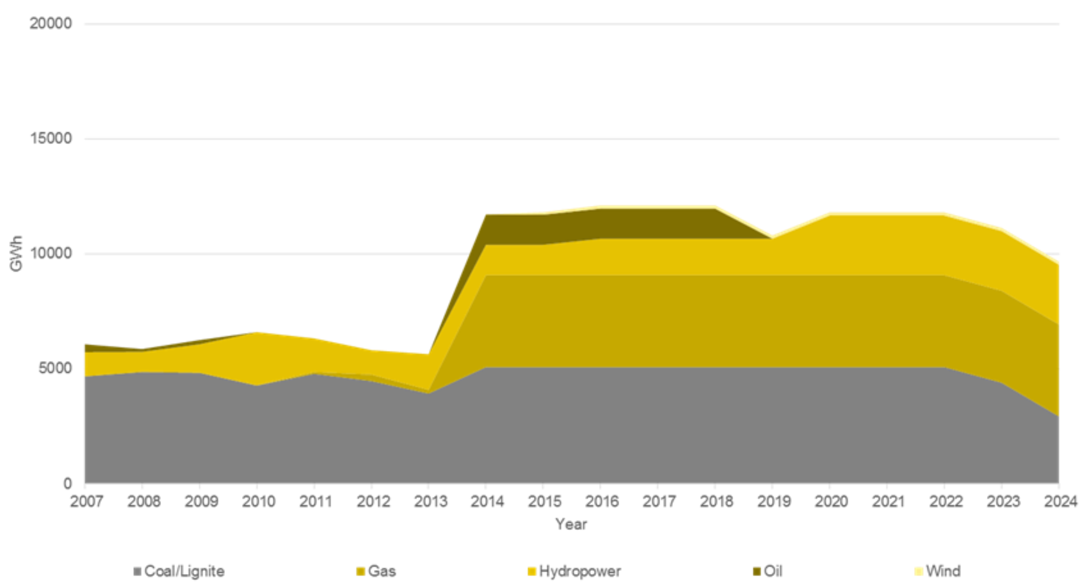

Figure 35 – Macedonia– Energy Mix Supply Scenario 4

4.5 Concluding remarks

This country report analyses the long-term electricity supply and demand pattern of Macedonia and examines its electricity export prospects from a stranded assets perspective.

The above analysis shows that Macedonia was historically (2007-2013) importing more than 20% of its demanded electricity. In terms of installed energy capacity, however, Macedonia should be able to export large amounts of electricity already in 2014 (of around 30% in a high demand growth scenario and 42% in case of a low demand growth scenario)[83]. Despite this, during the course of the next decade Macedonia will be turning from having a strong energy export potential to an importer unless additional investments in electricity generation are being realized. If Macedonia realized all of its currently planned capacity extension projects (scenario 3) or equivalent generation expansions, it would extend its export capacity more than 20% above its domestic demand (around 2000 GWh) in a high consumption demand scenario in 2024). If consumption demand was low, up to 45% of domestic electricity demand (around 4000 GWh) could be exported.

This situation would give rise to a substantial dependency on the export market. The export analysis has shown that the case study countries are likely to compete for exporting electricity to the neighbouring countries. Competition may in particular come from EU Member States, namely Bulgaria and Romania, and possibly in the near future Ukraine and Turkey. A high dependency on the export market therefore exposes the country to create the risk of stranded assets. From this point of view, a make-or-buy decision should also be investigated prior to new investments.

Concerning the peak load demand and supply analysis it bears mentioning that Macedonia is expected to remain vulnerable in supply scenarios 1 and 2. Also under supply scenario 3 it would be unable to satisfy its domestic demand for most demand scenarios.

In the case of Macedonia a few demand side issues merit particular mentioning. A demand side issue that is not examined in the case study but should be mentioned are the transmission and distribution losses. In Macedonia the overall loss in transmission and distribution amount to around 18%[84]. An increased performance of the network will have a noticeable impact on the security of supply as well as on the net position without further additional generation capacities. Moreover, energy efficiency measures may lead to electricity savings and help to improve the country’s net position.

This report shows that the country does require good regional ties in the area of energy policy. The current infrastructure should therefore be examined from this perspective.

83 A significant difference between the actual historical data (2007 – 2013) and the installed production capacity in Macedonia (as of 2014) can be observed in the data. Possible domestic energy supply more than doubles from 2013 to 2014. This strong increase is explained by the difference between actual production presented by the historic data and the maximum capacity considered as of 2014. Specifically, this marked increase is largely attributable to the gas power plants ENERGETIKA Skopje (2197 GWh per year) and the Combined Cycle Cogeneration Power Plant TE-TO – Skopje (2011) (1800 GWH). But also the capacity increase of the Bogdanci wind park (100 GWh as of 2015) contributes to this increase

84 159 GWh in transmission and 990 GWh in distribution in 2013, see Energy Community Secretariat, Annual Implementation Report, August 2014, p. 91, available at: https://www.energy-community.org/pls/portal/docs/3356393.PDF

Importantly this report shows that the country has strong electricity export ambitions that creates the danger of stranded assets if the domestic electricity expansion decisions are taken without taking due account of developments in other countries in the Western Balkans and beyond. Decisions to buy or produce electricity should thus be taken in a strategic fashion that also takes due account of energy security considerations. It can thus be concluded that integration and collaboration in the area of energy policy in the Western Balkans is vital for Macedonia.

Sources

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[MK-02] Ministry of Economy in Macedonia (2010), ‘Strategy for Energy Development in the Republic of Macedonia until 2030, available at http://www.encharter.org/fileadmin/user_upload/Energy_policies_and_legislation/The_FYROM_2010_Energy_Strategy_to_2030_ENG.pdf

[MK-03] Data provided by ENTSO-E, https://www.entsoe.eu

[MK-04] Statement on security of supply - Republic of Macedonia -Skopje, September 2013

[MK-05] ELEM, http://www.elem.com.mk/

5. Country Report Albania

5.1 Introduction

This country report is a self-contained subset of the 'Report on the long-term economic viability of constructing new electricity capacities for electricity exports in the Western Balkan countries' that was commissioned by CEE Bankwatch and realized by the University of Groningen and The Advisory House.[85] The background of this study is that almost all governments in the Western Balkans[86] have plans to extend their electricity generation capacity to meet their demand, but they also demonstrate the ambition to become electricity exporters. Over investments in excess electricity generation capacity can give rise to stranded assets – assets that become uneconomic to operate since their marginal cost of generation exceeds the price for electricity. [87]

This country report examines Albania's energy generation[88] and its import/export potential. It examines if a potential excess production of energy would be likely to be met by demand of potential buyers in the region and beyond. Moreover the study presents how the energy mix in Albania will develop over time.

This report is structured as follows: section 2 presents the approach and methodology. Section 3 presents the data. Section 4 presents the analysis and section 5 the conclusions.

Before commencing, a general caveat is in order. This report is based on official documents and predictions provided by the respective governments, power supplier or network operators. Given the scope of this research this report does not engage in the analysis of the legal framework nor does it seek to determine future price levels[89]. Similarly, current transport and grid capacities do not fall within the scope of this study and we do not incorporate effects that may arise from grid or transport restrictions.

5.2 Approach and Methodology

In order to identify the long-term viability of the present and future electricity capacity changes in Albania and its export potential this study

- compares the current (and future) electricity production to the current (and future) domestic electricity demand and identifies short and long positions (Analysis section 1); and

85 Authors of this report are Stefan Weishaar, University of Groningen, and Sami Madani, The Advisory House

86 Countries belonging to the Western Balkans are: Albania, Bosnia and Herzegovina, Kosovo, Macedonia, Montenegro, Serbia

87 Ben Caldecott & Jeremy McDaniels: Stranded generation assets: Implications for European capacity mechanisms, Energy Markets and Climate Policy, Working Paper, January 2014, p. 5, http://www.smithschool.ox.ac.uk/research-programmes/stranded-assets/Stranded%20Generation%20Assets%20-%20Working%20Paper%20-%20Final%20Version.pdf

88 Electricity is frequently referred to as 'Energy'. This report only examines electricity. In this report these terms are used interchangeably

89 This report does thus not extend to costs of energy production and input prices or wholesale prices or the like

- compares the (expected) export capacity with the demand of potential regional customers (countries in the Balkans, Ukraine, and Turkey) and supra-regional customers (EU Member States) (Analysis section 2).

The development of the energy mix is presented subsequently (Analysis section 3).

5.2.1 Albania's Supply/Demand analysis

Based upon Albania's specific historic production and import/export figures we determine the national net electricity supply/demand position. In order to account for future developments we also analyse the supply/demand position with regard to the generation capacity that is presently under construction or planned. Based on the current existing plants, current construction projects and construction projects that are planned, we develop four electricity supply scenarios. While the first three supply scenarios are self-explanatory, the fourth requires additional explanation. Under the former government a large number of concessions for wind-parks were granted. Demand was expected to come from Italy. Since Italy does not appear to be presently actively requesting the building of wind parks, it is doubtful if the wind parks will be built. The wind parks have thus been included in scenario 4.

#	Scenario	Description
1	**Existing capacity**	Calculates the net position based on current supply and demand figures
2	**Likely future capacity**	Calculates the net position based on existing capacity (Scenario 1) and an estimation of additional supply facilities that are under full construction or near starting construction
3	**Planned future capacity**	Calculates the full net position based on Scenario 2 and includes the envisaged electricity production
4	**Envisaged wind capacity**	Calculates the full net position on the basis of Scenario 3 and includes the envisaged wind production to the extent it is known

Table 13 – Albania's electricity supply scenarios

The differentiation between 'likely future capacity' and 'planned future capacity' has been established by CEE Bankwatch. Determinants for differentiating between the two categories are whether construction permits have been granted, whether the constructors are identified and if the financing has been secured.

After obtaining results for electricity generation in Albania, we need to examine domestic demand before we can determine the national net long/short positions. We apply a robustness check in the form of three different electricity consumption scenarios. This robustness check is necessary since we seek to extrapolate electricity demand patterns over a period of 10 years and since changes in demand patterns severely affect Albania's ability to export electricity.

#	Scenario	Description
1	**Low**	Baseline growth scenario -1% growth rate
2	**Medium**	For the baseline growth scenario we assume that the future growth rate is the same as it was historically (1985-2012) (Data obtained from Republic of Albania Albanian Energy Regulator, ERE, Annual Report Power Sector Situation and ERE's Activity for 2012 [AL-01] p. 47)
3	**High**	Baseline growth scenario +1% growth rate

Table 14 - Albania's Electricity demand scenarios

The net long/short position of Albania is calculated by subtracting high, medium and low consumption demand from each of the four electricity supply scenarios. Albania's exporting ability is thus determined for all twelve combinations.

In order to determine the long and short position of Albania we also analyse the electricity power balance. This balance examines the actual feed-in of electricity and the demand situation at a particular point in time when the electricity feed-in reserves are at their presumed minimum and the electricity demand is at its presumed maximum. Subject to the caveat relating to the robustness of the underlying data, this enables the identification of critical electricity supply situations. This method should thus be used as an indication only[90].

Data for the hourly peak demand (hourly load values) during the period 2007-2008 is taken from Security of supply Statement of the Republic of Albania [AL-02] p.15, and data for 2009-2013 is taken from the Updated Security of supply Statement of the Republic of Albania [AL-03] p, 19. Hourly peak demand (2014-2020) is taken from the Updated Security of supply Statement of the Republic of Albania [AL-03] p. 19. The peak demand of the remaining years (2021-2024) is then forecasted with the growth rate that underlies the low-, medium-, and high demand scenario.

The peak energy supply (for all of the above supply scenarios) is calculated by multiplying the electricity generation capacity of those power plants that are base load capable with a parameter that reflects the supply security and availability of the electricity generation capacity. The data we use applies an in-feed supply security of 99% as a critical benchmark.[91]

Due to lack of information regarding the particular power plants and electricity networks, we are unable to account for required system reserves, revisions, and planned and

90 Net operators calculate the demand peaks in general for the 3rd Wednesday of each month. In our report, we deviate from this policy and determine the hourly peak demand on an annual basis

91 Bericht der deutschen Uebertragungsnetzbetreiber zur Leistungsbilanz 2013 nach EnWG §12 Abs. 4 und 5, 30.09.2013, available at http://www.bmwi.de/BMWi/Redaktion/PDF/J-L/leistungsbilanzbericht-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

unplanned outages and have to rely upon data from Germany.[92] Since for the purpose of this analysis the annual peak demand and peak supply is essential and only lasts for a short moment, we only consider the unplanned outages that cannot be time shifted beyond a period of 12 hours.[93] Based on historic supply statistics on these immediate unplanned outages in Germany we obtained parameters for expected base load supply.

Our data set does not distinguish between lignite and coal power plants. We selected the value for lignite since in the Balkans a lot of lignite is available.

Oil/gas is presumed not to be base load capable because of practices of short term supply contracts and unpredictable policy developments that may endanger the supply security with gas. This may be reconsidered for the future when/if the Ionian Adriatic Pipeline is operational.

The data for wind and solar power exhibit low values because these technologies are not base load capable.

Hydropower is regarded to only have a limited base load capacity. Despite significant historic variability in the hydropower electricity generation in the Balkans, it is evident that hydropower plants were able to produce electricity in a stable manner. We therefore do not follow the German report (prescribing 25%)[94] but use 40%.[95]

The net long/short position of peak hourly demand and supply for Albania is calculated by subtracting high, medium and low hourly demand from each of the peak electricity supply scenarios.

Type	Planned Availability
Lignite	93,5%
Coal	94%
Gas/Oil	0%
Biomass	65%
Wind	1%
Photovoltaic	0%
Hydropower	40% (instead of 25%)
Pump storage	80%

Table 15 – Estimated power plant planned availability per type

92 We thereby follow Bericht der deutschen Uebertragungsnetzbetreiber zur Leistungsbilanz 2013 nach EnWG §12 Abs. 4 und 5, 30.09.2013, available at http://www.bmwi.de/BMWi/Redaktion/PDF/J-L/leistungsbilanzbericht-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

93 We thereby follow Bericht der deutschen Uebertragungsnetzbetreiber zur Leistungsbilanz 2013 nach EnWG §12 Abs. 4 und 5, 30.09.2013, available at http://www.bmwi.de/BMWi/Redaktion/PDF/J-L/leistungsbilanzbericht-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

94 http://www.bmwi.de/BMWi/Redaktion/PDF/J-L/leistungsbilanzbericht-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

95 We calculated the regional average of hydropower generation capacity (excluding pump storage plants) by dividing total hydro power supply 2014 by total installed hydropower capacity (excluding pump storage plants) multiplied by 24 (hours) and 365 (days) = 7297GWh / 25447GWh ≈ 40%

5.2.2 Albania’s export analysis

The regional analysis examines export opportunities for electricity produced in the scenario countries. We thus compare the possible long position of Albania against the possible long/short positions of its trading partners.

The examined trading partners will be 1) in the Western Balkan region (i.e. the case study countries), 2) regional (i.e. countries adjacent to the case study countries) and supra-regional, i.e. other EU Member States (3) and in the EU, Ukraine and Turkey (4). In order to estimate the import potential of the recipient countries the long/short positions of these countries must be determined.

The following countries have been included in the export analysis:

#	Group	Countries included
1	**Western Balkans**	Bosnia and Herzegovina*, Kosovo*, Macedonia*, Montenegro*, Serbia*
2	**Region**	Group ‘Western Balkans’ and countries adjacent to the case study countries: Bulgaria, Croatia, Greece, Hungary, Italy, Romania, Slovenia
3	**Western Balkans and EU**	Group ‘Western Balkans’ and the EU-28 countries
4	**Western Balkan and EU incl. Ukraine and Turkey**	Group ‘Western Balkans and EU’ and Ukraine and Turkey*

*: Trading partners with different scenarios in this study

Table 16 – Export analysis’ groups for Albania

Data for the case study countries is based upon the net long and net short positions in the respective country analysis contained in this report. Data has been obtained from a Study of the European Commission[96] the Turkish Electrical Energy 10-Year Generation Capacity Projection (2009 – 2018)[97] and the IEA and the Energy Strategy of Ukraine.[98] Since the data in the EU report is based on PRIMES that models on the basis of 5 year intervals, we connected the interim years by means of linear approximation.

Given that any forecasting inherently involves uncertainty, we need to consider the range of possible outcomes – both at the supply side of Albania and its potential customers (group 1 to 4).

In order to reflect the range of possible import and export demand of the trading partners included in the respective analysis, we examine the lowest and the highest values for the

96 EU Commission, EU Energy, Transport and GHG Emissions Trends to 2050, Reference Scenario 2013, Appendix 2, p. 85 ff.

97 Turkish electricity Transmission Corporation, Turkish Electrical Energy 10-Year Generation Capacity Projection (2009 – 2018), 2009, Energy Demand Balance 2009-2018, (Case I-A) High Demand – Scenario 1, p. 44 and Project Generation Capacity and Energy Demand Balance 2009-2018 (Case II-A), Low Demand – Scenario 1. Approximation from 2018 onwards based on -9684,6x + 82780 (high demand) and -7259,3x + 77896, low demand (year 2009 represents 1)

98 IEA, Key World Energy Statistics, 2012, p. 27 and Energy Strategy of Ukraine for the period through 2035, p. 24, Annex 2. Since only values for 2012 and 2035 were available, values in between have been approximated linear

respective years. In terms of the country analysis contained in this report we take the net long/short position of the 'current supply' (scenario 1) and 'high demand growth scenario' as a low estimate and the supply scenario 4 and low demand growth scenario as an estimate for the high import/export value. For the EU and Ukraine we included one scenario each. For Turkey we included a high and low electricity demand scenario.

This approach enables us to identify possible trading partners in the various groups that would be in demand of the electricity produced by Albania. The analysis also offers an overview of the range of possible outcomes and hence allows decision makers to gain insights into the 'riskiness' of investments in the electricity sector. Hence this analysis enables an assessment of the potential risk that investments turn into 'stranded assets'.

Given that electricity investments are generally regarded as long term investments we have selected three evaluation points at the beginning (2014), in the middle (2019) and at the end (2024) of the period under examination in order to compare Albania's import/export capabilities with those of its trading partners.

5.2.3 Albania's energy mix

This section will present the evolution of the energy mix in Albania based on the electricity supply scenarios.

5.3 Data description

We obtained historic (2007 – 2012) production (total production) and consumption data (consumption total) for Albania from the IEA. Data for 2013 was not available.

The data for the various power plants are taken from several sources including energy companies (KESH, Ayenas or Ashta), the World Bank, National Agency of Natural Resources (AKBN), and from official reports such as Enti RregullatorI Energjisë Raport Vjetor Gjëndja e Sektorit të Energjisë dhe Veprimtaria e ERE-s gjatë Vitit 2013 [AL-04] and Strategjia Kombëtare e Energjisë 2013-2020 [AL-05][99].

There are 68 small hydropower plants under construction with an electricity generation capacity of 1296 GWh. Since no data is available on when those plants are scheduled to commence operations, it is assumed that half of them will commence in 2015, and the other half in 2016.[100] The Strategjia Kombëtare e Energjisë 2013 -2020 [AL-05] p. 45 suggests that small hydropower plants totalling 444 MWh should be built by 2020. Since no additional information is available, these small hydropower plants are not accounted for in the data set.

Under the former government a large number of concessions for wind farms have been given that would appear to have a sizeable impact upon Albania's energy supply. Expanding wind farms would have been attractive, as generated electricity could be exported to Italy. However, none of the wind farms have been built thus far, nor are they expected to commence operations before 2018. We thus take a conservative approach to determine supply scenario 3 and rely upon the data contained in table 4 (converted

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99 This document was never approved, but in the absence of officially approved other documents it was decided to use some data from this source

100 http://www.akbn.gov.al/index.php/en/hydroenergy/hydroenergy-situation

into GWh) of Strategjia Kombëtare e Energjisë 2013-2020 [AL-05]. We also assume that the data for 2017 is the same as for 2018. In order not to exclude precious data that are available for some wind farms, those were included in a hypothetical supply scenario 4.

The consumption demand scenario data we forecasted by calculating the historic growth rate during the period 1985 - 2012 (Data obtained from Republic of Albania Albanian Energy Regulator, ERE, Annual Report Power Sector Situation and ERE's Activity for 2012, [AL-01] p. 47) and by assuming that the future growth rate is the same as the historic growth rate.[101]

As described above, data for the hourly peak demand (hourly load values) during the period 2007-2008 is taken from Security of supply Statement of the Republic of Albania [AL-02] p.15, and data for 2009-2013 is taken from the Updated Security of supply Statement of the Republic of Albania [AL-03] p, 19. Hourly peak demand (2014-2020) is taken from the Updated Security of supply Statement of the Republic of Albania [AL-03] p. 19. The peak demand of the remaining years (2021-2024) is then forecasted with the growth rate that underlies the low-, medium-, and high demand scenario.

For the export analysis data has been obtained from several sources. For the case study countries data was obtained from this report. For the EU it has been taken from the EU Energy, Transport and GHG Emissions Trends to 2050, from the Reference Scenario 2013, Appendix 2, p. 85 ff.. The data for Turkey is taken from the Turkish electricity Transmission Corporation's report on the Turkish Electrical Energy 10-Year Generation Capacity Projection (2009 – 2018), 2009. In particular data is taken from the Energy Demand Balance 2009 – 2018, (Case I-A) High Demand – Scenario 1, p. 44 and Project Generation Capacity and Energy Demand Balance 2009 – 2018 (Case II-A), Low Demand – Scenario 1. It is adapted to suit our needs by means of an approximation from 2018 onwards based on -9684,6x + 82780 (high demand) and -7259,3x + 77896, low demand (year 2009 represents 1). Data for Ukraine is taken from the IEA's Key World Energy Statistics, 2012, p. 27 and from the Energy Strategy of Ukraine for the period through 2035, p. 24, Annex 2. Because only values for 2012 and 2035 were available, they have been approximated in a linear fashion.

5.4 Analysis

This section of the report describes relevant data observations and findings. First, the supply and demand analysis is presented (subsection 1). This section also examines the net long and short positions as well as peak electricity demand and supply. Subsection 2 presents the export analysis and subsection 3 presents the energy mix.

5.4.1 Supply and Demand

The figures below present the supply and demand patterns for Albania, showing the historic and future supply patterns (for existing capacity, likely future capacity and planned future capacity, and envisaged wind capacity) in relation to each of the growth scenarios (low, medium and high growth).

101 We used the following function for forecasting: $(1+x)^{27}=7617/2575=2.95$. For the low and high growth scenario we simply subtracted or added 1% of the growth

Regarding the historical (2007 – 2012) supply and demand pattern, it is evident that Albania has been able to cover its demand in 2010 while in the other years it has been importing energy.

In the low growth electricity consumption scenario Albania will not be able to cover its electricity needs. In supply scenario 1 the country needs to import around 5000 GWh. Also in supply scenario 2 and 3 the country is short, however by a much smaller fraction. Only in supply scenario 4 the country is able to export electricity.

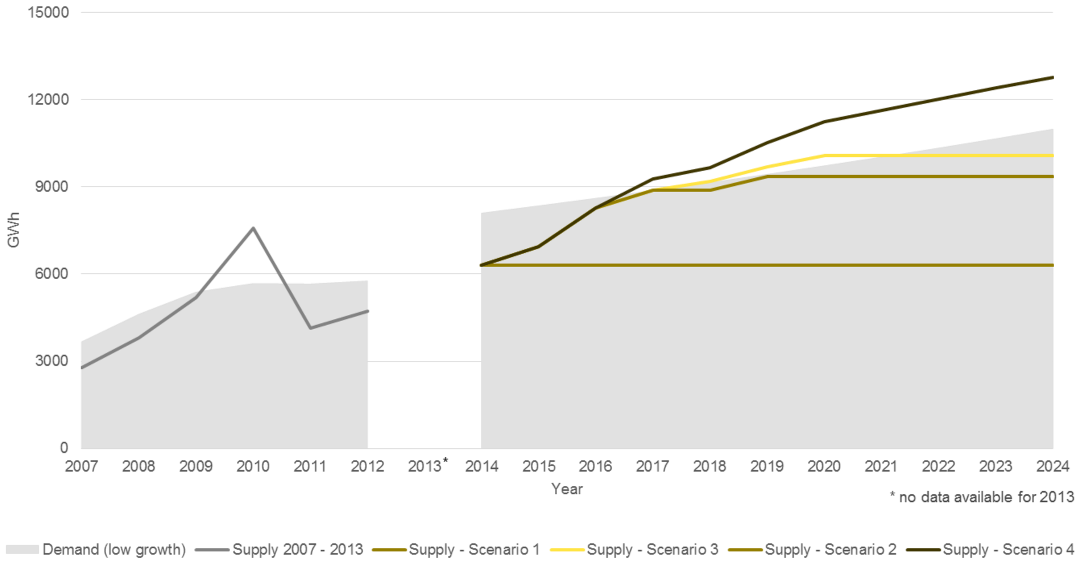

Figure 36 - Supply / Demand (Low Growth) - Albania

In the case of medium consumption growth, Albania would remain an energy importer under all scenarios but scenario 4. In the latter case the country would be able to export several hundred GWh. This scenario does, however, presume that significant advances in wind power generation are undertaken. This is not yet the case.

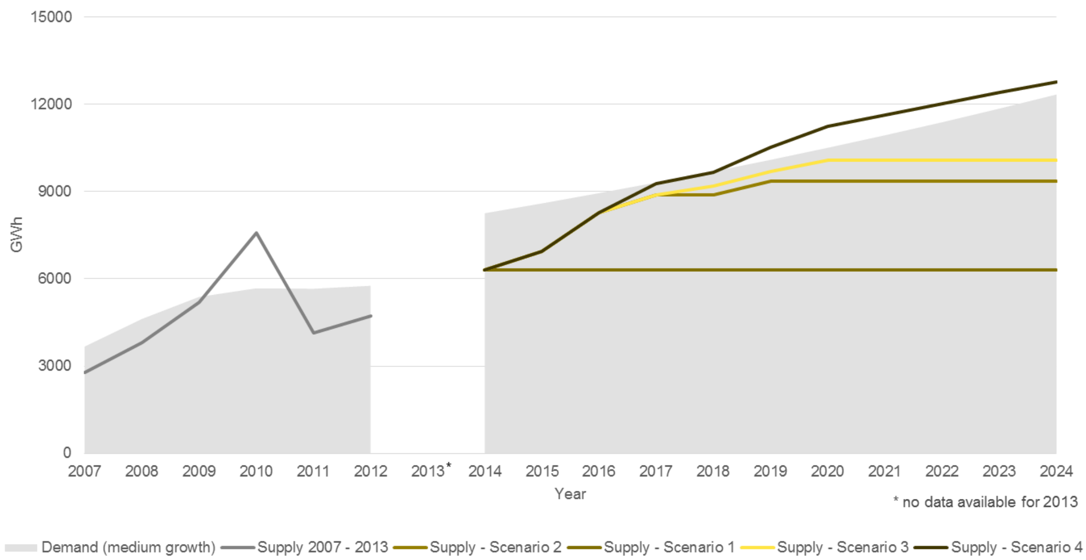

Figure 37 - Supply / Demand (Medium Growth) - Albania

In the figure presenting high electricity consumption demand in Albania, it can clearly be seen that all production is insufficient for satisfying Albania's electricity demand. Even in the case of supply scenario 4 Albania would remain an electricity importer. Significant electricity capacity extensions and/or energy savings measures should be undertaken to satisfy national demand and to cushion electricity supply volatility relating to hydropower generation and wind.

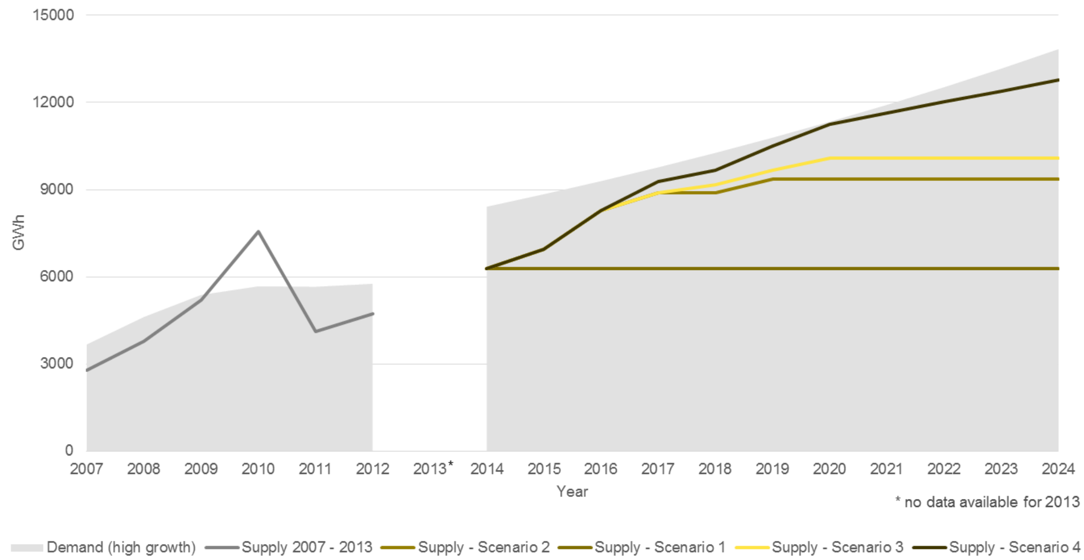

Figure 38 - Supply / Demand (High Growth) - Albania

5.4.1.1 Net Position

After examining the general supply and demand patterns, we examine the net long and net short position of Albania. For each of the electricity consumption growth scenarios (low, medium and high growth) we examine the net positions in relation to the energy supply changes (existing capacity, likely future capacity and planned future capacity, envisaged wind capacity).

In case of the low consumption growth scenario it is apparent that Albania is a net importer. It was only able to export electricity in 2010, which was a year characterized by heavy rainfall.

In the case of low consumption demand, supply scenario 1 would be insufficient to cover Albania's electricity demand. Scenarios 2 and 3 would enable the country to have a balanced position until 2019 and 2021 respectively. Only supply scenario 4 (or similar investments) would enable Albania to become a net exporter of electricity.

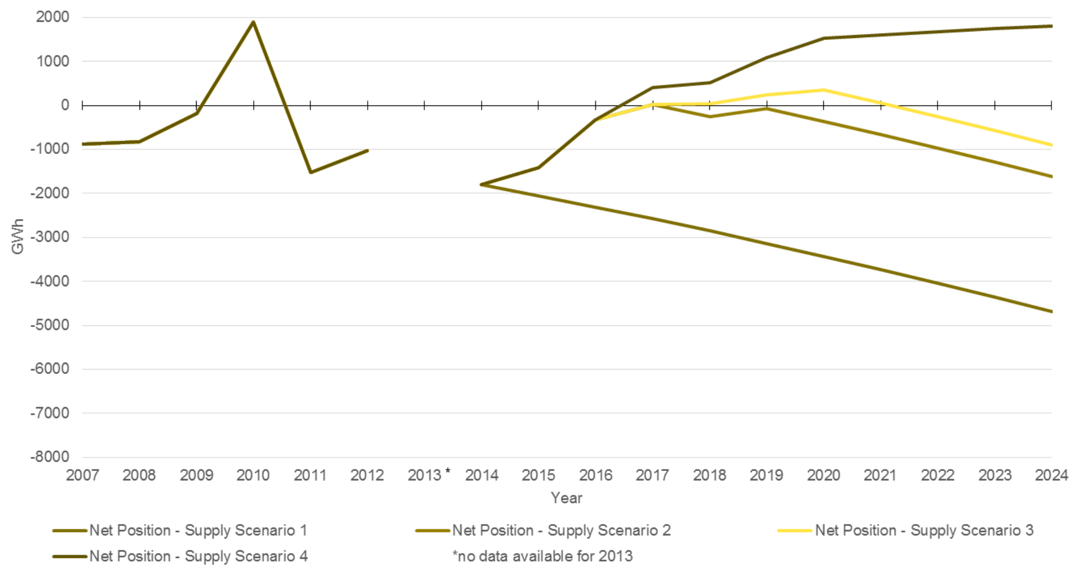

Figure 39 - Net Position - Low growth scenario - Albania

In the case of the medium electricity consumption growth scenario it is evident that none of the first three supply scenarios is sufficient to satisfy Albania's electricity demand. In scenarios 2 and 3, Albania would have a slightly negative electricity balance. The country would require the electricity capacity extensions (or similar ones) contained in scenario 4 to secure self-sufficiency during the period of examination.

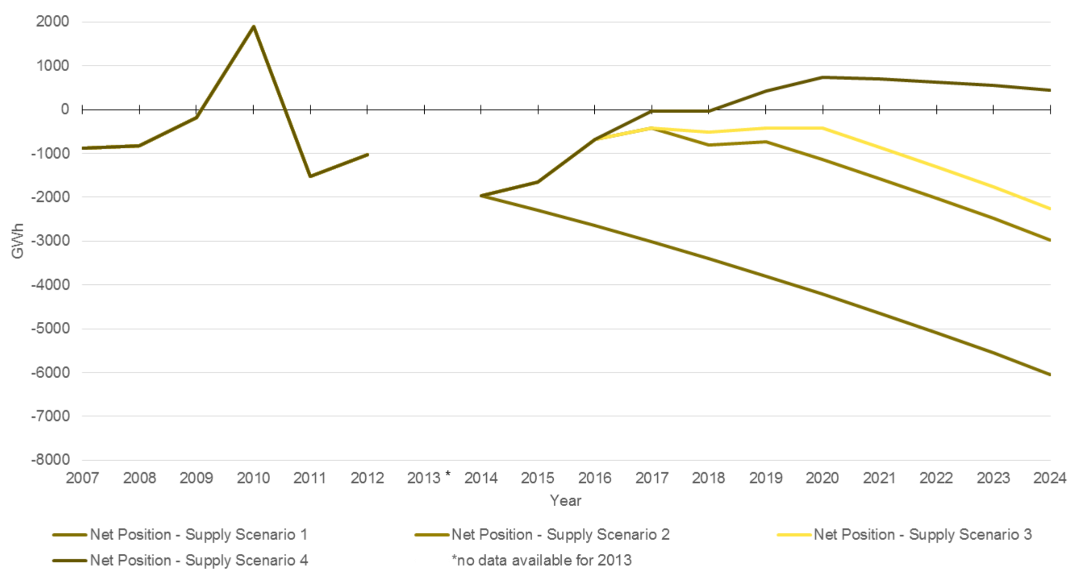

Figure 40 - Net Position - Medium growth scenario - Albania

The high electricity consumption growth scenario shows similar but more severe findings to those described in the medium growth scenario above. Only significant electricity generation would enable Albania to (nearly) satisfy its future energy needs. Nevertheless Albania would remain a net-importer.

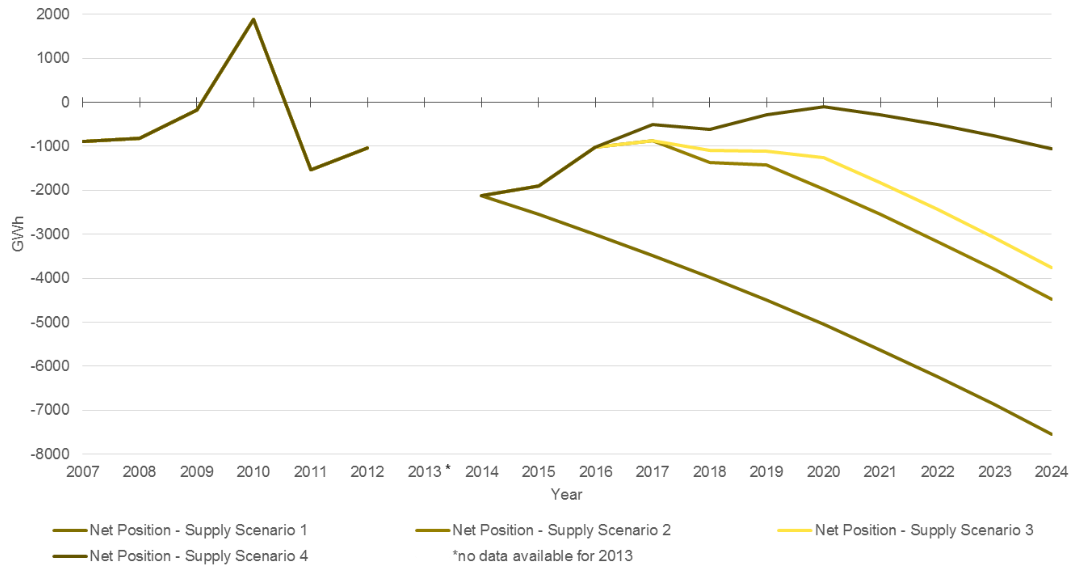

Figure 41 - Net Position - High growth scenario - Albania

5.4.1.2 <u>Peak supply / peak demand balance</u>

This balance examines the actual feed-in of electricity and the demand situation in Albania when the electricity feed-in reserves are at their presumed minimum and the electricity demand is at its presumed maximum. Subject to the caveat relating to the robustness of the underlying data, this enables the identification of critical electricity supply situations. This method should thus be interpreted with caution and viewed as an indication only.

Based on the available information, however, the figure below paints a dim outlook for Albania. It clearly shows that peak demand for all demand scenarios severely outpaces the available peak supply and that over the years this situation will exacerbate.

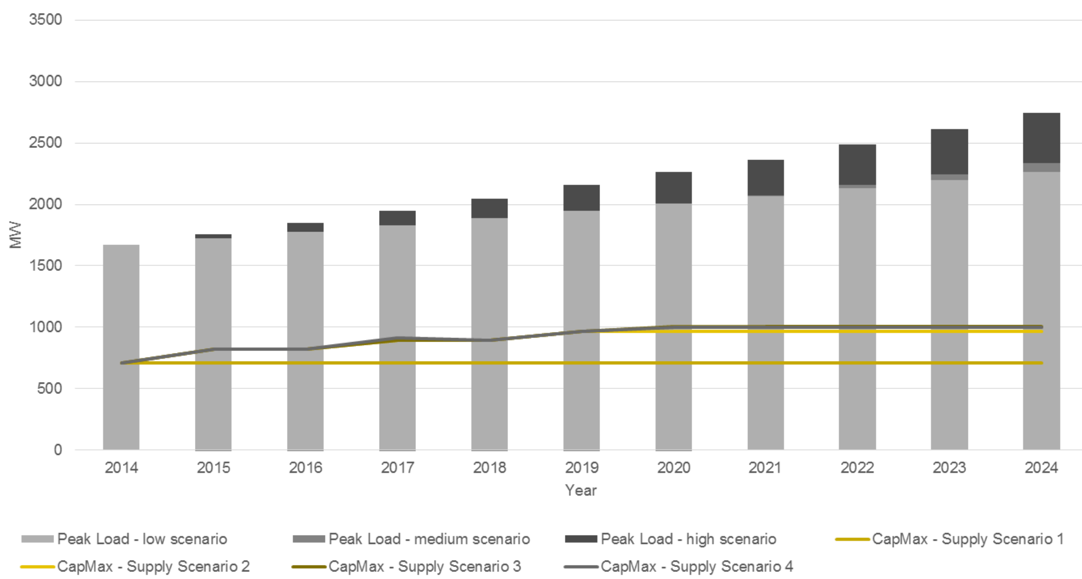

Figure 42 - Albania – Peak Supply/Demand Balance

5.4.2 Export analysis

This section of the report examines where energy produced in Albania could be exported. Potential trading partners can be found in the Western Balkans (i.e. in the other case study countries) (group 1), in the countries surrounding the Western Balkans (i.e. in the region) (group 2), or supra-regionally in the EU (group 3) or in the EU, Ukraine and Turkey (group 4). The export potential of Albania is thus compared to the net position in these scenarios.

Reflecting the range of outcomes in the supply and demand scenarios, the import/export capabilities of Albania and its trading partners are presented in the form of a range in the net exports, showing a minimum and a maximum value. Reflecting the underlying assumptions of the scenarios the range of possible outcomes widens over time.

In the figure below the import/export potential of Albania is shown in gold. Positive values denote Albania's export potential, while negative values denote its import needs. Positive values for the trading partners denote their demand for exports (short position) and negative numbers denote their export supply (long position). In the figure below export possibilities exist if there is a positive net position of Albania and positive export demand of the trading partners.

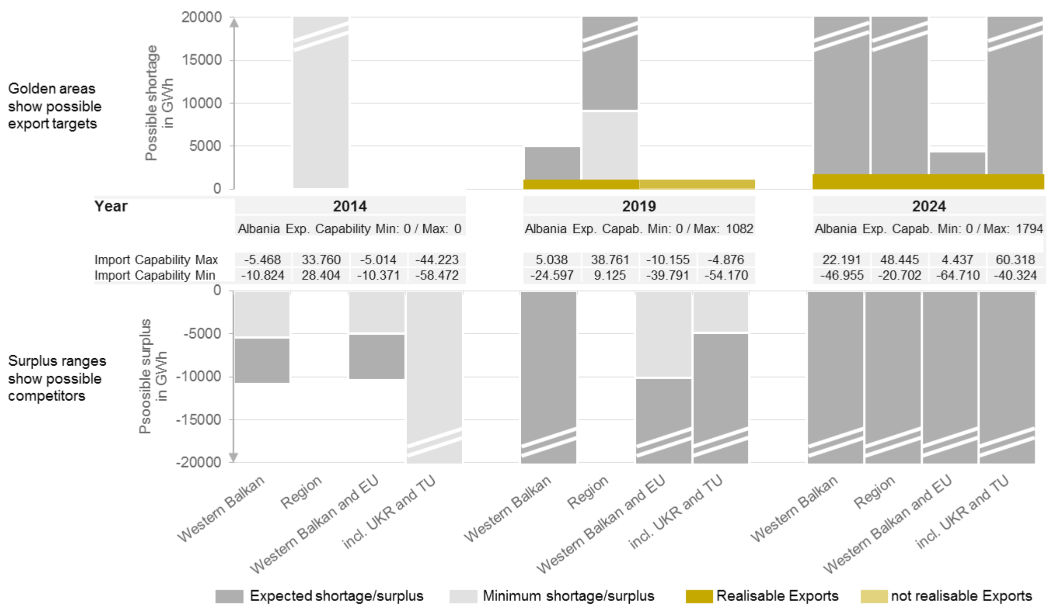

Figure 43 – Albania - Export Analysis

In 2014 Albania was in a short position and thus unable to export electricity. The case study countries (group 1) were in a net long position entailing that they could export electricity. Examining the Western Balkans and its immediate neighbours jointly (group 2), it is noteworthy that they are in a net short position requiring about 28000 to 35000 GWh of electricity. Widening the framework of reference to the Western Balkans and the EU (group 3) shows that the region is in a slight long position. Including also Ukraine and Turkey (group 4) shows that there is a significant amount of excess supply in 2014.

In 2019 Albania is in a significant net short position or in a slight positive position (around 11% of domestic demand in case of a low consumption growth scenario and supply scenario 4, enabling Albania to export up to 1000 GWh; under supply scenario 3

Albania's long position would account to around 3% of domestic demand) and thus unlikely to export electricity. The case study countries (group 1) would be in a slight long or in a short position entailing that there might be a small export market for Albanian electricity. However, given the range of the net position, it appears more likely that the case study countries will be striving to export electricity. Again the Western Balkans and its immediate neighbours considered jointly (group 2) are in a significant net short position and thus be importing electricity. Widening the framework of reference to the Western Balkans and the EU (group 3) shows, however, that there is no excess demand expected in 2019. Including also Ukraine and Turkey (group 4) into the analysis shows that there is a significant excess supply in 2019.

Also in 2024 Albania is in a net short position and thus unable to export electricity.
The case study countries (group 1) will either be in a long or in a short position entailing that there might potentially be an export market for Albanian electricity. However, given the range of the net position, it appears more likely that the case study countries will be striving to export electricity. Again the Western Balkans and its immediate neighbours considered jointly (group 2) are in a significant net short position or in a net long position. It is thus unclear if they would be importers or exporters of electricity. Widening the framework of reference to the Western Balkans and the EU (group 3) shows, however, that it is unlikely that there will be a lot of excess demand in 2024. Including also Ukraine and Turkey (group 4) into the analysis, the figure shows the possibility of a significant excess demand (but also a long position) in 2024. The maximum value for export demand is strongly driven by the Turkish electricity demand figures that are based on an exponential forecasting function. If Turkey is considered as a potential market, the transport capacities (costs) need to be observed.

For the purpose of evaluating export potentials and stranded assets a number of relationships need to be described. Transporting electricity is costly: in particular transfer fees (within countries) and transmission fees (between countries) must be paid. Also electricity transportation requires infrastructure. While this report does not extend to these dimensions, we assume that the local electricity market in the Western Balkans and the surrounding states are the most important indicator if there is demand for Albanian electricity. That the EU is in a long position indicates that there will at least be competition which can be expected to put pressure on the electricity price. Given that Albania is predominantly in a short position, Albania is unlikely to be at risk of incurring stranded assets resulting from competition on the export market. Given that future electricity markets are potentially long or might be supplied by other competitors, future international and domestic electricity prices may come under pressure and give rise to stranded assets for those installations that have high electricity generation costs.

5.4.3 Energy Mix

The figures below present the changes in Albania's energy mix. The data from 2007 – 2012 present the energy mix based on actual production figures. By contrast, the data from 2014 – 2024 show the energy mix based on the maximum likely electricity generation capacity. For 2013 no data was available.

In supply scenario 1 electricity in Albania is exclusively generated by hydropower.

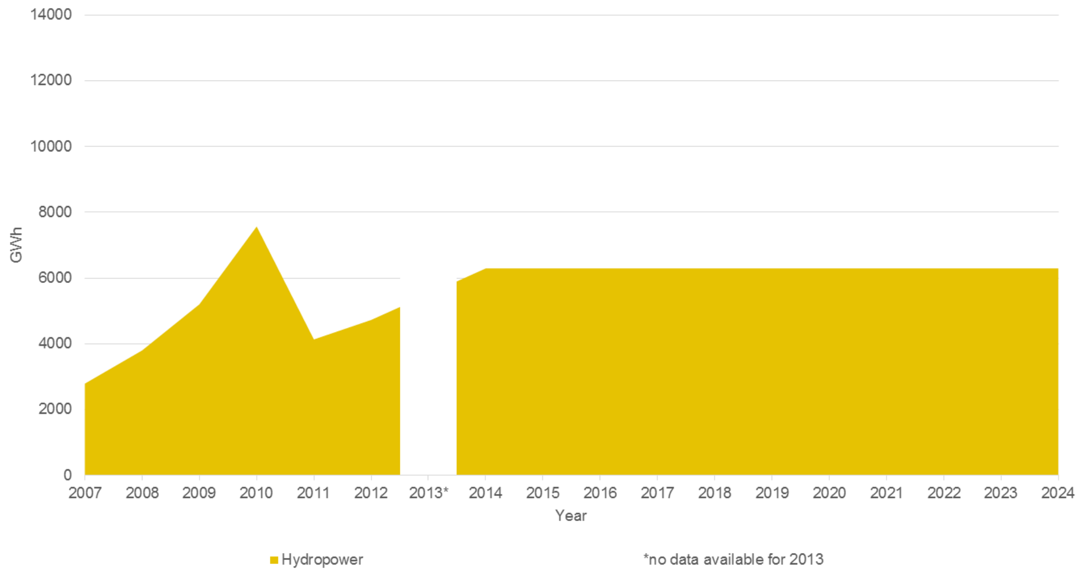

Figure 44 – Albania – Energy Mix Supply Scenario 1

If the current construction projects are being realized, hydropower continues to dominate. Gas will account for roughly 7%.

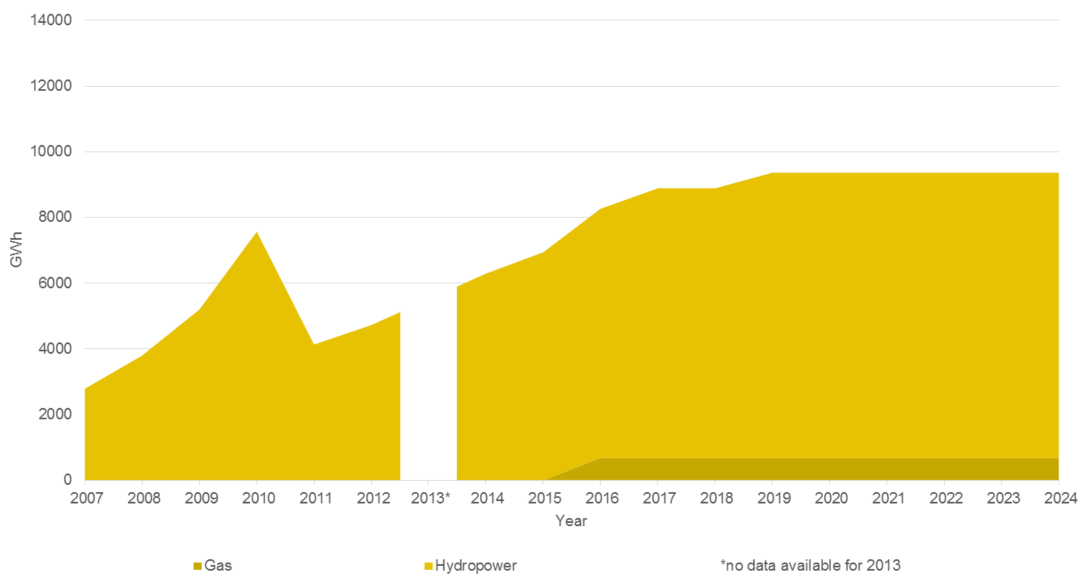

Figure 45 – Albania – Energy Mix Supply Scenario 2

Also in the planned future capacity scenario (supply scenario 3) the Albanian energy mix is dominated by hydropower (90% in 2024). Gas accounts for 6,5% and wind for 3,5% in 2024.

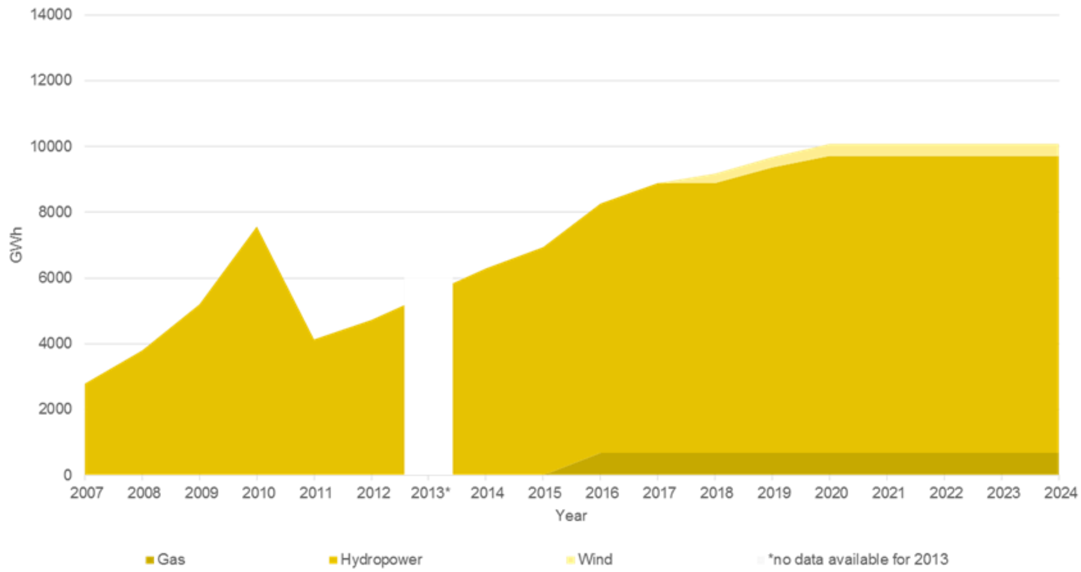

Figure 46 – Albania – Energy Mix Supply Scenario 3

In supply scenario 4 wind power starts to play an important role, accounting for 24% in 2024. Gas accounts for 5%. Hydropower remains the most important source of energy in Albania, accounting for 71% in 2024.

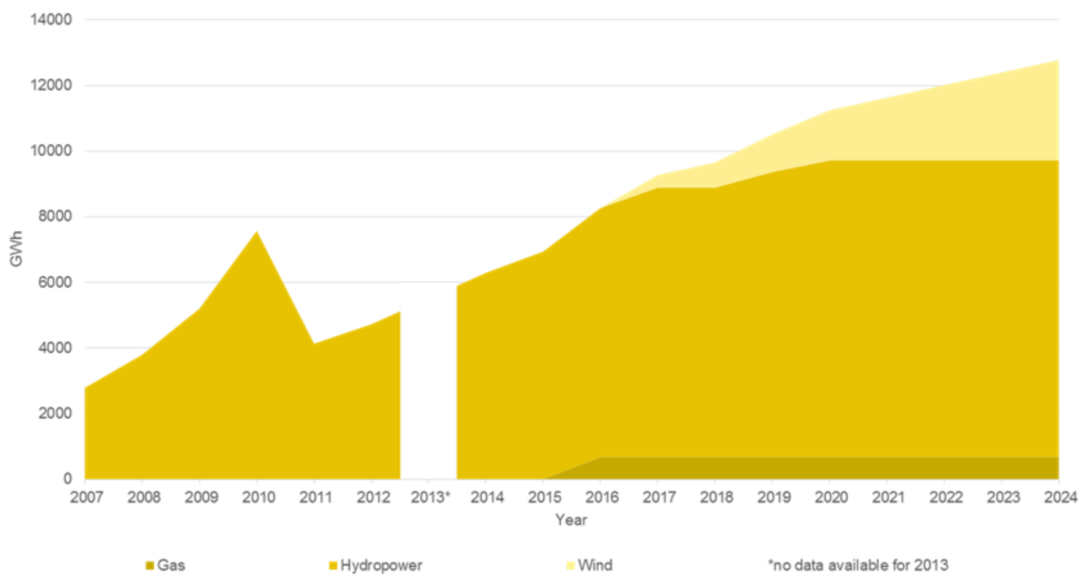

Figure 47 – Albania – Energy Mix Supply Scenario 4

5.5 Concluding remarks

This country report analyses the long-term electricity supply and demand pattern of Albania and examines its electricity export prospects from a stranded assets perspective.

The above analysis shows that also in the course of the next decade Albania will remain an electricity importer. Depending on the particular demand and supply scenarios the country could end up having to import around 8000 GWh (Supply scenario 1 in the case of high electricity demand). It is apparent that significant investments in electricity generation (and or energy conservation) have to be undertaken to allow Albania to meet its demand. Only in the case of low electricity demand growth and supply scenario 4 will Albania be able to export up to 2.000 GWh (amounting to around 16% of domestic demand in 2024) while in all other scenarios the country will be in a short position.

While the above situation would give rise to a substantial dependency on the export market, it may be an unlikely outcome given that in most supply scenarios Albania is a net importer. Stranded assets may therefore not be an immediate concern for the country. Should Albania become a net exporter it bears mentioning that the export analysis shows that the case study countries are likely to compete for exporting electricity to the neighbouring countries. Competition may in particular come from EU Member States, namely Bulgaria and Romania, and possibly in the near future Ukraine and Turkey. A high dependency on the export market would expose the country to the risk of stranded assets. From this point of view, a make-or-buy decision should also be investigated prior to new investments.

Concerning the peak load demand and supply analysis it bears mentioning that the country appears to be ill-prepared in all supply scenarios. The country is unable to satisfy its peak demand. Additional steps such as energy conservation, enhancing grid infrastructure and interconnections should be examined.

The report shows a number of issues related to electricity supply that should be pointed out. Albania is highly dependent on hydropower which has historically been showing a high volatility; in 2010 (a humid year) electricity generation was ca. 2000 GWh (or 41%) higher than 2009, while 2011 electricity generation was ca. 3000 GWh (or 55%) lower than in 2010. Also in the future additional hydropower plants are planned that will increase the country's dependence on water. Expanding the energy mix with additional energy sources, as envisaged in scenarios 3 and 4, is therefore evaluated positively as they will diversify Albania's energy mix.

It is not only the supply side that influences the long or short position of Albania, but also demand side. A demand side issue that is not examined in the case study but should be mentioned are the transmission and distribution losses. It has to be noted that Albania has an overall loss in transmission and distribution of more than 45%[102]. An increased performance of the network will have a major impact on the security of supply as well as on Albania's net position. It needs to be noted that losses may also be attributable to electricity theft and may therefore not have an impact on the physical position of the country and its supply security. An analysis of an increased network efficiency would outline the full potential. Moreover, energy efficiency measures may lead to electricity savings and help to improve the country's net position.

This report shows that the country does require good regional ties in the area of energy policy. The current infrastructure should therefore be examined from this perspective. Importantly this report shows that the country has strong electricity export ambitions that create the danger of stranded assets if the domestic electricity expansion decisions are taken without taking due account of developments in other countries in the Western

102 210 GWh in transmission and 3218 GWh in distribution in 2013, see Energy Community Secretariat, Annual Implementation Report, August 2014, p. 31, available at: https://www.energy-community.org/pls/portal/docs/3356393.PDF

Balkans and beyond. Decisions to buy or produce electricity should thus be taken in a strategic fashion that also takes due account of energy security considerations. It can thus be concluded that integration and collaboration in the area of energy policy in the Western Balkans is vital for Albania.

Sources

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6. Country Report Kosovo[103]

6.1 Introduction

This country report is a self-contained subset of the 'Report on the long-term economic viability of constructing new electricity capacities for electricity exports in the Western Balkan countries' that was commissioned by CEE Bankwatch and realized by the University of Groningen and The Advisory House.[104] The background of this study is that almost all governments in the Western Balkans[105] have plans to extend their electricity generation capacity to meet their demand, but they also demonstrate the ambition to become electricity exporters. Over investments in excess electricity generation capacity can give rise to stranded assets – assets that become uneconomic to operate since their marginal cost of generation exceeds the price for electricity.[106]

This country report examines Kosovo's energy generation[107] and its import/export potential. It examines if a potential excess production of energy would be likely to be met by demand of potential buyers in the region and beyond. Moreover the study presents how the energy mix in Kosovo will develop over time.

This report is structured as follows: section 2 presents the approach and methodology. Section 3 presents the data. Section 4 presents the analysis and section 5 the conclusions.

Before commencing, a general caveat is in order. This report is based on official documents and predictions provided by the respective governments, power supplier or network operators. Given the scope of this research this report does not engage in the analysis of the legal framework nor does it seek to determine future price levels[108]. Similarly, current transport and grid capacities do not fall within the scope of this study and we do not incorporate effects that may arise from grid or transport restrictions.

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103 Throughout this report, this designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo declaration of independence

104 Authors of this report are Stefan Weishaar, University of Groningen, and Sami Madani, The Advisory House

105 Countries belonging to the Western Balkans are: Albania, Bosnia and Herzegovina, Kosovo, Macedonia, Montenegro, Serbia

106 Ben Caldecott & Jeremy McDaniels: Stranded generation assets: Implications for European capacity mechanisms, Energy Markets and Climate Policy, Working Paper, January 2014, p. 5, http://www.smithschool.ox.ac.uk/research-programmes/stranded-assets/Stranded%20Generation%20Assets%20-%20Working%20Paper%20-%20Final%20Version.pdf

107 Electricity is frequently referred to as 'Energy'. This report only examines electricity. In this report these terms are used interchangeably

108 This report does thus not extend to costs of energy production and input prices or wholesale prices or the like

6.2 Approach and Methodology

In order to identify the long-term viability of the present and future electricity capacity changes in Kosovo and its export potential, this study

- compares the current (and future) electricity production to the current (and future) domestic electricity demand and identifies short and long positions (Analysis section 1); and
- compares the (expected) export capacity with the demand of potential regional customers (countries in the Balkans, Ukraine, and Turkey) and supra-regional customers (EU Member States) (Analysis section 2).

The development of the energy mix is presented subsequently (Analysis section 3).

6.2.1 Kosovo's Supply/Demand analysis

Based upon Kosovo's specific historic production and import/export figures we determine the national net electricity supply/demand position. In order to account for future developments we also analyse the supply/demand position with regard to the generation capacity that is presently under construction or planned. Based on the current existing plants, current construction projects and construction projects that are planned, we develop three electricity supply scenarios.

#	Scenario	Description
1	**Existing capacity**	Calculates the net position based on current supply and demand figures
2	**Likely future capacity**	Calculates the net position based on existing capacity (Scenario 1) and an estimation of additional supply facilities that are under full construction or near starting construction
3	**Planned future capacity**	Calculates the full net position based on Scenario 2 and includes the envisaged electricity production

Table 17- Kosovo's electricity supply scenarios

The differentiation between 'likely future capacity' and 'planned future capacity' has been established by CEE Bankwatch. Determinants for differentiating between the two categories are whether construction permits have been granted, whether the constructors are identified and if the financing has been secured.

After obtaining results for electricity generation in Kosovo, we need to examine domestic demand before we can determine the national net long/short positions. We apply a robustness check in the form of three different electricity consumption scenarios. This robustness check is necessary since we seek to extrapolate electricity demand patterns over a period of 10 years and since changes in demand patterns severely affect Kosovo's ability to export electricity.

#	Scenario	Description
1	**Existing capacity**	GDP Low Growth Scenario (1,71% growth) (Statement of Security of Supply for Kosovo [KO-01] p. 17)

2	**Likely future capacity**	Base Growth Scenario (2,48% growth) (Statement of Security of Supply for Kosovo [KO-01] p. 17)
3	**Planned future capacity**	High Growth Scenario (3,2% growth) (Statement of Security of Supply for Kosovo [KO-01] p. 17)

Table 18 - Kosovo's electricity demand scenarios

Please note that the Statement of Security Supply for Kosovo [KO-01] provides data up until 2022. For 2023 and 2024 we used a linear approximation based on the average growth rate provided by the statement.[109]

The net long/short position of Kosovo is calculated by subtracting high, medium and low consumption demand from each of the three electricity supply scenarios. Kosovo's exporting ability is thus determined for all nine combinations.

In order to determine the long and short position of Kosovo we also analyse the electricity power balance. This balance examines the actual feed-in of electricity and the demand situation at a particular point in time when the electricity feed-in reserves are at their presumed minimum and the electricity demand is at its presumed maximum. Subject to the caveat relating to the robustness of the underlying data, this enables the identification of critical electricity supply situations. This method should thus be used as an indication only.[110]

Data for the hourly peak demand (hourly load values) during the period 2007 – 2013 is taken from the Statement of Security of Supply for Kosovo [KO-01] p. 17. We obtain the data for the peak hourly demand for the years 2014 – 2022 from the Statement of Security of Supply for Kosovo [KO-01] p. 17 and forecast the remaining years with the growth rate that underlies the low-, medium-, and high demand scenario.

Because the data between the historic data (2007 – 2013) and the future data (2014 – 2024) can differ we need a starting point for our peak demand forecast that also includes information from 2014. We therefore apply the following formula:

The peak load for 2014 is calculated as follows:

$$P_{2014} = \frac{D_{2014}}{Average(D_n, D_{n-1}, D_{n-2})} * Average(P_n, P_{n-1}, P_{n-2})$$

where:
D represents the demand in the given year,
P is the peak load
And n is the next year before 2014 where data is available, normally 2013.

The peak load for year n is calculated as follows

$$P_n = \frac{D_n}{D_{n-1}} * P_{n-1}$$

109 Statement of Security of Supply for Kosovo [KO-01] p. 17., Table 5.3

110 Net operators calculate the demand peaks in general for the 3rd Wednesday of each month. In our report, we deviate from this policy and determine the hourly peak demand on an annual basis

where:
D represents the demand in the given year,
P is the peak load
And n is the year after 2014.

We multiply this ratio with the average peak of 2011 – 2013 to determine the hourly peak demand for 2014. The peak demand is then forecasted with the growth rate that underlies the low-, medium-, and high demand scenario.

The peak energy supply (for all of the above supply scenarios) is calculated by multiplying the electricity generation capacity of those power plants that are base load capable with a parameter that reflects the supply security and availability of the electricity generation capacity. The data we use applies an in-feed supply security of 99% as a critical benchmark.[111]

Due to lack of information regarding the particular power plants and electricity networks, we are unable to account for required system reserves, revisions, and planned and unplanned outages and have to rely upon data from Germany.[112] Since for the purpose of this analysis the annual peak demand and peak supply is essential and only lasts for a short moment, we only consider the unplanned outages that cannot be time shifted beyond a period of 12 hours.[113] Based on historic supply statistics on these immediate unplanned outages in Germany we obtained parameters for expected base load supply.

Our data set does not distinguish between lignite and coal power plants. We selected the value for lignite since in the Balkans a lot of lignite is available.

Oil/gas is presumed not to be base load capable because of practices of short term supply contracts and unpredictable policy developments that may endanger the supply security with gas.

The data for wind and solar power exhibit low values because these technologies are not base load capable.

Hydropower is regarded to only have a limited base load capacity. Despite significant historic variability in the hydropower electricity generation in the Balkans, it is evident that hydropower plants were able to produce electricity in a stable manner. We therefore do not follow the German report (prescribing 25%)[114] but use 40%.[115]

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111 Bericht der deutschen Uebertragungsnetzbetreiber zur Leistungsbilanz 2013 nach EnWG §12 Abs. 4 und 5, 30.09.2013, available at http://www.bmwi.de/BMWi/Redaktion/PDF/J-L/leistungsbilanzbericht-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

112 We thereby follow Bericht der deutschen Uebertragungsnetzbetreiber zur Leistungsbilanz 2013 nach EnWG §12 Abs. 4 und 5, 30.09.2013, available at http://www.bmwi.de/BMWi/Redaktion/PDF/J-L/leistungsbilanzbericht-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

113 We thereby follow Bericht der deutschen Uebertragungsnetzbetreiber zur Leistungsbilanz 2013 nach EnWG §12 Abs. 4 und 5, 30.09.2013, available at http://www.bmwi.de/BMWi/Redaktion/PDF/J-L/leistungsbilanzbericht-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

114 http://www.bmwi.de/BMWi/Redaktion/PDF/J-L/leistungsbilanzbericht-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

The net long/short position of peak hourly demand and supply for Kosovo is calculated by subtracting high, medium and low hourly demand from each of the peak electricity supply scenarios.

Type	Planned Availability
Lignite	93,5%
Coal	94%
Gas/Oil	0%
Biomass	65%
Wind	1%
Photovoltaic	0%
Hydropower	40% (instead of 25%)
Pump storage	80%

Table 19 - Estimated power plant planned availability per type

6.2.2 Kosovo's export analysis

The regional analysis examines export opportunities for electricity produced in the scenario countries. We thus compare the possible long position of Kosovo against the possible long/short positions of its trading partners.

The examined trading partners will be 1) in the Western Balkan region (i.e. the case study countries), 2) regional (i.e. countries adjacent to the case study countries) and supra-regional, i.e. other EU Member States (3) and in the EU, Ukraine and Turkey (4). In order to estimate the import potential of the recipient countries the long/short positions of these countries must be determined.

The following countries have been included in the export analysis:

#	Group	Countries included
1	**Western Balkans**	Albania*, Bosnia and Herzegovina*, Macedonia*, Montenegro*, Serbia*
2	**Region**	Group 'Western Balkans' and countries adjacent to the case study countries: Bulgaria, Croatia, Greece, Hungary, Italy, Romania, Slovenia
3	**Western Balkans and EU**	Group 'Western Balkans' and the EU-28 countries
4	**Western Balkan and EU incl. Ukraine and Turkey**	Group 'Western Balkans and EU' and Ukraine and Turkey*

*: Trading partners with different scenarios in this study

Table 20 – Export analysis' groups for Kosovo

115 We calculated the regional average of hydropower generation capacity (excluding pump storage plants) by dividing total hydro power supply 2014 by total installed hydropower capacity (excluding pump storage plants) multiplied by 24 (hours) and 365 (days) = 7297GWh / 25447GWh ≈ 40%

Data for the case study countries is based upon the net long and net short positions in the respective country analysis contained in this report. Data has been obtained from a Study of the European Commission[116] the Turkish Electrical Energy 10-Year Generation Capacity Projection (2009 – 2018)[117] and the IEA and the Energy Strategy of Ukraine.[118] Since the data in the EU report is based on PRIMES that models on the basis of 5 year intervals, we connected the interim years by means of linear approximation.

Given that any forecasting inherently involves uncertainty we need to consider the range of possible outcomes – both at the supply side of Kosovo and its potential customers (group 1 to 4).

In order to reflect the range of possible import and export demand of the trading partners included in the respective analysis, we examine the lowest and the highest values for the respective years. In terms of the country analysis contained in this report we take the net long/short position of the 'current supply' (scenario 1) and 'high demand growth scenario' as a low estimate and the supply scenario 3 and low demand growth scenario as an estimate for the high import/export value. For the EU and Ukraine we included one scenario each. For Turkey we included a high and low electricity demand scenario.

This approach enables us to identify possible trading partners in the various groups that would be in demand of the electricity produced by Kosovo. The analysis also offers an overview over the range of possible outcomes and hence allows decision makers to gain insights into the 'riskiness' of investments in the electricity sector. Hence this analysis enables an assessment of the potential risk that investments turn into 'stranded assets'.

Given that electricity investments are generally regarded as long term investments we have selected three evaluation points at the beginning (2014), in the middle (2019) and at the end (2024) of the period under examination to compare Kosovo's import/export capabilities with those of its trading partners.

6.2.3 Kosovo's energy mix

This section will present the evolution of the energy mix in Kosovo based on the electricity supply scenarios.

6.3 Data description

We obtained historic (2007 – 2012) production (total production) and consumption data (consumption total) for Kosovo from the Statement of Security of Supply for Kosovo [KO-01] p.10, Figure 3.6 for generation and figure 3.7 for demand. Data for 2013 was not available (yet). Therefore, we do not consider this year.

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116 EU Commission, EU Energy, Transport and GHG Emissions Trends to 2050, Reference Scenario 2013, Appendix 2, p. 85 ff.

117 Turkish electricity Transmission Corporation, Turkish Electrical Energy 10-Year Generation Capacity Projection (2009 – 2018), 2009, Energy Demand Balance 2009-2018, (Case I-A) High Demand – Scenario 1, p. 44 and Project Generation Capacity and Energy Demand Balance 2009-2018 (Case II-A), Low Demand – Scenario 1. Approximation from 2018 onwards based on -9684,6x + 82780 (high demand) and -7259,3x + 77896, low demand (year 2009 represents 1)

118 IEA, Key World Energy Statistics, 2012, p. 27 and Energy Strategy of Ukraine for the period through 2035, p. 24, Annex 2. Since only values for 2012 and 2035 were available, values in between have been approximated linear

Production forecasts for the period 2014 – 2022 for the various power plants were obtained from the Statement of Security of Supply for Kosovo [KO-01] particularly from p. 19, table 5.6. Missing data for 2023 and 2024 was projected based on 2022.

For the TPP New Kosova we found several references to when the plant should become operational. The Statement of Security of Supply [KO-01] p.19 cites 2018, while the Transmission Development Plan 2014-2023 [KO-02] p. 37 mentions that it would not be earlier than 2019. According to the information from CEE Bankwatch, also 2019 may be optimistic since the EIA process is not completed yet and the tender for the strategic investor is still to be concluded.

According to the Transmission Development Plan 2014-2023 [KO-02] p. 37, the HPP Zhuri is expected to become operational in 2019, while the Statement of Security of Supply [KO-01] expects 2017. However, according to the Energy Community[119] there are currently no concrete investment plans. For this reason, this plant is considered level 3.

Information regarding the wind farm Zatric was taken directly from the investor[120] and the KOSTT[121]. The wind farm Budakova has a projected annual production ranging from 89 GWh to 133 GWh, depending on turbine type[122]. We took 111 GWh as an average estimate. Information on timing is provided by KOSTT[123].

For the wind farm Kitka, with a projected capacity of 30 MW, no expected annual electricity generation was available. We therefore assumed that the wind farm is level 3, and estimated the annual production to be 2/3rd of the output of Budakova. The wind farm is planned to be operational by 2016[124].

Small hydropower plants are mentioned in the Long term energy balance of the Republic of Kosovo [KO-03] and the Statement of Security of Supply for Kosovo [KO-01]. The conservative scenario in the first source, p. 21, table 19 ff. indicate that there are 36MW of small hydropower capacity installed in 2015, which seems not to be realistic[125]. Therefore, we use the conservative scenario and start in 2016, considering 22,9 MW as

119 http://www.energy-community.org/portal/page/portal/ENC_HOME/AREAS_OF_WORK/Implementation/Kosovo/Renewable_Energy

120 Investor’s article, March 8, 2013, available at: http://www.nek.ch/windenergie-geothermie-e/publikationen/dokumente/2013.03.08_EIEE_Kosovo_080313.pdf Investor’s news update, 13.06.2014, available at: http://www.nek.ch/windenergie-geothermie-d/news/meldungen/20140613_Landnutzungsrechte_Zatric.php?navanchor

121 KOSTT presentation, December 2013, p. 14, available at: http://www.irena.org/documentdownloads/events/2013/december/9_neziri.pdf

122 Investor’s article, March 8, 2013, available at: http://www.nek.ch/windenergie-geothermie-e/publikationen/dokumente/2013.03.08_EIEE_Kosovo_080313.pdf

123 KOSTT presentation, December 2013, p. 14, available at: http://www.irena.org/documentdownloads/events/2013/december/9_neziri.pdf

124 Irena presentation, p. 14, available at: http://www.irena.org/documentdownloads/events/2013/december/9_neziri.pdf

125 The only information available was a SHPP of 22,9 MW from an article by the project sponsor: http://www.kelag.at/files/pageflip/nachhaltigkeit_2014/files/assets/seo/page6.html

level 2, the rest as level 3. It is still regarded to be ambitious by CEE Bankwatch, hence this is why the 2022 figure that is prolonged to 2023 and 2024 is not increased.

Solar and biomass information have been taken from the Long term energy balance of the Republic of Kosovo [KO-03] p 21 ff. which presents a conservative growth scenario.

We obtained the projected consumption demand for all three scenarios from the Statement of Security of Supply for Kosovo [KO-01] p. 17.

As described above, data for the hourly peak demand (hourly load values) during the period 2007 – 2013 is taken from the Statement of Security of Supply for Kosovo [KO-01] p. 17. We obtain the data for the peak hourly demand for the years 2014 – 2022 from the Statement of Security of Supply for Kosovo [KO-01] p. 17 and forecast the remaining years with the growth rate that underlies the low-, medium-, and high demand scenario.

For the export analysis data has been obtained from several sources. For the case study countries data was obtained from this report. For the EU it has been taken from the EU Energy, Transport and GHG Emissions Trends to 2050, from the Reference Scenario 2013, Appendix 2, p. 85 ff.. The data for Turkey is taken from the Turkish electricity Transmission Corporation’s report on the Turkish Electrical Energy 10-Year Generation Capacity Projection (2009 – 2018), 2009. In particular data is taken from the Energy Demand Balance 2009 – 2018, (Case I-A) High Demand – Scenario 1, p. 44 and Project Generation Capacity and Energy Demand Balance 2009 – 2018 (Case II-A), Low Demand – Scenario 1. It is adapted to suit our needs by means of an approximation from 2018 onwards based on -9684,6x + 82780 (high demand) and -7259,3x + 77896, low demand (year 2009 represents 1). Data for Ukraine is taken from the IEA’s Key World Energy Statistics, 2012, p. 27 and from the Energy Strategy of Ukraine for the period through 2035, p. 24, Annex 2. Because only values for 2012 and 2035 were available, they have been approximated in a linear fashion.

6.4 Analysis

This section of the report describes relevant data observations and findings. First, the supply and demand analysis is presented (subsection 1). This section also examines the net long and short positions as well as peak electricity demand and supply. Subsection 2 presents the export analysis and subsection 3 presents the energy mix.

6.4.1 Supply and Demand

The figures below present the supply and demand patterns for Kosovo, showing the historic and future supply patterns (for existing capacity, likely future capacity and planned future capacity) in relation to each of the growth scenarios (low, medium and high growth).

Regarding the historical (2007 – 2012) supply and demand pattern, it can be seen that the generation of power is almost sufficient to cover consumption. A few hundred GWh only had to be imported. Furthermore, it is apparent that the power generation and consumption from 2007 to 2012 have both increased by around 20%.

All figures below show a significant gap in 2018 resulting from the planned decommissioning of TPP Kosova A. The TPP New Kosova will not be operational before 2019. Therefore, if Kosovo A is decommissioned in 2018, Kosovo will lose around one third of its production capacity, which will result in a strong short position in all scenarios.

Kosovo will either need to import energy in all scenarios listed below in 2018 or decommission Kosovo A at a later point in time.

In the low growth electricity consumption scenario Kosovo will remain dependent on energy imports after 2018 in the case of the current capacity scenario (supply scenario 1). This is attributable to the decommissioning of Kosovo A. In supply scenario 3, the new TPP New Kosova and the hydropower plant Zhuri would overcompensate the decommissioning of Kosovo A. These developments together with the realization of the planned renewables, would result in a production increase of more than 20% above the estimated low growth scenario.

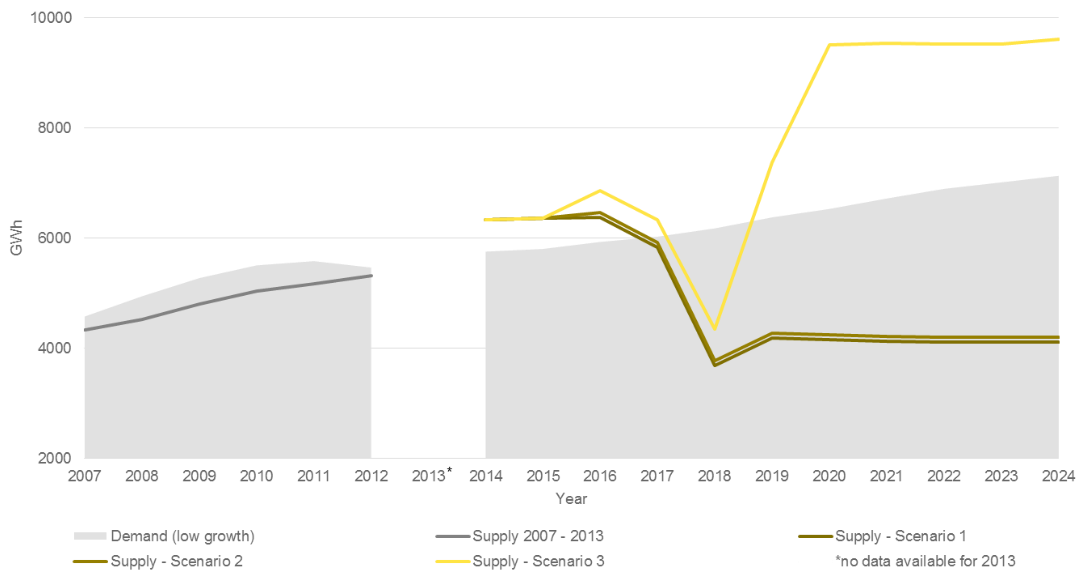

Figure 48 - Kosovo – Supply/Demand – Low Growth

In the case of medium consumption growth scenario, Kosovo needs to produce around 700 GWh of additional electricity by 2024 in order to fulfil the additional needs compared to the low consumption growth scenario. As a result, in supply scenario 1, Kosovo is only able to cover roughly half of its electricity demand in 2024. Only in supply scenario 3 the demand can be covered completely, except the temporal gap in 2018 which results from the decommissioning of Kosova A.

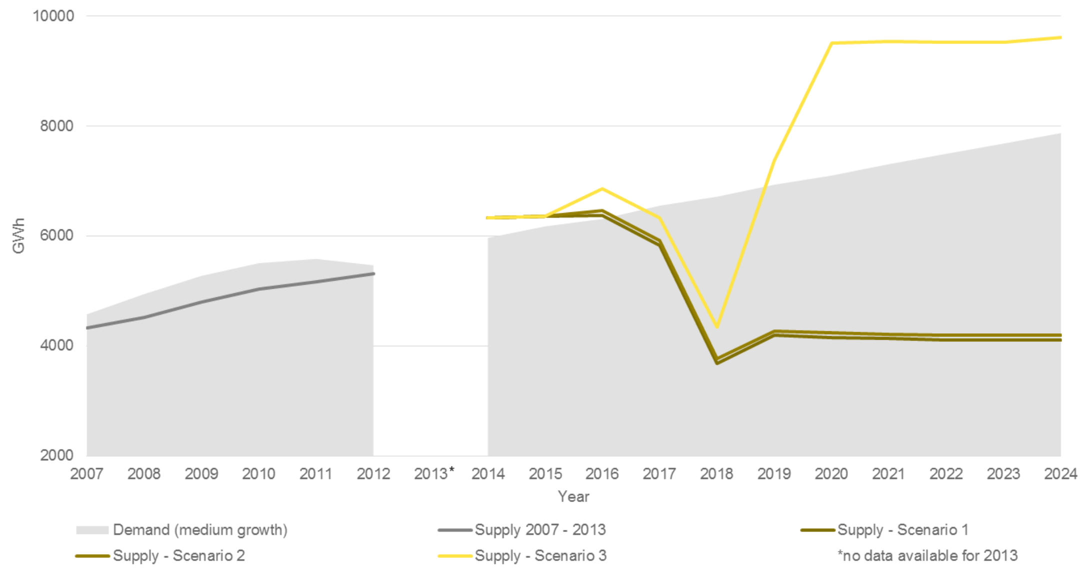

Figure 49 - Kosovo – Supply/Demand – Medium Growth

The figure presenting the high electricity consumption demand in Kosovo shows an expected demand of more than 8500 GWh in 2024, which can only be covered in supply scenario 3 (or equivalent). Furthermore it can be seen, that it is necessary to closely investigate further development from 2024 onwards, since the generation capacity may reach its limits after 2024. Supply scenario 1 does not satisfy the electricity demand in the future: more than 50% of the required electricity needs to be imported in case of the high growth scenario. This figure also shows that even in the case of high domestic electricity consumption growth, the realization of all of the future planned capacity expansions (or equivalent measures) would not result in the creation of a substantial export capacity.

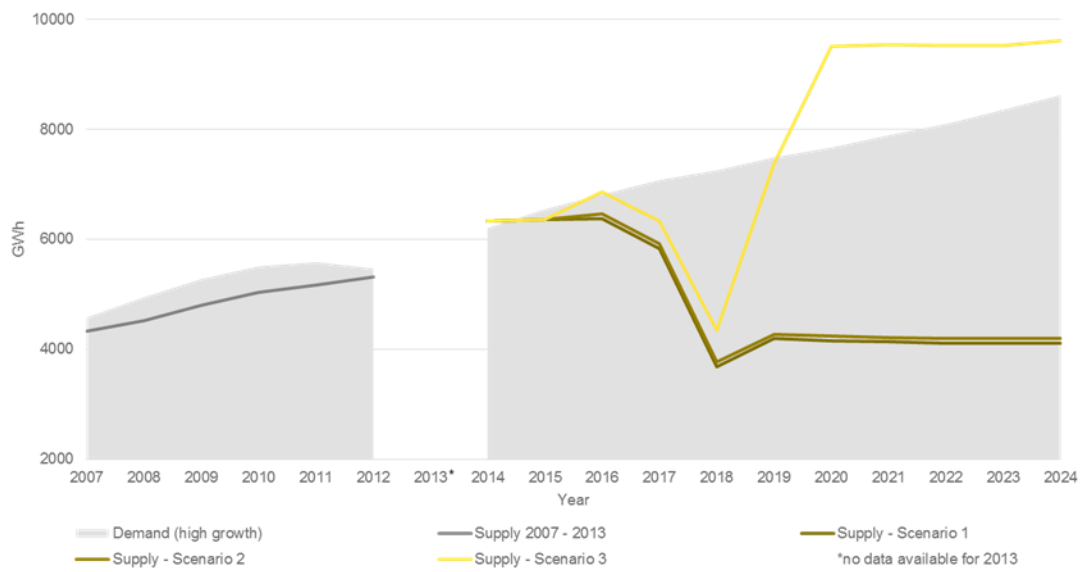

Figure 50 - Kosovo – Supply/Demand – High Growth

6.4.1.1 <u>Net Position</u>

After examining the general supply and demand patterns, we examine the net long and net short position of Kosovo. For each of the electricity consumption growth scenarios (low, medium and high growth) we examine the net positions in relation to the energy supply changes (existing capacity, likely future capacity and planned future capacity).

In the past, Kosovo enjoyed a more or less a balanced position. It was always in a small short position but is to be expected to turn into a small long position in the near future.

In case of the low consumption growth scenario it is apparent that the electricity generation capacity declines in 2018 and therefore turn the net long position into a short position of around 3 TWh in 2024. This is caused by the phase out of the Kosovo A power plant. Again, we observe that realizing all planned projects (or equivalent electricity generation capacity extensions) (supply scenario 3) entails that Kosovo would get into a long position and thus be able to export more than 2000 GWh per year.

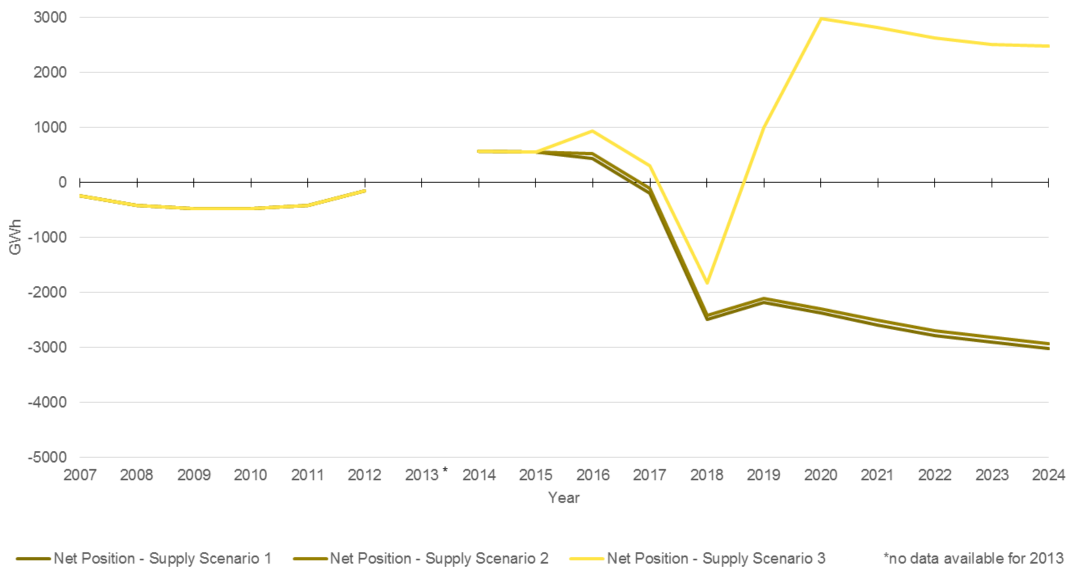

Figure 51 - Kosovo – Net Position – Low Growth

In the case of the medium electricity consumption growth scenario, the situation is nearly identical to the low growth scenario, but Kosovo will fall as of 2017 into a short position that will deteriorate to more than 3500 GWh in 2024 (assuming that no new generation capacity is going into operation (supply level 1)). Therefore, as supply scenario 3 shows, at least some of the planned future capacity extensions (or equivalent projects) must be realized to secure self-sufficiency during the period of examination. The realisation of all currently planned power plants will result in an export capability of around 1800 GWh in 2024.

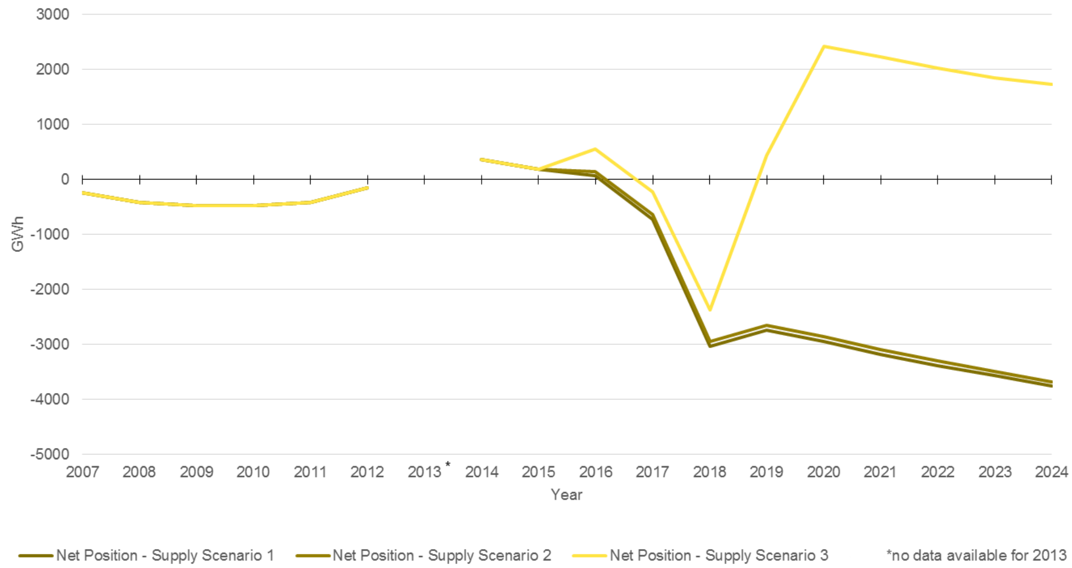

Figure 52 - Kosovo – Net Position – Medium Growth

The high electricity consumption growth scenario shows similar but more severe findings to those described in the low and medium growth scenario above. Moreover, it indicates that the implementation of all projects (or equivalent measures) may be required in order to maintain self-sufficiency, assuming a high electricity consumption growth. In supply level 1, the short position will be more than 4000 GWh, less than half of the demand in 2024. Even in supply level 3, the long position will drop from nearly 2000 GWh in 2020 to less than 1000 GWh in 2024.

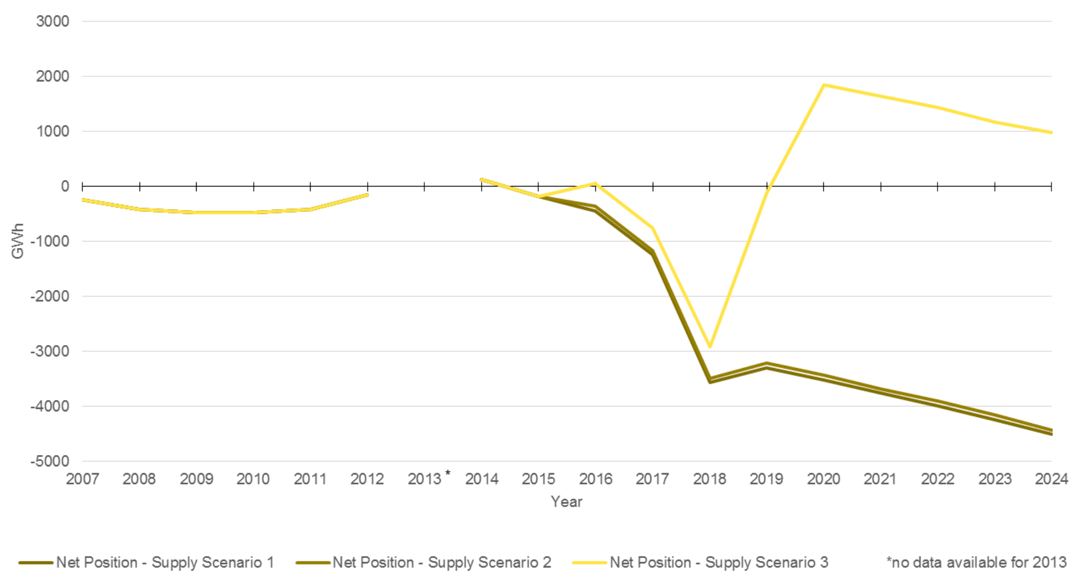

Figure 53 - Kosovo – Net Position – High Growth

6.4.2 <u>Peak supply / peak demand balance</u>

This balance examines the actual feed-in of electricity and the demand situation in Kosovo when the electricity feed-in reserves are at their presumed minimum and the electricity demand is at its presumed maximum. Subject to the caveat relating to the robustness of the underlying data, this enables the identification of critical electricity supply situations. This method should thus be interpreted with caution and viewed as an indication only.

Based on the available information, however, the figure below presents a difficult situation for Kosovo in relation to supply scenario 1: Kosovo is unable to meet its peak demand, especially not once Kosova A is decommissioned (expected for 2018). Also in supply scenario 3, Kosovo cannot satisfy peak demand situations, although it does relatively better than other countries in the region.

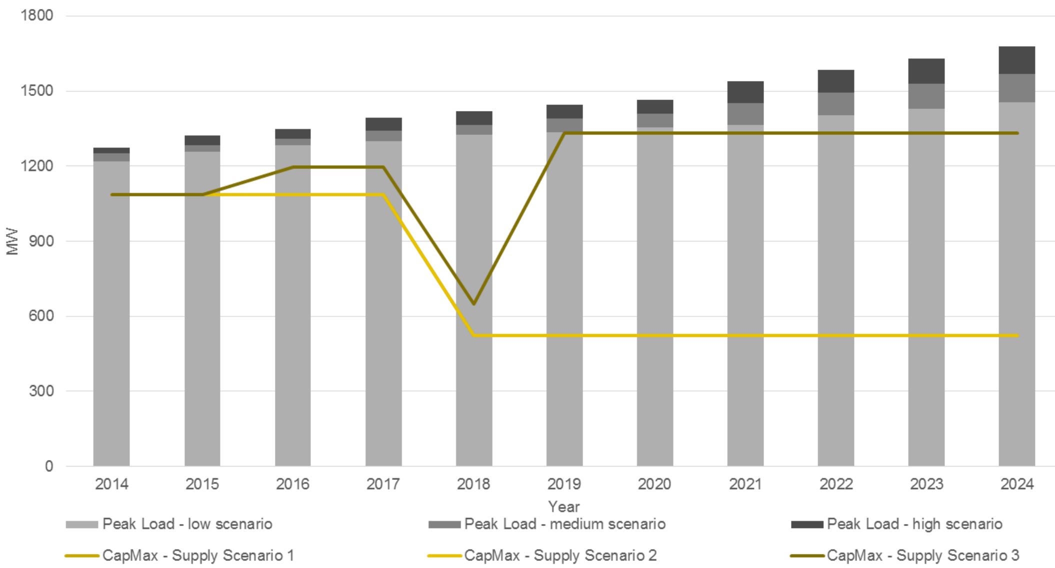

Figure 54 - Kosovo – Peak Supply/Demand Balance

6.4.3 Export analysis

This section of the report examines where energy produced in Kosovo could be exported. Potential trading partners can be found in the Western Balkans (i.e. in the other case study countries) (group 1), in the countries surrounding the Western Balkans (i.e. in the region) (group 2), or supra-regionally in the EU (group 3) or in the EU, Ukraine and Turkey (group 4). The export potential of Kosovo is thus compared to the net position in these scenarios.

Reflecting the range of outcomes in the supply and demand scenarios, the import/export capabilities of Kosovo and its trading partners are presented in the form of a range in the net exports, showing a minimum and a maximum value. Reflecting the underlying assumptions of the scenarios the range of possible outcomes widens over time.

In the figure below the import/export potential of Kosovo is shown in gold. Positive values denote Kosovo's export potential, while negative values denote its import needs. Positive values for the trading partners denote their demand for exports (short position) and negative numbers denote their export supply (long position). In the figure below export possibilities exist if there is a positive net position of Kosovo and positive export demand of the trading partners.

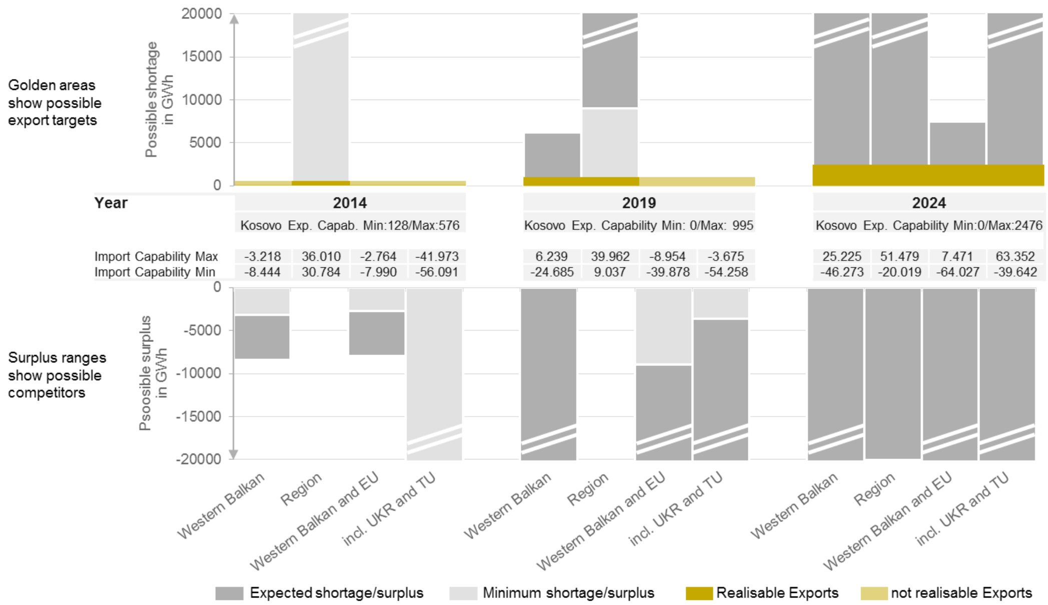

Figure 55 - Kosovo - Export Analysis

In 2014 Kosovo is in a slight short or in a long position. The long position would amount to around 10% of domestic demand in 2014 (low consumption growth scenario). The case study countries (group 1) were in a net long position entailing that they could export electricity. Examining the Western Balkans and its immediate neighbours jointly (group 2), it is noteworthy that they are in a net short position requiring about 28000 to 35000 GWh of electricity. Widening the framework of reference to the Western Balkans and the EU (group 3) shows that the region is in a slight long position. Including also Ukraine and Turkey (group 4) shows that there is a significant amount of excess supply in 2014.

In 2019 Kosovo is in a small net positive or substantial net short position. The long position would amount to around 15% of domestic demand in 2019 (low consumption growth scenario). The case study countries (group 1) would be in a slight long or in a short position entailing that there might be a small export market for Kosovo electricity. However, given the range of the net position, it appears more likely that the case study countries will be striving to export electricity. Again the Western Balkans and its immediate neighbours considered jointly (group 2) are in a significant net short position and thus be importing electricity. Widening the framework of reference to the Western Balkans and the EU (group 3) shows, however, that there is no excess demand expected in 2019. Including also Ukraine and Turkey (group 4) into the analysis shows that there is a significant excess supply in 2019.

Also in 2024 Kosovo is in a net short or long position and might be able to export up to 35% of domestic demand in 2024 (low consumption growth scenario). The case study countries (group 1) will either be in a long or in a short position entailing that there might potentially be an export market for Kosovo’s electricity. However, given the range of the net position, it appears more likely that the case study countries will be striving to export electricity. Again the Western Balkans and its immediate neighbours considered jointly (group 2) are in a significant net short position or in a net long position. It is thus unclear if they would be importers or exporters of electricity. Widening the framework of reference to the Western Balkans and the EU (group 3) shows, however, that it is unlikely that there will be a lot of excess demand in 2024. Including also Ukraine and Turkey (group 4) into the analysis, the figure shows the possibility of a significant excess demand (but also a long position) in 2024. The maximum value for export demand is strongly driven by the Turkish electricity demand figures that are based on an exponential forecasting function. If Turkey is considered as a potential market, the transport capacities (costs) need to be observed.

For the purpose of evaluating export potentials and stranded assets a number of relationships need to be described. Transporting electricity is costly: in particular transfer fees (within countries) and transmission fees (between countries) must be paid. Also electricity transportation requires infrastructure. While this report does not extend to these dimensions, we assume that the local electricity market in the Western Balkans and the surrounding states are the most important indicator if there is demand for Kosovo electricity. That the EU is in a long position indicates that there will at least be competition which can be expected to put pressure on the electricity price.

The above has shown that Kosovo is predominantly in a short position but may turn into an exporting country if all capacity extensions under supply scenario 3 (or equivalent) are realized. Even though Kosovo's total supply of exported electricity is relatively small, it represents a meaningful amount in terms of domestic electricity demand. The country may therefore grow quickly dependent on its export markets. Given that future electricity markets are potentially long or might be supplied by other competitors, future electricity prices may be lower and hence give rise to stranded assets.

6.4.4 Energy Mix

The figures below present the changes in Kosovo's energy mix. No data is available for 2013. The data from 2007 – 2012 present the energy mix on the basis of actual production figures. By contrast, the data from 2014 – 2024 show the energy mix based on the maximum likely electricity generation for fuel based power plants, while we assume a normal year for hydropower (conservative approach).

Based on the underlying supply scenarios, the energy mix in Kosovo is not changing significantly during the period of investigation. Fossil fuel power plants generated nearly all electricity; hydropower does only cover 2% to 3% of the annual generation.

Supply scenario 1 shows that coal power plants will decrease its production significantly in 2018. The production of energy from hydropower plants will not change significantly.

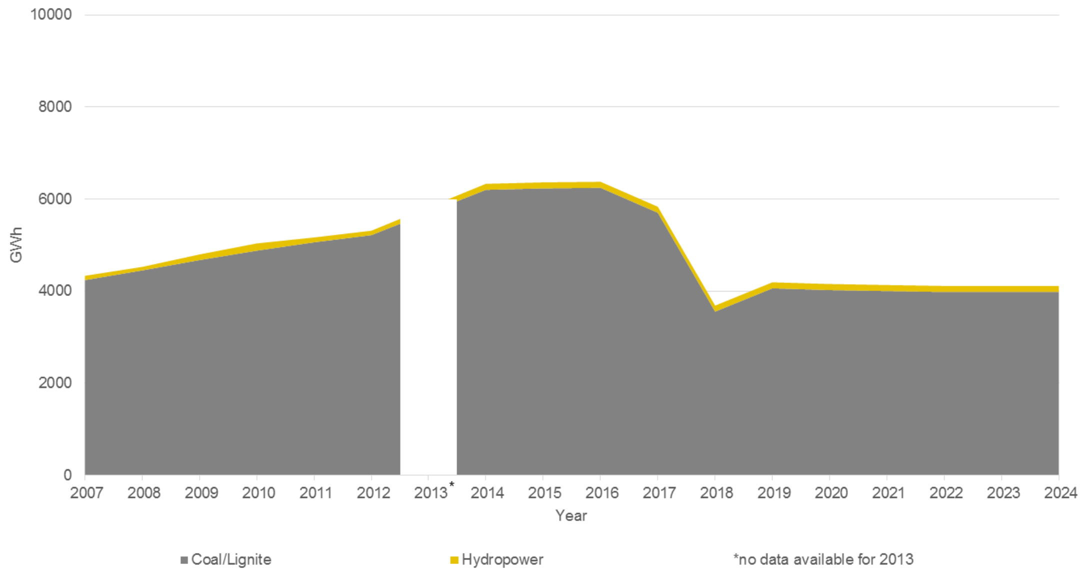

Figure 56 - Kosovo– Energy Mix Supply Scenario 1

Supply scenario 1 differs only marginally from supply scenario 2. Hydro power generation in supply scenario 2 is around 23 GWh higher. Since the changes are negligible, we do not reproduce the figure.

If all projects are realized until 2024, electricity generation capacity will increase significantly from around 6000 GWh in 2014 to more than 9500 GWh in 2024. The share of coal/lignite power will drop to 86%, while the share of hydropower will increase to more than 10%. Wind will increase its share from 0% to 3% in 2024, while biomass' share will be negligible in 2024.

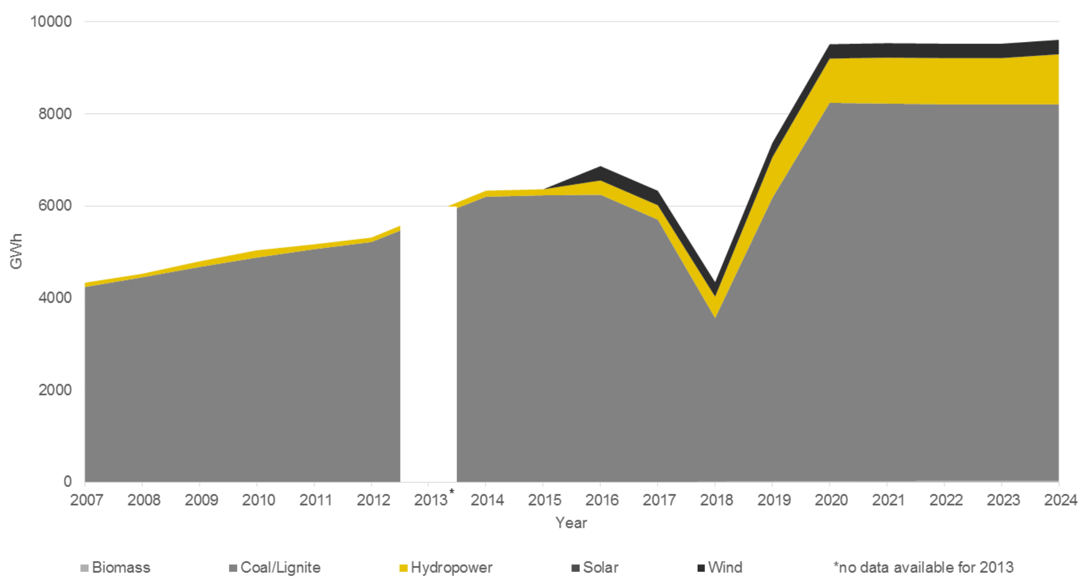

Figure 57 - Kosovo– Energy Mix Supply Scenario 3

The analysis above also offers insights into the question under which supply scenarios the country would be able to comply with its obligations under the Energy Community Treaty regarding the implementation of the EU Renewable Energy Directive

2009/28/EC.[126] Kosovo has assumed a binding renewable energy sources target of 25%.[127] This target is computed as follows:

$$RES\ Target\ Share\ = \frac{RES\ Electricity + RES\ Heating - Cooling + RES\ Transport}{Gross\ Final\ Energy\ Consumption}$$

In Kosovo's National Renewable Energy Action Plan, p. 15, it is stated that in 2020 the country has a RES electricity target of 25.64%.[128]

The figures above show that Kosovo is unlikely to meet these objectives under any of the supply scenarios. In supply scenario 1 electricity production is strongly based on coal/lignite, amounting to around 97% in 2020. In Supply scenario 2 the situation improves only marginally as the renewable energy share increases to 5% hydropower and coal/lignite retains 95%. In supply scenario 3 the renewable share increases to around 13.5% (10% hydro, 3% wind and the rest biomass and solar) while coal/lignite still accounts for around 86.5%. Kosovo does thus not seem set to realize its RES target for electricity unless it makes additional efforts.

6.5 Concluding remarks

This country report analyses the long-term electricity supply and demand pattern of Kosovo and examines its electricity export prospects from a stranded assets perspective.

The above analysis shows that in the course of the next decade Kosovo will reach a turning point. Depending on the decisions to be made, Kosovo can turn into a strong net electricity importer or turn from balanced country into a net exporter. It is noteworthy that the currently envisaged electricity generation capacity is barely enough to cover the demand increases in the low growth scenario and supply scenarios 1 and 2. An additional 1100 GWh are needed during the period 2014 – 2024 to satisfy demand in the case of the low growth scenario, or a significant demand decrease is required; while supply level 3 only envisages an increase of around 1200 GWh for renewables, if all currently envisaged projects would be realised.

The amount of electricity that can be exported could reach up to 2.500 GWh in 2024 in case of supply scenario 3 and low demand growth, constituting around 35% of domestic demand in 2024. In case of high demand growth the export potential with ca. 1.000 GWh amounts to around 11% of domestic demand in 2024. In other supply scenarios, however, Kosovo is a net importer.

Supply scenario 3 (or equivalent capacity extensions) would give rise to a substantial dependency on the export market. The export analysis shows that the case study

126 The RES Directive transposes the European target of a 20% renewable energy sources (RES) in gross final energy demand by 2020

127 http://www.irena.org/DocumentDownloads/events/2013/December/Background_Paper-A.pdf

128 Ministarstvo Ekonomskog Razvoja, National Renewable Energy Action Plan (NREAP) 2011 - 2020 (2013) p. 15, available at https://www.energy-community.org/portal/page/portal/ENC_HOME/DOCS/2570177/NREAP_18.11.2013-_engl.pdf

countries are likely to compete for exporting electricity to the neighbouring countries. Competition may in particular come from EU Member States, namely Bulgaria and Romania, and possibly in the near future Ukraine and Turkey. A high dependency on the export market therefore exposes the country to create the risk of stranded assets. From this point of view, a make-or-buy decision should also be investigated prior to new investments.

Concerning the peak load demand and supply analysis it bears mentioning that Kosovo is expected to remain vulnerable, particularly in supply scenario 1. In supply scenario 3 the situation is less severe, however, the country will remain unable to meet its peak demand.

The report shows a number of issues related to electricity supply. Kosovo is strongly depending on fossil energy. Depending on the realisation of the planned power plants, Kosovo's fossil fuel dependence may increase. The country also is strongly depending on a few main power plants. This may lead to electricity supply problems once plants are decommissioned, as is the case in 2018 with Kosova A. The effects of a more diversified electricity mix and less concentrated electricity production should be investigated.

It is not only the supply side that influences the long or short position of Kosovo, but also demand side. A demand side issue that is not examined in the case study but should be mentioned are the transmission and distribution losses. In Kosovo the overall loss in transmission and distribution of more than 35%[129]. An increased performance of the network will have a major impact on the security of supply as well as on the net position. It needs to be observed that losses may also be attributable to electricity theft. Moreover, energy efficiency measures may lead to electricity savings and help to improve the country's net position.

Based on the findings above we expect that the Kosovo will keep its position as a balanced country. This may change if the new TPP New Kosova enters operation. However this would bring other challenges such as potential failure to meet renewable energy targets and over-reliance on one source of fuel. Additional efforts will be needed to change this and meet Kosovo's obligatory Energy Community renewable energy target of 25% by 2020.

This report shows that the country does require good regional ties in the area of energy policy. The current infrastructure should therefore be examined from this perspective. Importantly this report shows that the country has strong electricity export ambitions that create the danger of stranded assets if the domestic electricity expansion decisions are taken without taking due account of developments in other countries in the Western Balkans and beyond. Decisions to buy or produce electricity should thus be taken in a strategic fashion that also takes due account of energy security considerations. It can thus be concluded that integration and collaboration in the area of energy policy in the Western Balkans is vital for Kosovo.

129 110 GWh in transmission and 1704 GWh in distribution in 2013, see Energy Community Secretariat, Annual Implementation Report, August 2014, p. 73, available at: https://www.energy-community.org/pls/portal/docs/3356393.PDF

Sources

[KO-01] Statement of Security of Supply for Kosovo (Electricity, Natural Gas and Oil), July 2013, available at: http://www.energy-community.org/portal/page/portal/ENC_HOME/DOCS/2422181/Statement_of_Security_of_Supply_for_Kosovo_%28Electricity_Gas__Oil%29_Final_Eng.pdf

[KO-02] Transmission Development Plan 2014-2023, KOSTT, available at: http://www.kostt.com/website/images/stories/dokumente/publikime/Transmission_Development_Plan_2014-2023.pdf

[KO-03] Long term energy balance of the Republic of Kosovo 2013-2022 (2012), Ministry of Economic Development, December 2012, available at: http://mzhe.rks-gov.net/repository/docs/Balanca_afatagjate_2013_-2022_-_eng_finall.pdf

7. Country Report Serbia

7.1 Introduction

This country report is a self-contained subset of the ‘Report on the long-term economic viability of constructing new electricity capacities for electricity exports in the Western Balkan countries’ that was commissioned by CEE Bankwatch and realized by the University of Groningen and The Advisory House.[130] The background of this study is that almost all governments in the Western Balkans[131] have plans to extend their electricity generation capacity to meet their demand, but they also demonstrate the ambition to become electricity exporters. Over investments in excess electricity generation capacity can give rise to stranded assets – assets that become uneconomic to operate since their marginal cost of generation exceeds the price for electricity. [132]

This country report examines Serbia’s energy generation[133] and its import/export potential. It examines if a potential excess production of energy would be likely to be met by demand of potential buyers in the region and beyond. Moreover the study presents how the energy mix in Serbia will develop over time.

This report is structured as follows: section 2 presents the approach and methodology. Section 3 presents the data. Section 4 presents the analysis and section 5 the conclusions.

Before commencing, a general caveat is in order. This report is based on official documents and predictions provided by the respective governments, power supplier or network operators. Given the scope of this research this report does not engage in the analysis of the legal framework nor does it seek to determine future price levels[134]. Similarly, current transport and grid capacities do not fall within the scope of this study and we do not incorporate effects that may arise from grid or transport restrictions.

7.2 Approach and Methodology

In order to identify the long-term viability of the present and future electricity capacity changes in Serbia and its export potential, this study

- compares the current (and future) electricity production to the current (and future) domestic electricity demand and identifies short and long positions (Analysis section 1); and

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130 Authors of this report are Stefan Weishaar, University of Groningen, and Sami Madani, The Advisory House

131 Countries belonging to the Western Balkans are: Albania, Bosnia and Herzegovina, Kosovo*(this designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo declaration of independence), Macedonia, Montenegro, Serbia

132 Ben Caldecott & Jeremy McDaniels: Stranded generation assets: Implications for European capacity mechanisms, Energy Markets and Climate Policy, Working Paper, January 2014, p. 5, http://www.smithschool.ox.ac.uk/research-programmes/stranded-assets/Stranded%20Generation%20Assets%20-%20Working%20Paper%20-%20Final%20Version.pdf

133 Electricity is frequently referred to as ‘Energy’. This report only examines electricity. In this report these terms are used interchangeably

134 This report does thus not extend to costs of energy production and input prices or wholesale prices or the like

- compares the (expected) export capacity with the demand of potential regional customers (countries in the Balkans, Ukraine, and Turkey) and supra-regional customers (EU Member States) (Analysis section 2).

The development of the energy mix is presented subsequently (Analysis section 3).

7.2.1 Serbia' Supply/Demand analysis

Based upon Serbia's specific historic production and import/export figures the national net and peak electricity supply/demand position is determined. In order to account for future developments we also analyse the supply/demand position with regard to the generation capacity that is presently under construction or planned. Based on the current existing plants, current construction projects and construction projects that are planned, we develop three electricity supply scenarios.

#	Scenario	Description
1	**Existing capacity**	Calculates the net position based on current supply and demand figures
2	**Likely future capacity**	Calculates the net position based on existing capacity (Scenario 1) and an estimation of additional supply facilities that are under full construction or near starting construction
3	**Planned future capacity**	Calculates the full net position based on Scenario 2 and includes the envisaged electricity production

Table 21 - Serbia's electricity supply scenarios

The differentiation between 'likely future capacity' and 'planned future capacity' has been established by CEE Bankwatch. Determinants for differentiating between the two categories are whether construction permits have been granted, whether the constructors are identified and if the financing has been secured.

After obtaining results for electricity generation in Serbia, we need to examine domestic demand before we can determine the national net long/short positions. We apply a robustness check in the form of three different electricity consumption scenarios. This robustness check is necessary since we seek to extrapolate electricity demand patterns over a period of 10 years and since changes in demand patterns severely affect Serbia's ability to export electricity.

#	Scenario	Description
1	**Low**	Scenario with energy efficiency measures, Energy Development Strategy of Serbia by 2025 with projection up to the year 2030 [SER-01] p. 82
2	**Medium**	Reference scenario, Energy Development Strategy of Serbia by 2025 with projection up to the year 2030 [SER-01] p. 82
3	**High**	The high growth scenario is based on the reference scenario to which the difference between the energy efficiency and the reference scenario was added

Table 22 - Serbia's Electricity demand scenarios

The low and medium scenarios were selected to provide for comparability between our report and existing reports and to enhance stakeholder acceptability. The high consumption growth scenario was selected with the same range between the low demand growth and the baseline scenario to allow for a robust energy policy in case of high consumption demand growth.

The net long/short position of Serbia is calculated by subtracting high, medium and low consumption demand from each of the three electricity supply scenarios. Serbia's exporting ability is thus determined for all nine combinations.

In order to determine the long and short position of Serbia we also analyse the electricity power balance. This balance examines the actual feed-in of electricity and the demand situation at a particular point in time when the electricity feed-in reserves are at their presumed minimum and the electricity demand is at its presumed maximum. Subject to the caveat relating to the robustness of the underlying data, this enables the identification of critical electricity supply situations. This method should thus be used as an indication only[135].

Data for the hourly peak demand (hourly load values) during the period 2007 – 2013 is taken from Entso-E [SER-02]. We determine the peak hourly demand for each year (2007 – 2013) and forecast the remaining years (2014 – 2024).

Because the values between the historic data (2007 – 2013) and the future data (2014-2024) can differ[136] we need a starting point for our peak demand forecast that also includes information from 2014. We therefore apply the following formula:

The peak load for 2014 is calculated as follows:

$$P_{2014} = \frac{D_{2014}}{Average(D_n, D_{n-1}, D_{n-2})} * Average(P_n, P_{n-1}, P_{n-2})$$

where:
D represents the demand in the given year,
P is the peak load
And n is the next year before 2014 where data is available, normally 2013.

The peak load for year n is calculated as follows

$$P_n = \frac{D_n}{D_{n-1}} * P_{n-1}$$

where:
D represents the demand in the given year,
P is the peak load
And n is the year after 2014.

135 Net operators calculate the demand peaks in general for the 3rd Wednesday of each month. In our report we deviate from this policy and determine the hourly peak demand on an annual basis

136 Historical data shows the actual produced electricity while the future data is based on planned volumes

We multiply this ratio with the average peak of 2011 – 2013 to determine the hourly peak demand for 2014. The peak demand is then forecasted with the growth rate that underlies the low-, medium-, and high demand scenario.

The peak energy supply (for all of the above supply scenarios) is calculated by multiplying the electricity generation capacity of those power plants that are base load capable with a parameter that reflects the supply security and availability of the electricity generation capacity. The data we use applies an in-feed supply security of 99% as a critical benchmark.[137]

Due to lack of information regarding the particular power plants and electricity networks, we are unable to account for required system reserves, revisions, and planned and unplanned outages and have to rely upon data from Germany.[138] Since for the purpose of this analysis the annual peak demand and peak supply is essential and only lasts for a short moment, we only consider the unplanned outages that cannot be time shifted beyond a period of 12 hours.[139] Based on historic supply statistics on these immediate unplanned outages in Germany we obtained the following parameters for the expected base load supply.

Our data set does not distinguish between lignite and coal power plants. We selected the value for lignite since in the Balkans a lot of lignite is available.

Oil/Gas is presumed not to be base load capable because of practices of short term supply contracts and unpredictable policy developments that may endanger the supply security with gas.

The data for wind and solar power exhibit low values because these technologies are not base load capable.

Hydropower is regarded to only have a limited base load capacity. Despite significant historic variability in the hydropower electricity generation in the Balkans, it is evident that hydropower plants were able to produce electricity in a stable manner. We therefore do not follow the German report (prescribing 25%)[140] but use 40%.[141]

137 Bericht der deutschen Uebertragungsnetzbetreiber zur Leistungsbilanz 2013 nach EnWG §12 Abs. 4 und 5, 30.09.2013, available at http://www.bmwi.de/BMWi/Redaktion/PDF/J-L/leistungsbilanzbericht-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

138 We thereby follow Bericht der deutschen Uebertragungsnetzbetreiber zur Leistungsbilanz 2013 nach EnWG §12 Abs. 4 und 5, 30.09.2013, available at http://www.bmwi.de/BMWi/Redaktion/PDF/J-L/leistungsbilanzbericht-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

139 We thereby follow Bericht der deutschen Uebertragungsnetzbetreiber zur Leistungsbilanz 2013 nach EnWG §12 Abs. 4 und 5, 30.09.2013, available at http://www.bmwi.de/BMWi/Redaktion/PDF/J-L/leistungsbilanzbericht-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

140 http://www.bmwi.de/BMWi/Redaktion/PDF/J-L/leistungsbilanzbericht-2013,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

141 We calculated the regional average of hydropower generation capacity (excluding pump storage plants) by dividing total hydro power supply 2014 by total installed hydropower capacity (excluding pump storage plants) multiplied by 24 (hours) and 365 (days) = 7297GWh / 25447GWh ≈ 40%

Type	Planned Availability
Lignite	93,5%
Coal	94%
Gas/Oil	0%
Biomass	65%
Wind	1%
Photovoltaic	0%
Hydropower	40% (instead of 25%)
Pump storage	80%

Table 23 - Estimated power plant planned availability per type

7.2.2 Serbia's export analysis

The regional analysis examines export opportunities for electricity produced in the scenario countries. We thus compare the possible long position of Serbia against the possible long/short positions of its trading partners.

The examined trading partners will be 1) in the Western Balkan region (i.e. the case study countries), 2) regional (i.e. countries adjacent to the case study countries) and supra-regional, i.e. other EU Member States (3) and in the EU, Ukraine and Turkey (4). In order to estimate the import potential of the recipient countries the long/short positions of these countries must be determined.

The following countries have been included in the export analysis:

#	Group	Countries included
1	**Western Balkans**	Albania*, Bosnia and Herzegovina*, Kosovo[142]*, Macedonia*, Montenegro*
2	**Region**	Group 'Western Balkans' and countries adjacent to the case study countries: Bulgaria, Croatia, Greece, Hungary, Italy, Romania, Slovenia
3	**Western Balkans and EU**	Group 'Western Balkans' and the EU-28 countries
4	**Western Balkan and EU incl. Ukraine and Turkey**	Group 'Western Balkans and EU' and Ukraine and Turkey*

*: Trading partners with different scenarios in this study

Table 24 – Export analysis' groups for Serbia

Data for the case study countries is based upon the net long and net short positions in the respective country analysis contained in this report. Data has been obtained from a Study of the European Commission[143] the Turkish Electrical Energy 10-Year Generation

142 This designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo declaration of independence

143 EU Commission, EU Energy, Transport and GHG Emissions Trends to 2050, Reference Scenario 2013, Appendix 2, p. 85 ff.

Capacity Projection (2009 – 2018)[144] and the IEA and the Energy Strategy of Ukraine.[145] Since the data in the EU report is based on PRIMES that models on the basis of 5 year intervals, we connected the interim years by means of linear approximation.

Given that any forecasting inherently involves uncertainty, we need to consider the range of possible outcomes – both at the supply side of Serbia and its potential customers (group 1 to 4).

In order to reflect the range of possible import and export demand of the trading partners included in the respective analysis, we examine the lowest and the highest values for the respective years. In terms of the country analysis contained in this report we take the net long/short position of the 'current supply' (scenario 1) and 'high demand growth scenario' as a low estimate and the supply scenario 3 and low demand growth scenario as an estimate for the high import/export value. For the EU and Ukraine we included one scenario each. For Turkey we included a high and low electricity demand scenario.

This approach enables us to identify possible trading partners in the various groups that would be in demand of the electricity produced by Serbia. The analysis also offers an overview over the range of possible outcomes and hence allows decision makers to gain insights into the 'riskiness' of investments in the electricity sector. Hence this analysis enables an assessment of the potential risk that investments turn into 'stranded assets'.

Given that electricity investments are generally regarded as long term investments we have selected three evaluation points at the beginning (2014), in the middle (2019) and at the end (2024) of the period under examination to compare Serbia's import/export capabilities with those of its trading partners.

7.2.3 Serbia's energy mix

This section will present the evolution of the energy mix in Serbia based on the three electricity supply scenarios.

7.3 Data description

We obtained historic (2007 – 2013) production (total production) and consumption data (consumption total) for Serbia from Entso-E's [SER-02] 'Detailed Monthly Production (in GWh)' data set[146].

Data for the period 2014 – 2024 was obtained from Energy Development Strategy of Serbia by 2025 with projection up to the year 2030 [SER-01] p. 82.

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144 Turkish electricity Transmission Corporation, Turkish Electrical Energy 10-Year Generation Capacity Projection (2009 – 2018), 2009, Energy Demand Balance 2009-2018, (Case I-A) High Demand – Scenario 1, p. 44 and Project Generation Capacity and Energy Demand Balance 2009-2018 (Case II-A), Low Demand – Scenario 1. Approximation from 2018 onwards based on -9684,6x + 82780 (high demand) and -7259,3x + 77896, low demand (year 2009 represents 1)

145 IEA, Key World Energy Statistics, 2012, p. 27 and Energy Strategy of Ukraine for the period through 2035, p. 24, Annex 2. Since only values for 2012 and 2035 were available, values in between have been approximated linearly

146 Historical Entso-E data from Serbia includes Kosovo

All projections for the consumption demand scenarios (reference scenario and scenario with energy efficiency measures) were obtained from the Energy Development Strategy of Serbia by 2025 with projection up to the year 2030 [SER-01] p. 82. The high growth scenario is based on the reference scenario to which the difference between the energy efficiency and the reference scenario was added.

Data for coal/lignite plants in Serbia have been taken from SEEC and Energy Community [SER-05]. Nikola Tesla A3, A4, B1 are planned to install FGD in 2018 and Nikola Tesla B2 is scheduled to do the same in 2019. Since we do not have precise data on the implications on production – we assume that the production will continue as indicated in the report. Morava, will have a dust filter installed in 2015. We do not have data on how production is impacted so we assume that production continues as described in the report. Data regarding the annual electricity generation capacity of Stavalj, Kovin and Kostolac B3 was not available and we were therefore unable to include these plants in our analysis.

Data for the gas power plants was obtained from Panonske TE-TO.[147]

The data for the biomass power plant was taken from the Progress Report on Implementation of the National Renewable Energy Action Plan of the Republic of Serbia (2014)[148] contains information on generation in 2013 from 4.8 MW of biogas plants which we assumed to be stable in the coming years.

Data for several hydropower plants (Đerdap 1, Đerdap 2, Pirot, Vlasina, Bajina Bašta pumped storage plant) was taken from EPS.[149] The pump storage plant is assumed not to produce any additional electricity.

Drin-Lim hydropower plants have been calculated by computing the sum of its individual plants: HPP Bajina Basta (1819 GWh), HPP Zvornik (550 GWh), HPP Elektormorava (67 GWh)[150] and HPP Limske with 839 GWh (Average from 2005 and 2006).[151] Naturally, the RHPP Bajina Basta was excluded.

The HPPs of Srednja Drina (Dubravica, Tegare, Rogacica) will share their electricity generation equally between Bosnia and Herzegovina and Serbia.[152] These power plants were projected to commence construction in 2014 and commence operations towards

147 http://panonske.rs

148 The Progress Report on Implementation of the National Renewable Energy Action Plan of the Republic of Serbia (2014), p. 8, available at https://www.energy-community.org/portal/page/portal/ENC_HOME/DOCS/3552161/Progress_Report_on_NREAP__SERBIA_2014_ENG_FINAL.pdf

149 http://www.eps.rs

150 http://www.eps.rs/Eng/Article.aspx?lista=Sitemap&id=71

151 http://www.uea.ac.uk/documents/107435/107587/ccp08-12.pdf

152 See http://www.vienna-economic-forum.com/uploads/media/Glamocic_Prezentacija_razvojni_projekti.pdf , p.11

the end of 2020-2023.[153] Because the project does not have funding, no strategic investor and no permits we selected 2023 as a starting date.

Similarly the HPPs of Donja Drina (Kozluk, Drina I, II and III) will share its electricity generation equally between Bosnia and Herzegovina and Serbia.[154] The generation capacity has been taken from the list of electricity projects presented in DNV KEMA, REKK, EIHP, The Development and Application of a Methodology to Identify Projects of Energy Community Interest [SER-03] p. 78. The date for commencing electricity generation was estimated to fall within 2018-2020: we selected the mid-term value, 2019, as a starting date.

The data for small hydropower plants have been obtained from the National Renewable Energy Action Plan for Serbia, [SER-04] p. 130 ff. Since this report only states a figure for 2020, for the previous years we have linearly extrapolated how much would be needed to be built each year starting from 2016 to fulfil the target for 2020. After 2020 we have no indication about targets or expectations so we retained the 2020 values.

Data for the wind power was obtained from various sources. For Alibunar 1 and Kula it was obtained from the respective project promoter's website.[155] Data for Plandište, Ćibuk 1, Alibunar have been obtained from CEE Bankwatch that had e-mail correspondence with Continental Wind/Serbia Wind Energy Association.

Data for solar power plants was taken from several sources[156].

We obtained the projected consumption demand from the Energy Development Strategy of Serbia by 2025 with projection up to the year 2030 [SER-01] p. 82, taking the energy efficiency scenario as a low growth scenario and the reference scenario as our medium growth scenario. The high consumption growth scenario was selected with the same range between the low demand growth and the reference scenario to allow for a robust energy policy in case of high consumption demand growth.

As described above, data for the hourly peak demand (hourly load values) during the period 2007 – 2013 is taken from Entso-E [SER-02]. We determine the peak hourly demand for each year (2007 – 2013) and forecast the remaining years (2014 – 2024).

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153 Presentation of energy projects by Minister of Energy, Development and Environmental Protection, December 2012, p. 20 available at
http://www.mzv.sk/App/WCM/Aktualit.nsf/vw_ByID/ID_D54591C5BB38AEF9C1257ADA00561AD3_SK

154 See http://www.vienna-economic-forum.com/uploads/media/Glamocic_Prezentacija_razvojni_projekti.pdf , p. 11

155 Project promoter website: http://www.windvision.com/english/projects-in-serbia

156 Source 1: http://www.solarisenergy.co.rs/, Source of information about generation production: http://ceefor.co.rs/pdf/reference/4.2.pdf and http://www.enertec.si/sl/reference/mse-solaris-1--999-kwp.html;
Source 3: Serbia govt. press release on opening of the solar park, 10 September 2014: http://www.srbija.gov.rs/vesti/vest.php?id=218915
Source 4: PV Magazine, 20.11.2014: http://www.pv-magazine.com/news/details/beitrag/serbia-inaugurates-2-mw-solar-farm-while-rejecting-pv_100017234/#axzz3PD7z5IdrčInfo
Source 5: RTS news, 17 May 2011: http://www.rts.rs/page/stories/sr/story/57/Srbija+danas/893294/Prva+solarna+elektrana+u+Srbiji.html

For the export analysis data has been obtained from several sources. For the case study countries data was obtained from this report. For the EU it has been taken from the EU Energy, Transport and GHG Emissions Trends to 2050, from the Reference Scenario 2013, Appendix 2, p. 85 ff.. The data for Turkey is taken from the Turkish electricity Transmission Corporation's report on the Turkish Electrical Energy 10-Year Generation Capacity Projection (2009 – 2018), 2009. In particular data is taken from the Energy Demand Balance 2009 – 2018, (Case I-A) High Demand – Scenario 1, p. 44 and Project Generation Capacity and Energy Demand Balance 2009 – 2018 (Case II-A), Low Demand – Scenario 1. It is adapted to suit our needs by means of an approximation from 2018 onwards based on -9684,6x + 82780 (high demand) and -7259,3x + 77896, low demand (year 2009 represents 1). Data for Ukraine is taken from the IEA's Key World Energy Statistics, 2012, p. 27 and from the Energy Strategy of Ukraine for the period through 2035, p. 24, Annex 2. Because only values for 2012 and 2035 were available, they have been approximated in a linear fashion.

7.4 Analysis

This section of the report describes relevant data observations and findings. First, the supply and demand analysis is presented (subsection 1). This section also examines the net long and short positions as well as peak electricity demand and supply. Subsection 2 presents the export analysis and subsection 3 presents the energy mix.

7.4.1 Supply and Demand

The figures below present the supply and demand patterns for Serbia, showing the historic and future supply patterns (for existing capacity, likely future capacity and planned future capacity) in relation to each of the growth scenarios (low, medium and high growth).

Regarding the historical (2007 – 2013) supply and demand pattern, it is evident that Serbia has been able to cover its demand and been able to export electricity.

At the low growth electricity consumption scenario, Serbia is able to satisfy demand during the period of examination. In the case of the existing capacity scenario (scenario 1), however, Serbia will be in a balanced position in 2024. In the case of supply scenario 2 Serbia will be in a near balanced position in the same year. Only in supply scenario 3 Serbia turns into a substantial long position with an export potential equivalent to around 55% of its domestic demand.

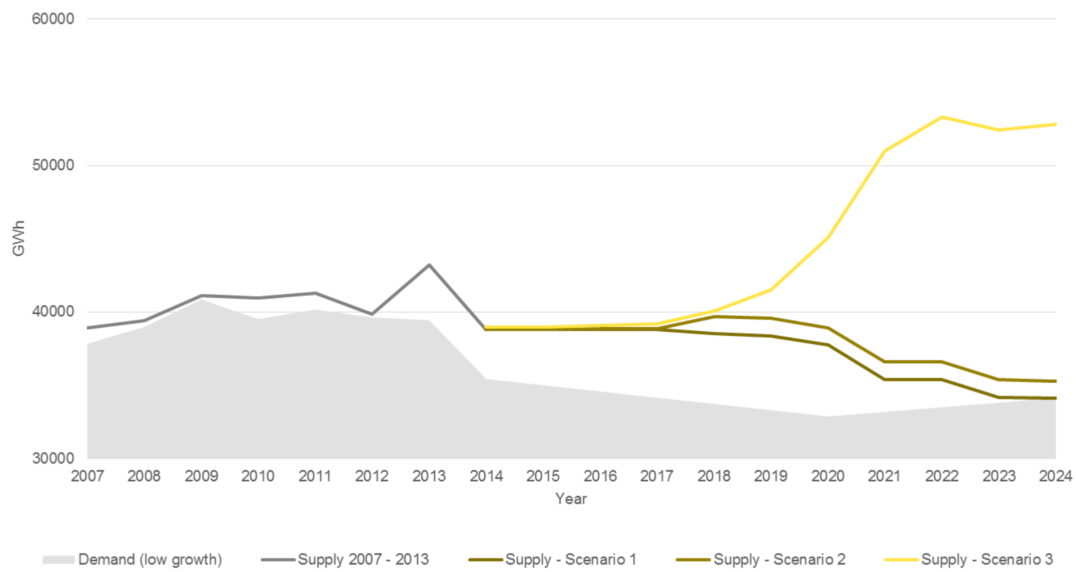

Figure 58 - Supply / Demand (Low Growth) - Serbia[157]

In the case of medium consumption growth Serbia would turn from a balanced energy supply situation into a short position in 2020/2021 in scenarios 1 and 2. As shown above, Serbia would muster a significant export capacity in supply scenario 3, equivalent to around 38% of its domestic demand.

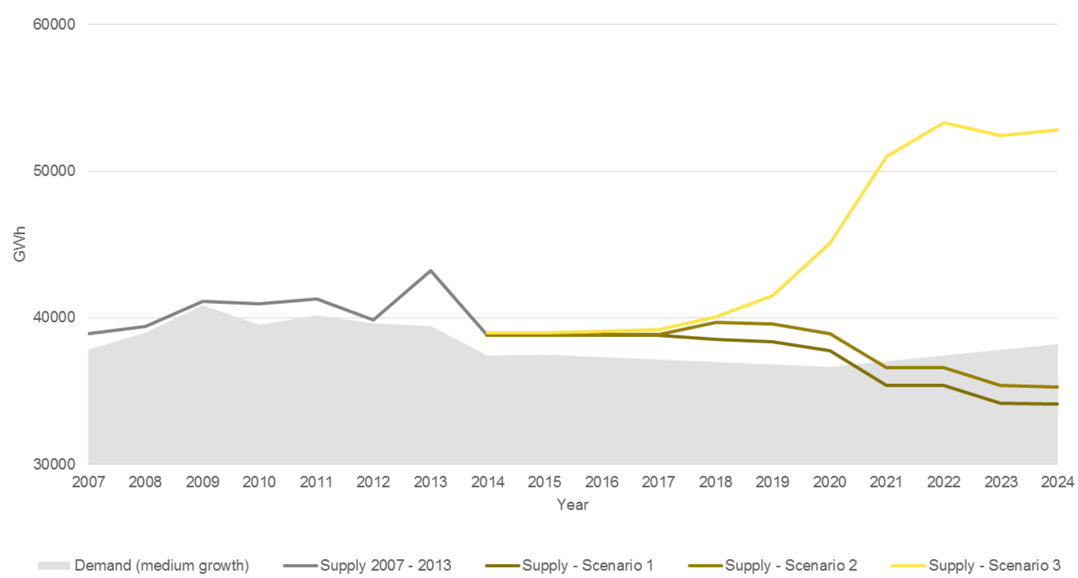

Figure 59 - Supply / Demand (Medium Growth) - Serbia[158]

The figure presenting high electricity consumption demand in Serbia exhibits a slight short position in supply scenarios 1 and 2. The country is in an increased short position towards the end of the examined period. In supply scenario 3 Serbia reaches a balanced position in around 2018 and is then able to export an equivalent of 25% of its domestic demand.

157 Historical Entso-E data from Serbia includes Kosovo

158 Historical Entso-E data from Serbia includes Kosovo

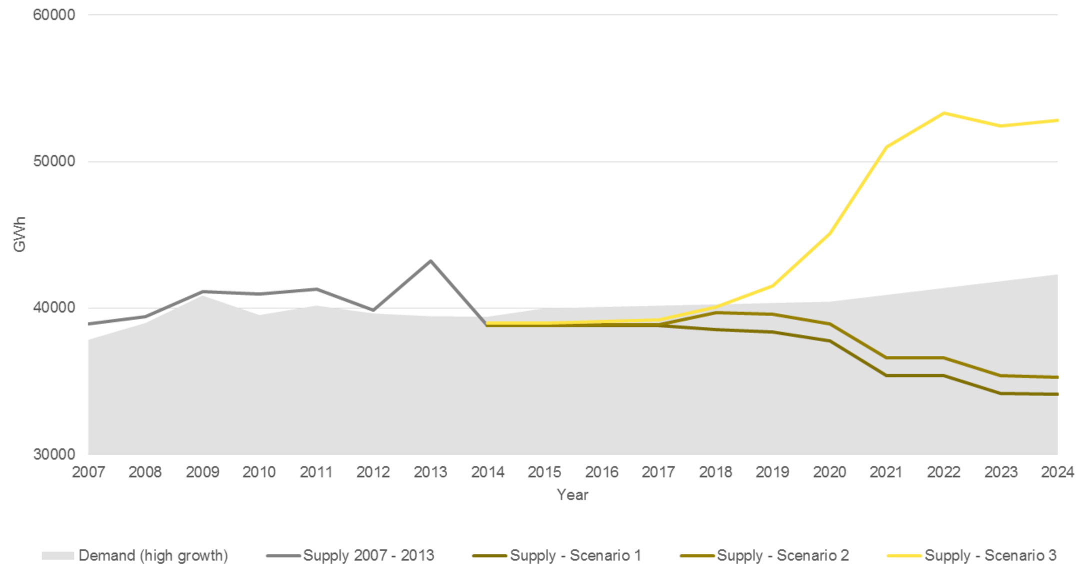

Figure 60 - Supply / Demand (High Growth) - Serbia[159]

7.4.1.1 Net Position

After examining the general supply and demand patterns, we examine the net long and net short position of Serbia. For each of the electricity consumption growth scenarios (low, medium and high growth) we examine the net positions in relation to the energy supply changes (existing capacity, likely future capacity and planned future capacity).

In case of the low consumption growth scenario it is apparent that in supply scenarios 1 and 2, Serbia has an export potential of around 4500 GWh – 5000 GWh up until 2020. Its export potential then quickly deteriorates and Serbia only has a balanced position in 2024. In the case of low demand growth and supply scenario 3 Serbia musters a huge amount of export potential of around 18.000 GWh in 2024.

159 Historical Entso-E data from Serbia includes Kosovo

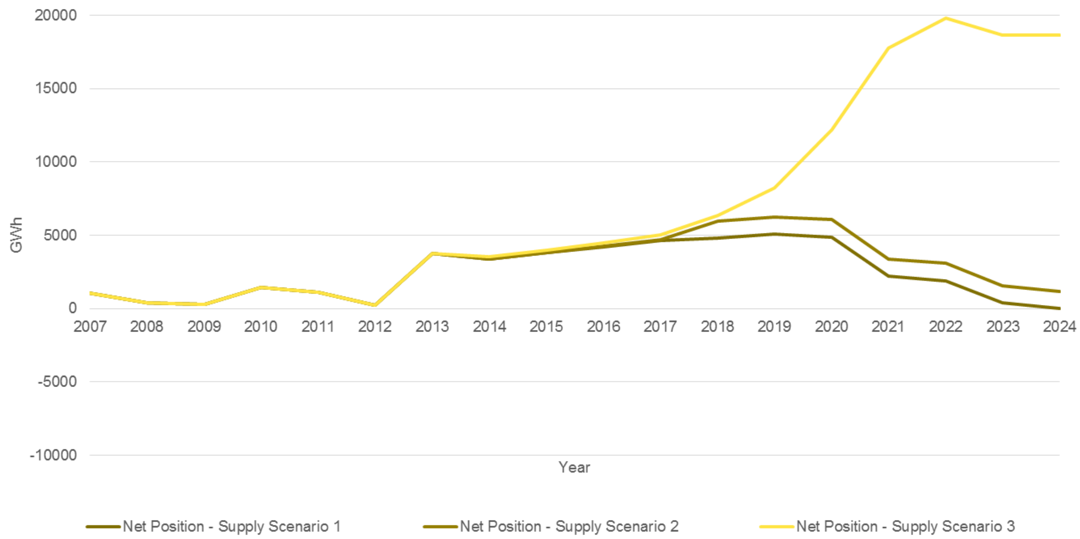

Figure 61 - Net Position - Low growth scenario - Serbia[160]

In the case of the medium electricity consumption growth scenario, Serbia remains in a long position up to 2020/2021 (in supply scenario 1 and 2). Its export potential during this period would be around 1500 GWh. In case of supply scenario 3 Serbia would build up an export potential of around 15000 GWh towards the end of the examined period.

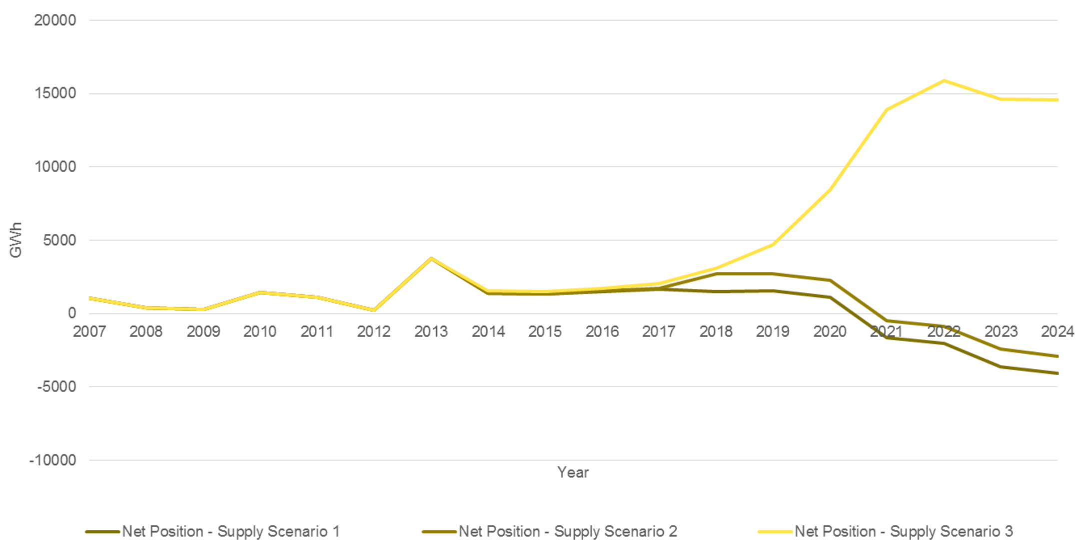

Figure 62 - Net Position - Medium growth scenario - Serbia[161]

The high electricity consumption growth scenario shows that Serbia would be in a slight short position in scenario 1 and 2 up until 2020 when the short position exacerbates. Serbia will also be in a short position in supply scenario 3 up until 2018 when it starts to strengthen its export potential. Its export potential will reach around 10.000 GWh in 2024.

160 Historical Entso-E data from Serbia includes Kosovo

161 Historical Entso-E data from Serbia includes Kosovo

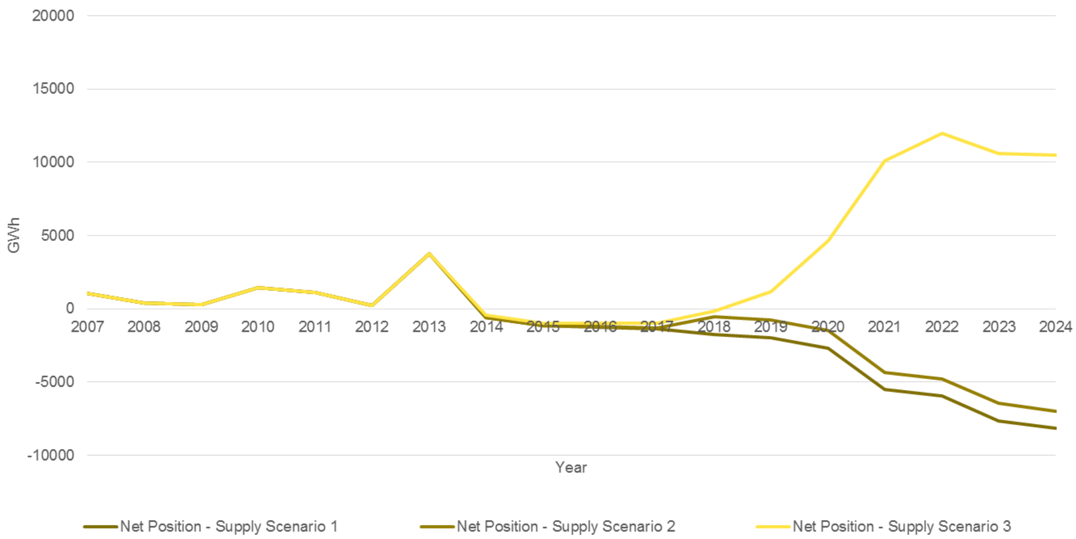

Figure 63 - Net Position - High growth scenario - Serbia[162]

7.4.1.2 Peak supply / peak demand balance

This balance examines the actual feed-in of electricity and the demand situation in Serbia when the electricity feed-in reserves are at their presumed minimum and the electricity demand is at its presumed maximum. Subject to the caveat relating to the robustness of the underlying data, this enables the identification of critical electricity supply situations. This method should thus be interpreted with caution and viewed as an indication only.

Based on the available information, however, the figure below presents a difficult situation for Serbia in relation to supply scenario 1: Serbia is unable to meet its peak demand. In supply scenario 3, however, Serbia will be able to meet peak demand in the case of the medium demand growth scenario as of 2021. Thereafter, Serbia is able to meet its peak demand in all growth scenarios.

162 Historical Entso-E data from Serbia includes Kosovo

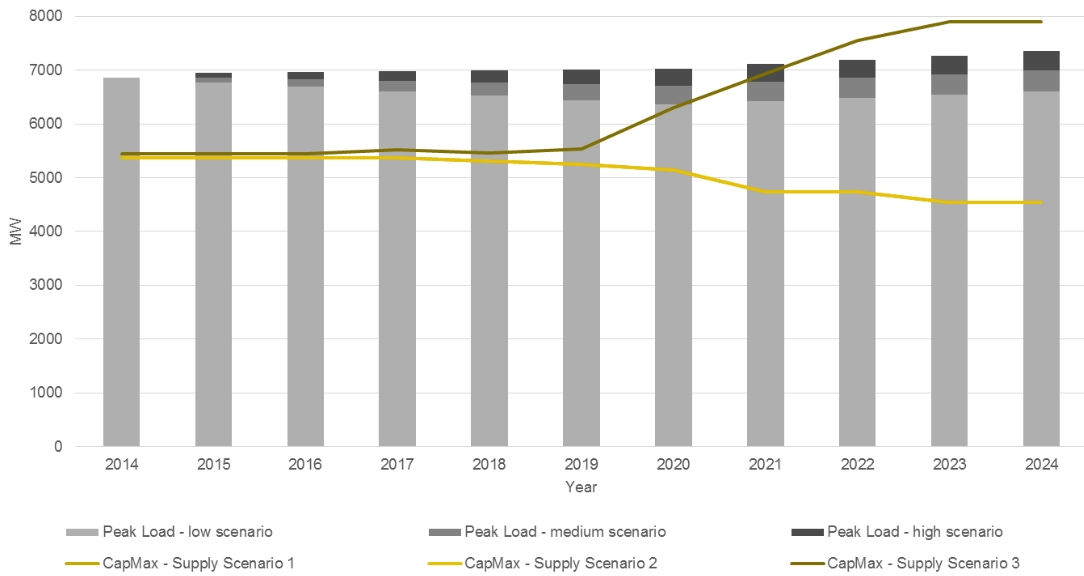

Figure 64 - Serbia – Peak Supply/Demand Balance

7.4.2 Export analysis

This section of the report examines where energy produced in Serbia could be exported. Potential trading partners can be found in the Western Balkans (i.e. in the other case study countries) (group 1), in the countries surrounding the Western Balkans (i.e. in the region) (group 2), or supra-regionally in the EU (group 3) or in the EU, Ukraine and Turkey (group 4). The export potential of Serbia is thus compared to the net position in these groups.

Reflecting the range of outcomes in the supply and demand scenarios the import/export capabilities of Serbia and its trading partners are presented in the form of a range in the net exports, showing a minimum and a maximum value. Reflecting the underlying assumptions of the scenarios the range of possible outcomes widens over time.

In the figure below the import/export potential of Serbia is shown in golden. Positive values denote Serbia's export potential, while negative values denote its import needs. Positive values for the trading partners denote their demand for exports (short position) and negative numbers denote their export supply (long position). In the figure below export possibilities exist if there is a positive net position of Serbia and positive export demand of the trading partners.

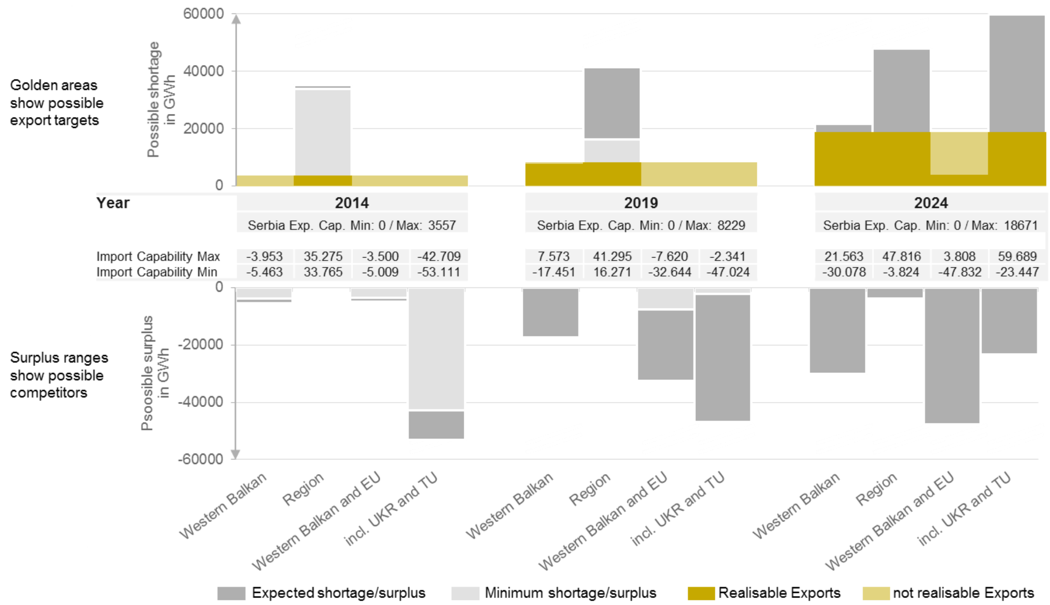

Figure 65 - Serbia - Export Analysis

In 2014 Serbia is in a long position. The case study countries (group 1) are in a net long position entailing that they could export electricity. Examining the Western Balkans and its immediate neighbours jointly (group 2), it is noteworthy that they are in a net short position requiring about 28000 to 35000 GWh of electricity, which is mostly driven by Italy. Widening the framework of reference to the Western Balkans and the EU (group 3) shows that the region is in a slight long position. Including Ukraine and Turkey (group 4) shows that there is a significant about of excess supply in 2014.

In 2019, the case study countries (group 1) will be in a slight long or in a short position entailing that there might be an export market for Serbian electricity while Serbia's supply-demand scenarios indicate that Serbia might be in a long position. Again the Western Balkans and its immediate neighbours considered jointly (group 2) are in a significant net short position and thus be importing electricity. Widening the framework of reference to the Western Balkans and the EU (group 3) shows, however, that there is no excess demand expected in 2019. Including Ukraine and Turkey (group 4) into the analysis shows that there is a significant excess supply in 2019.

In 2024 Serbia is most likely in a net long position and thus able to export electricity. The case study countries (group 1) will be in a long or in a short position entailing that there might potentially be an export market for Serbian electricity. However, given the range of the net position, it is not clear whether the case study countries will be import or export electricity. The Western Balkans and its immediate neighbours considered jointly (group 2) are in a significant net short position, mostly driven by Italian power demand. Widening the framework of reference to the Western Balkans and the EU (group 3) shows, however, that it is unlikely that there will be a high excess demand in 2024. Including Ukraine and Turkey (group 4) into the analysis, the figure shows the possibility of a significant excess demand (but also a long position) in 2024. The maximum value for export demand is strongly driven by the Turkish electricity demand figures that are based on an exponential forecasting function. Even if Turkey is considered a potential market, the transport capacities (costs) need to be observed.

For the purpose of evaluating export potentials and stranded assets a number of relationships need to be described. Transporting electricity is costly: in particular, transfer fees (within countries) and transmission fees (between countries) must be paid. In addition, electricity transportation requires infrastructure. While this report does not extend to these dimensions, it is assumed that the local electricity market in the Western Balkans and the surrounding states are the most important indicator if there is demand for Serbian electricity. In the region, Serbia is in direct competition with Bosnia and Herzegovina, which has most likely also a long position and will put pressure on the electricity price.

The EU's long position indicates that there will be other competitors, which can be expected to put pressure on the electricity price, especially for imports into EU. Given that Serbia is most likely in a long position and most likely to export electricity into the Western Balkans neighbourhood, Serbia might be likely be at risk of incurring stranded assets if other Western Balkan countries do realize most of their planned projects. For this reason, it might be appropriate to take a closer look at the feasibility of investments that are undertaken to satisfy export demand.

7.4.3 Energy Mix

The figures below present the changes in Serbia's energy mix. The data from 2007 – 2013 present the energy mix based on actual production figures. By contrast, the data from 2014 – 2024 show the energy mix based on the maximum likely electricity generation capacity.

The energy mix in Serbia is relatively stable over time with hydropower increasing its production share from 27% in 2014 to 31% in 2024. Gas remains steady at around 6% to 7%. Coal/lignite slightly deteriorates during the examined period from 66% to 61%.

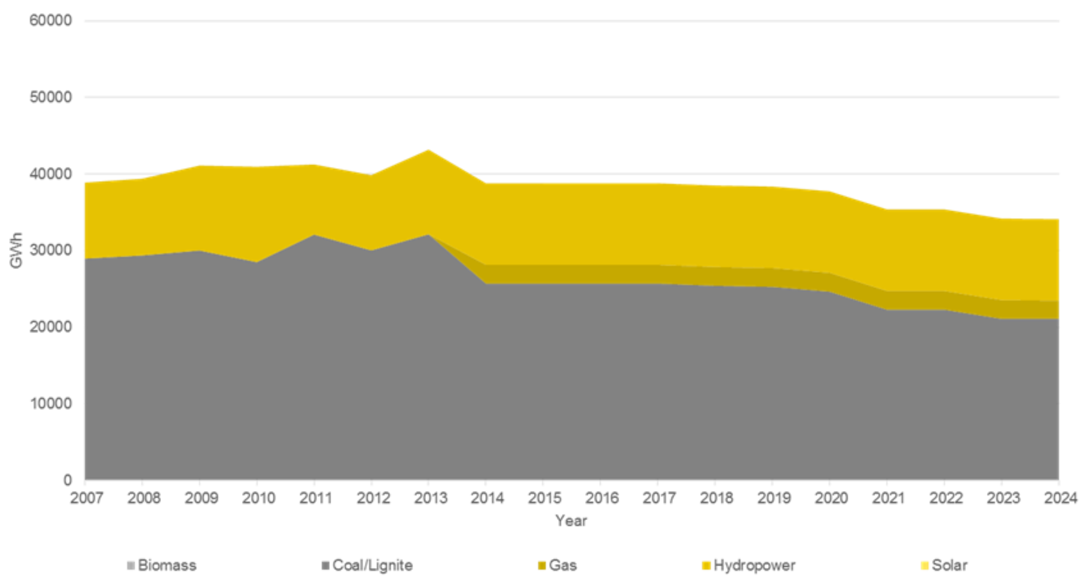

Figure 66 - Serbia– Energy Mix Supply Scenario 1[163]

163 Historical Entso-E data from Serbia includes Kosovo

The energy mix in supply scenario 2 shows similar trends. The share of coal/lignite declines during the period of from 66% to 60%, while hydropower slightly increases from 27% to 30%. The share of gas remains stable at around 6%. Wind enters the energy mix with around 3% in 2018. The share of solar power and biomass are negligible.

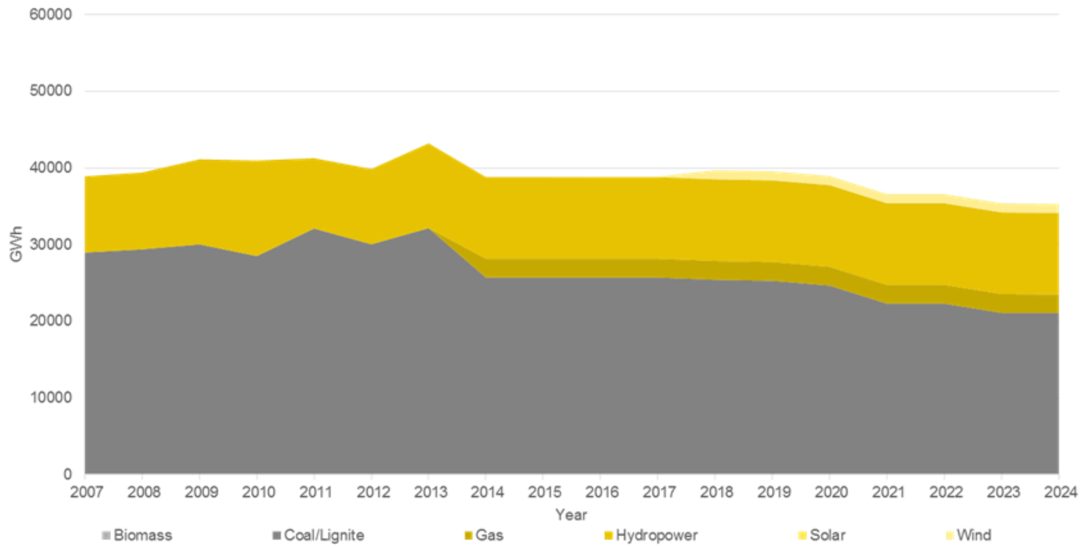

Figure 67 - Serbia– Energy Mix Supply Scenario 2[164]

In supply scenario 3 the share of both hydropower and coal/lignite decreases (to 26% and 58% respectively) while gas expands to around 10%. Wind falls from 3% to 2% while biomass reaches around 2%. Incineration and solar power are negligible.

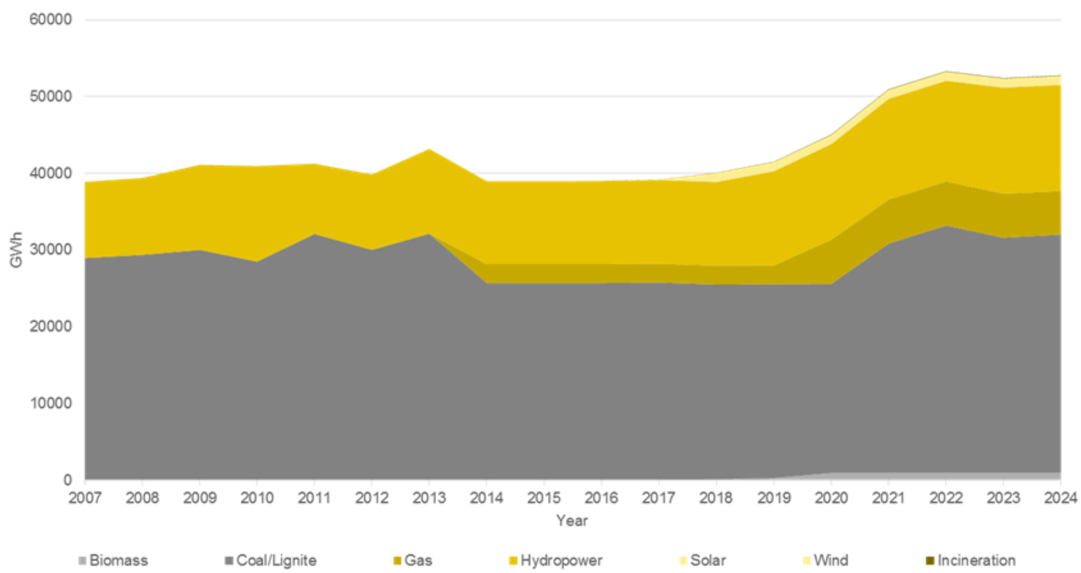

Figure 68 - Serbia– Energy Mix Supply Scenario 3[165]

164 Historical Entso-E data from Serbia includes Kosovo

165 Historical Entso-E data from Serbia includes Kosovo

The analysis above also offers insights into the question under which supply scenarios the country would be able to comply with its obligations under the Energy Community Treaty regarding the implementation of the EU Renewable Energy Directive 2009/28/EC.[166] Serbia has assumed a binding renewable energy sources target of 27%.[167] This target is computed as follows:

$$RES\ Target\ Share = \frac{RES\ Electricity + RES\ Heating - Cooling + RES\ Transport}{Gross\ Final\ Energy\ Consumption}$$

In Serbia's National Renewable Energy Action Plan, p. 18, it is stated that in 2020 the country has a RES electricity target of 36.6%.[168] Under supply scenario 1 the renewable energy share only amounts to around 28% (mainly hydro power) in 2020. Under supply scenario 2 the renewable energy share is slightly higher, around 30% (mainly attributable to hydro (27%) and wind (3%). Also under supply scenario 3 Serbia is not able to meet its RES electricity target. In this scenario coal/lignite and gas account for more than 2/3 of the electricity generation.

7.5 Concluding remarks

This country report analyses the long-term electricity supply and demand pattern of Serbia and examines its electricity export prospects from a stranded assets perspective.

The above analysis shows that in the course of the next decade Serbia may maintain its long position and, depending on the scenario investigated, even increase its export capabilities. In an optimistic scenario this can amount to an equivalent of 25% of Serbia's required demand in 2024, amounting to around 18.000 GWh. In the case of a high growth scenario the country would still be able to export 10.000 GWh in 2024. This may be indicative of Serbia preparing to significantly strengthen its position as an electricity exporter.[169]

This situation would give rise to a substantial dependency on the export market. Serbia will most likely face other competitors, either from the region, e.g. Bosnia and Herzegovina or the EU, which can be expected to put pressure on the electricity price. Given that Serbia is most likely to be in a long position and most likely to export electricity into the Western Balkans neighbourhood, competition may in particular come from EU Member States, namely Bulgaria and Romania, and possibly in the near future Ukraine and Turkey. Serbia might therefore be likely to be at risk of incurring stranded assets if other Western Balkans countries do realize most of their planned capacity extension. For this reason, it might be appropriate to take a closer look at the feasibility of investments that are undertaken to satisfy export demand. From this point of view, a make-or-buy decision should also be investigated prior to new investments.

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166 The RES Directive transposes the European target of a 20% renewable energy sources (RES) in gross final energy demand by 2020

167 http://www.irena.org/DocumentDownloads/events/2013/December/Background_Paper-A.pdf

168 National Renewable Energy Action Plan of The Republic of Serbia (2013) p. 18, available at https://www.energy-community.org/pls/portal/docs/2144185.PDF

169 If none of the projects classified as supply level 3 would be realized, Serbia would be in a balanced position in the case of the low demand growth scenario and in a limited short position in case of a medium growth scenario

Concerning the peak load demand and supply analysis it bears mentioning that Serbia is expected to remain vulnerable. Only in supply scenario 3 Serbia would be able to satisfy its peak demand as of 2022. It is noteworthy that Serbia is the most important power generator among the countries investigated. This implies that Serbia may not be able to rely upon its neighbours in the Western Balkans, when it needs to satisfy its peak demand and that this issue should be closely examined.

In the case of Serbia a few demand side issues merit particular mentioning. A demand side issue that is not examined in the case study but should be mentioned are the transmission and distribution losses. In Serbia the overall loss in transmission and distribution of around 15%[170]. An increased performance of the Serbian network may have a significant impact on the security of supply as well as on the net position and export capability. Moreover, energy efficiency measures may lead to electricity savings and help to improve the country's net position.

This report shows that the country does require good regional ties in the area of energy policy. The current infrastructure should therefore be examined from this perspective. Importantly this report shows that the country has strong electricity export ambitions that create the danger of stranded assets if the domestic electricity expansion decisions are taken without taking due account of developments in other countries in the Western Balkans and beyond. Decisions to buy or produce electricity should thus be taken in a strategic fashion that also takes due account of energy security considerations. It can thus be concluded that integration and collaboration in the area of energy policy in the Western Balkans is vital for Serbia.

<u>Sources</u>

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[SER-02] Data provided by ENTSO-E, https://www.entsoe.eu

[SER-03] DNV KEMA, REKK, EIHP, The Development and Application of a Methodology to Identify Projects of Energy Community Interest (2013), https://www.energy-community.org/portal/page/portal/ENC_HOME/DOCS/2558181/0633975AD4927B9CE053C92FA8C06338

[SER-04] Renewable Energy Action Plan for Serbia, 2013: http://www.energy-community.org/pls/portal/docs/2144185.PDF,

[SER-05] SEEC and Energy Community (2013), Study on the Need for

[170] 1103 GWh in transmission and 4486 GWh in distribution in 2013, see Energy Community Secretariat, Annual Implementation Report, August 2014, p. 149., available at: https://www.energy-community.org/pls/portal/docs/3356393.PDF

Modernization of Large Combustion Plants in the Contracting Parties of the Energy Community in the context of the implementation of Directive 2001 /80/EC, November 2013, available at https://www.energy-community.org/portal/page/portal/ENC_HOME/DOCS/2652179/LCP2-cover+report-final.pdf

8. Regional analysis

8.1 Introduction

Previous sections of this report have presented country analyses of the Western Balkan countries (Albania, Bosnia and Herzegovina, Kosovo, Macedonia, Montenegro and Serbia). This section takes a holistic approach and examines the region's energy generation[171] and its import/export potential from a stranded assets perspective. It examines if a potential excess production of energy would be likely to be met by demand of potential buyers in the region and beyond.

This report builds draws upon the country reports and will therefore follow the methodology contained therein. This section is structured as follows: section 2 presents the supply and demand analysis including the peak demand and supply situation and section 3 presents the export analysis. Section 4 concludes.

8.2 Supply and demand analysis

The figures below present the supply and demand patterns for the Western Balkans during the period of investigation 2014 – 2024. The figure presents the supply patterns (for supply scenarios 1 to 4) in relation to each of the growth scenarios (low, medium and high growth).

In the case of the low growth scenario it is evident that in supply scenario 1 and 2, the Western Balkans will become dependent on electricity imports as of 2020 and 2022/2023 respectively. In case the countries in the region realise supply scenario 3 (or equivalent), they build up a significant amount of export capacity (ca. 45.000 GWh) in 2024. This is the equivalent of 56% of the Western Balkans overall demand in 2024.

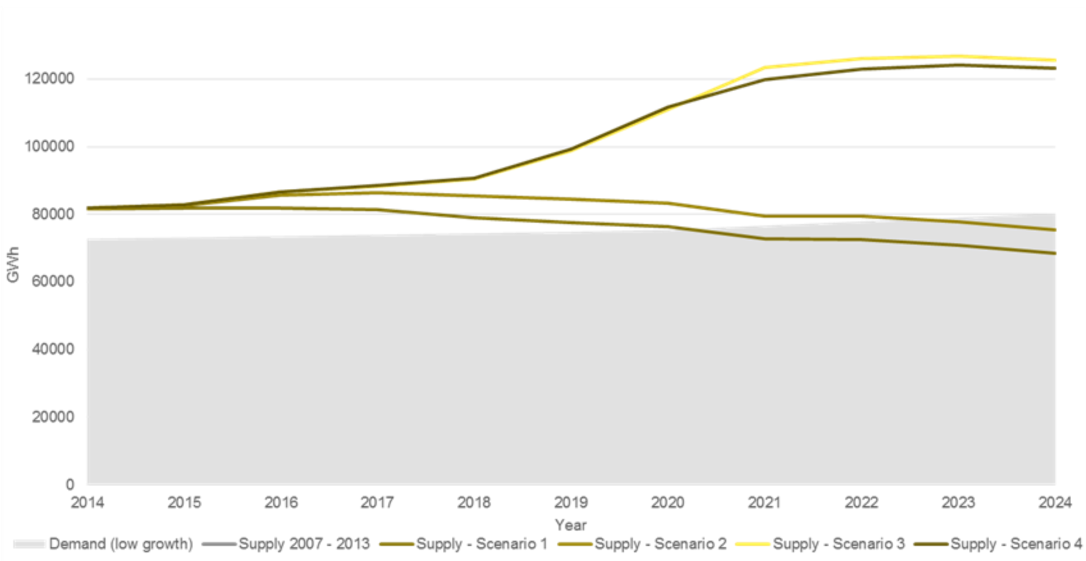


Figure 69 - Western Balkans – Supply/Demand – Low Growth

171 Electricity is frequently referred to as 'Energy'. This report only examines electricity. In this report these terms are used interchangeably

In the case of the medium growth scenario it is evident that in supply scenario 1 and 2, the Western Balkans will become dependent on electricity imports as of 2017/18 and 2020 respectively. In case the countries in the region realise supply scenario 3 (or equivalent), they build up a significant amount of export capacity (ca. 36.000 GWh) in 2024. This is the equivalent of 40% of the Western Balkans overall demand in 2024.

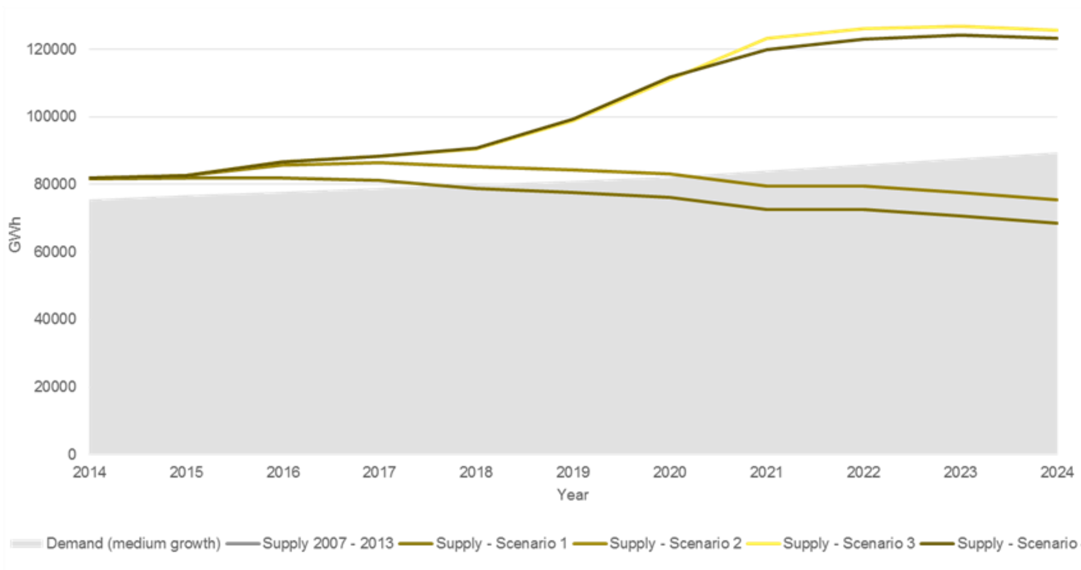


Figure 70 – Western Balkans – Supply/Demand – Medium Growth

In the case of the high growth scenario the Western Balkans would become dependent on electricity imports as of 2016 (scenario 1) and 2018 (scenario 2). As in the analysis presented above, the region would be able to enjoy a considerable amount of excess electricity capacity for export in scenario 3 amounting to ca. 27.000 GWh) in 2024. This is the equivalent of 27% of the Western Balkans overall demand in 2024.

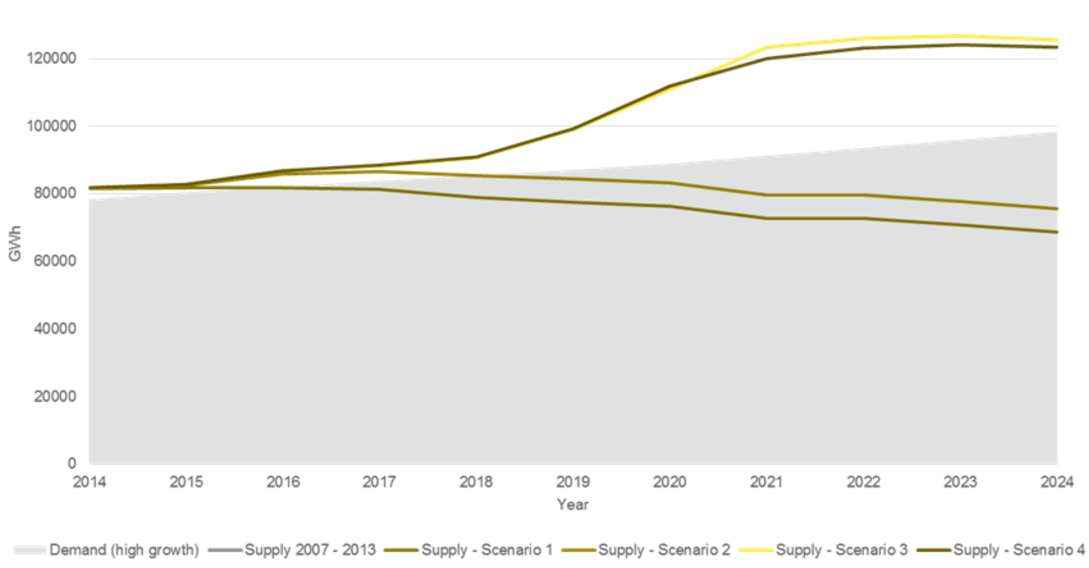


Figure 71 – Western Balkans – Supply/Demand – High Growth

Based upon the official government reports of the Western Balkan countries, the region develops a substantial export capacity under supply scenarios 3 and 4 while under the existing capacity and the likely future capacity scenarios the region would be in a short position.

In order to determine the long and short position of the Western Balkans we also analyse the electricity power balance. This balance examines the actual feed-in of electricity and the demand situation in the Western Balkans when the electricity feed-in reserves are at their presumed minimum and the electricity demand is at its presumed maximum. Subject to the caveat relating to the robustness of the underlying data, this enables the identification of critical electricity supply situations. This method should thus be interpreted with caution and viewed as an indication only.

Two possible scenarios were investigated:

A) Each country assumes its responsibility to ensure that it is able to satisfy its own peak demand, meaning, that the maximum yearly peak demand sums up to the Western Balkan peak demand

B) Countries in the Western Balkans co-operate to address demand peaks jointly and thus help to ensure electricity security across borders. This would require a very good interconnection between the Western Balkan countries and a close cooperation. Peak demand in the Western Balkans may be reduced to due to synergy effects.

In scenario A the peak demands for each country were identified and added together. This scenario thereby presents the worst case scenario that peak demands would arise in all countries in the Western Balkans at the same point in time. By contrast, scenario B calculates the maximum peak demand in the Western Balkans by adding all daily peak demands of the various countries together. For scenario A the sum of the forecasted peak load in the country reports was used. Scenario B is based upon the weighted average of the national demand growth rates that have been used to forecast the peak demand values during the period 2014-2024 in the country reports. For determining the starting point the same methodology applied in the country reports is used.

In the figure below, the striated bars show the peak demand in the Western Balkan in scenario A (case of no co-operation). The grey bars indicate the peak demand in case of scenario B (close cooperation).

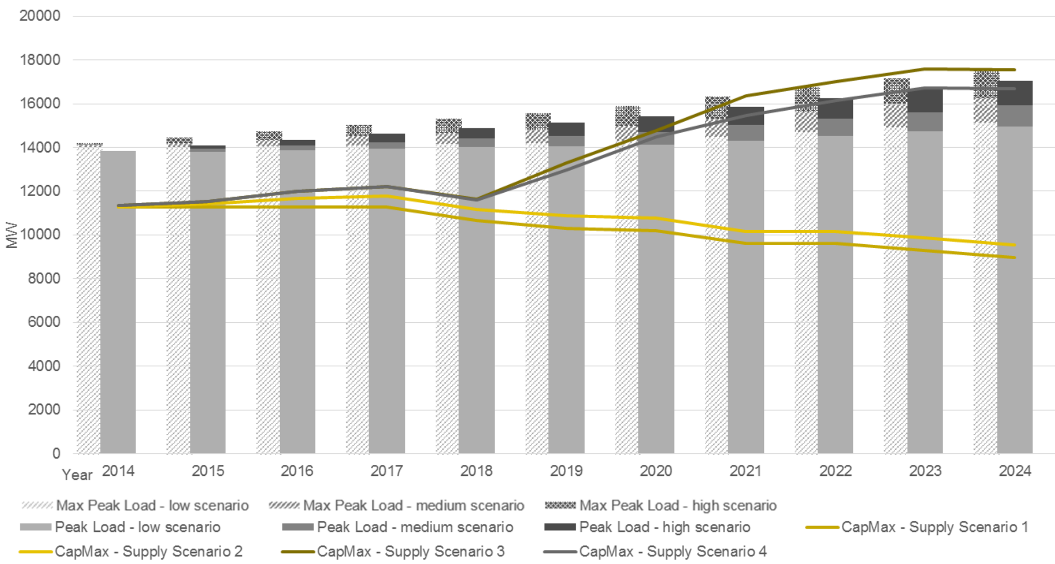


Figure 72 – Western Balkans – Peak Supply/Demand

Based on the available information the figure above shows that peak supply in scenario 1 and 2 is insufficient to meet peak demand in all years. Consequently supply security cannot be safeguarded throughout the Western Balkans without additional measures such as energy savings, reduction of line losses or additional generation capacities.

In the case of supply scenarios 3 and 4, the data indicate the effect of close cooperation of the Western Balkan countries. If the countries co-operate (scenario B), they might be able to absorb the peak demand in the low, medium and high growth scenario as of 2021 in case of supply scenario 4 and as of 2023 in case of supply scenario 3. Without cooperation (supply scenario A) security of supply cannot be provided in scenario 3 and scarcely be provided for under scenario 4. Cooperation therefore leads to enhanced supply security. To further substantiate the point that cooperation is beneficial, it should be observed that the peak demand in the Western Balkans for 2024 without cooperation is approximately 17630 MW in 2024 in the high growth scenario while with cooperation it is only around 15000 MW.

8.3 Import- / Export analysis

This section of the report provides an overview where energy produced in the Western Balkans could be exported. Potential trading partners can be found in the Western Balkans, in the countries surrounding the Western Balkans or supra-regionally in the EU, Ukraine and Turkey. The export potential of the Western Balkans is thus compared to the net position of other countries.

Reflecting the range of outcomes in the supply and demand scenarios, the import/export capabilities of the countries and their trading partners are presented in the form of a net export range. The net export range reflects a minimum and the maximum net export value based on the scenarios contained in the country reports. Reflecting the underlying assumptions of the demand and supply scenarios presented in this report, the range of possible outcomes widens over time.

Given that electricity investments are generally regarded as long term investments we have selected three evaluation points at the beginning (2014), in the middle (2019) and at the end (2024) of the period under examination to compare the regions import/export capabilities with those of its trading partners.

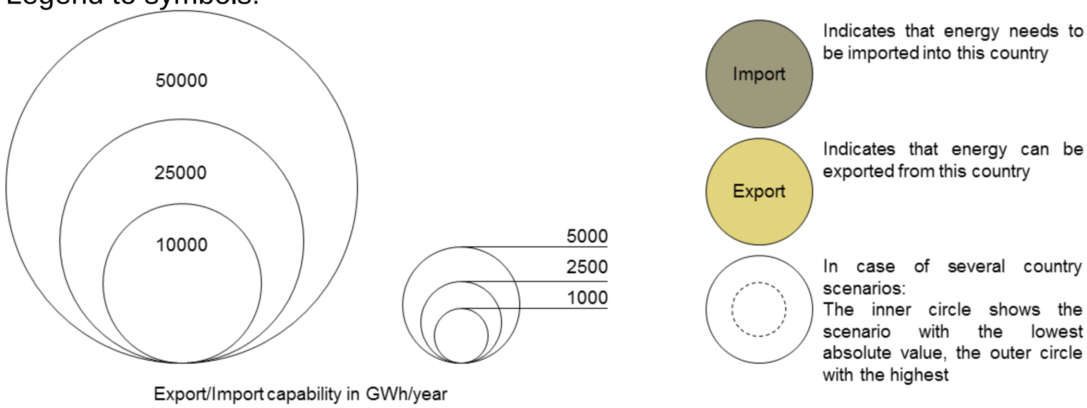
The data underlying the analysis in this section is presented in the table below.

	2014		2019		2024	
	Max Scenario	Min Scenario	Max Scenario	Min Scenario	Max Scenario	Min Scenario
Albania	*-1.805*	*-2.122*	*247*	*-4.497*	*-905*	*-7.542*
Bosnia Herzegovina	*3.479*	*3.479*	*12.826*	*1.233*	*19.261*	*-3.028*
Bulgaria	*9.904*	*9.904*	*10.986*	*10.986*	*11.230*	*11.230*
Croatia	*-4.852*	*-4.852*	*-5.496*	*-5.496*	*-5.578*	*-5.578*
Greece	*-5.347*	*-5.347*	*-4.410*	*-4.410*	*-5.203*	*-5.203*
Hungary	*-6.250*	*-6.250*	*-5.880*	*-5.880*	*-4.866*	*-4.866*
Italy	*-37.395*	*-37.395*	*-33.694*	*-33.694*	*-28.912*	*-28.912*
Kosovo	*576*	*128*	*995*	*-3.296*	*2.476*	*-4.508*
Macedonia	*3.512*	*2.768*	*2.025*	*91*	*4.534*	*-3.913*
Montenegro	*-300*	*-300*	*524*	*-1.104*	*2.013*	*-2.570*
Romania	*3.266*	*3.266*	*3.959*	*3.959*	*6.173*	*6.173*
Serbia	*3.557*	*-608*	*8.229*	*-1.962*	*18.671*	*-8.171*
Slovenia	*1.447*	*1.447*	*814*	*814*	*902*	*902*
Turkey	*40.179*	*31.287*	*5.941*	*-13.717*	*-30.994*	*-62.489*
Ukraine	*7.922*	*7.922*	*8.438*	*8.438*	*6.608*	*6.608*
EU other	*38.774*	*38.774*	*48.916*	*48.916*	*44.008*	*44.008*
Total	***47.775***	***42.101***	***54.420***	***381***	***39.418***	***-67.859***

Table 25 – Import/export capabilities per country in the Balkan Region in GWh/year

In the figures below the export potential of a specific country is shown as a golden circle. Import demand is indicated by a dark green circle. The size of the circles depict the net import/net export potential in GWh per year of the country they are associated with. If the report investigated several scenarios per country, one circle will show the lowest scenario outcome, and another circle shows the highest scenario outcome. The outcome with the lowest absolute value for net import/net export is presented in the circle with the higher absolute value for net import/net export.

Legend to symbols:



The figure below shows a significant amount of excess supply in particular in the EU Member States and Turkey for 2014. Collectively these countries can provide a surplus of electricity of about 45.000 GWh. Exporters from the Western Balkans may therefore face competitive pressure on their targeted export markets.

Exporters in the Western Balkans are Bosnia and Herzegovina, Serbia and Macedonia which have an export potential of up to 3.500 GWh. Kosovo is likely to export small amounts of electricity. Exporters in the region are Romania (up to 3.200 GWh), Ukraine (8000 GWh) and Bulgaria (up to 10.000 GWh). Turkey may export between 31.000 and 40.000 GWh. This puts the exporting Western Balkan countries in direct competition within the Western Balkans but also with very large exporters and thus potential competitors in the region. This may put pressure on the electricity price, giving rise to the risk of stranded assets.

The main importers in the region, and therefore potential export targets for the Western Balkan electricity exports, are Italy[172] (import capacity of 37.000 GWh), Hungary, Greece and Croatia (the latter three have an import demand falling in the range of 6.200 to 4.800 GWh). Trading partners cannot only be found in the region, but also in the Western Balkans: Albania will most likely have to import electricity. Montenegro is likely to import small amounts of electricity.

172 According to ISPI-Online (http://www.ispionline.it/it/energy-watch/oversized-electricity-system-italy-12135), Italy has a lot of generation potential that is idle for the moment. Despite this, the reference scenario of the European Commission forecasts a strong short position for Italy. This may indicate that the available Italian capacity generation is not competitive enough against electricity imports

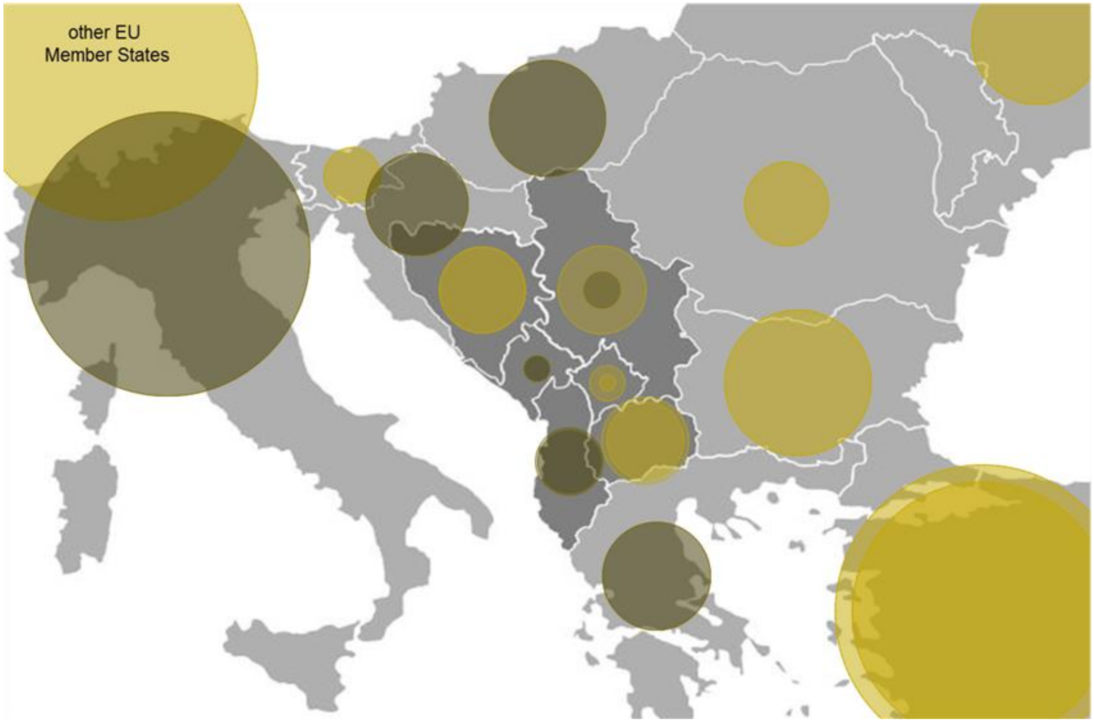


Figure 73 - Region – Comparison of net positions 2014

The figure below shows a wide range of possible outcomes: there may be a significant amount (54.000 GWh) of excess supply in 2019 or an overall balanced position (+/- 0). The high figure for export capacity is largely driven by EU Member States that alone could account for a long position of 49.000 GWh.

Likely exporters in the Western Balkans are Bosnia and Herzegovina (13.000 GWh) and Serbia (8.000), and Macedonia (up to 2.000 GWh). Exporters in the region are Romania (4.000 GWh), Ukraine (8.500 GWh) and Bulgaria (11.000 GWh). Turkey may export up to 6.000 GWh. This puts the exporting Western Balkan countries not only in a direct competition within the Western Balkans and very large exporters and thus potential competitors in the region accompany them. This may put pressure on the electricity price, giving rise to the risk of stranded assets.

The main importers in the region, and therefore potential export targets for the Western Balkan electricity exports, are Italy (import capacity of 33.500 GWh), Hungary, Greece and Croatia (the latter three have an import demand falling in the range of 5.900 to 4.400 GWh). In the Western Balkans Albania will import electricity with a high probability, possibly up to 4.500 GWh. Depending on the underlying scenario, even Turkey may turn into a net importer with an import capacity of ca. 13.500 GWh. Depending on the particular demand and supply scenario, Kosovo and Montenegro can either be exporting or importing small amounts of electricity.

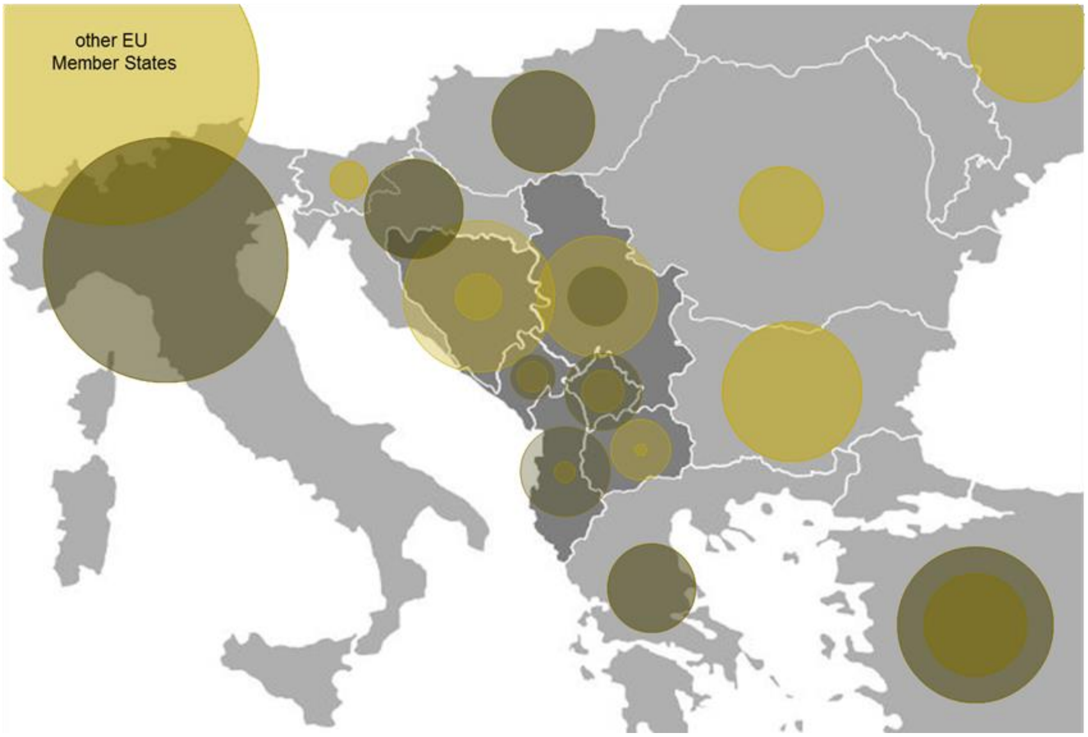


Figure 74 - Region – Comparison of net positions 2019

The figure for 2024 shows an ambiguous situation. Depending on the underlying scenarios and the underlying data[173] there may either be a large long or a large short position in the examined countries. The investigated countries can provide jointly electricity exports totalling 39.500 GWh or require 68.000 GWh in electricity imports. This wide range is largely attributable to the wide range of Turkish demand (31.000 to 63.000 GWh). The EU Member States maintain their strong long position of 44.000 GWh in 2024.

Exporters in the Western Balkans are Bosnia and Herzegovina (up to 19.000 GWh), Serbia (up to 18.500 GWh), and Macedonia (up to 4.500 GWh). Depending on the particular scenario these countries may, however, also be in a short position. Exporters in the region are Romania (6.000 GWh), Ukraine (6.500 GWh) and Bulgaria (11.000 GWh). This puts the exporting Western Balkan countries not only in a direct competition within the Western Balkans and very large exporters and thus potential competitors in the region accompany them. This may put pressure on the electricity price, giving rise to the risk of stranded assets.

The main importers in the region, and therefore potential export targets for the Western Balkan electricity exports, are Turkey (ranging from 31.000 to 68.000 GWh) and Italy (29.000 GWh), Hungary, Greece and Croatia (the latter three have an import demand falling in the range of 5.500 to 4.800 GWh). In the Western Balkans Albania will be likely to import electricity, possibly up to 7.500 GWh. Depending on the particular demand and supply scenario, Kosovo and Montenegro are either exporting or importing small amounts of electricity.

173 The Turkish reports used an exponential extrapolation of their expected demand, causing a high expected electricity demand in 2024

The data for 2024 underline the improbability that there will be high excess demand for this year. The maximum value for export demand is strongly driven by the Turkish electricity demand figures that are based on an exponential forecasting function. Even if Turkey is considered a potential market, the transport capacities (costs) need to be observed.

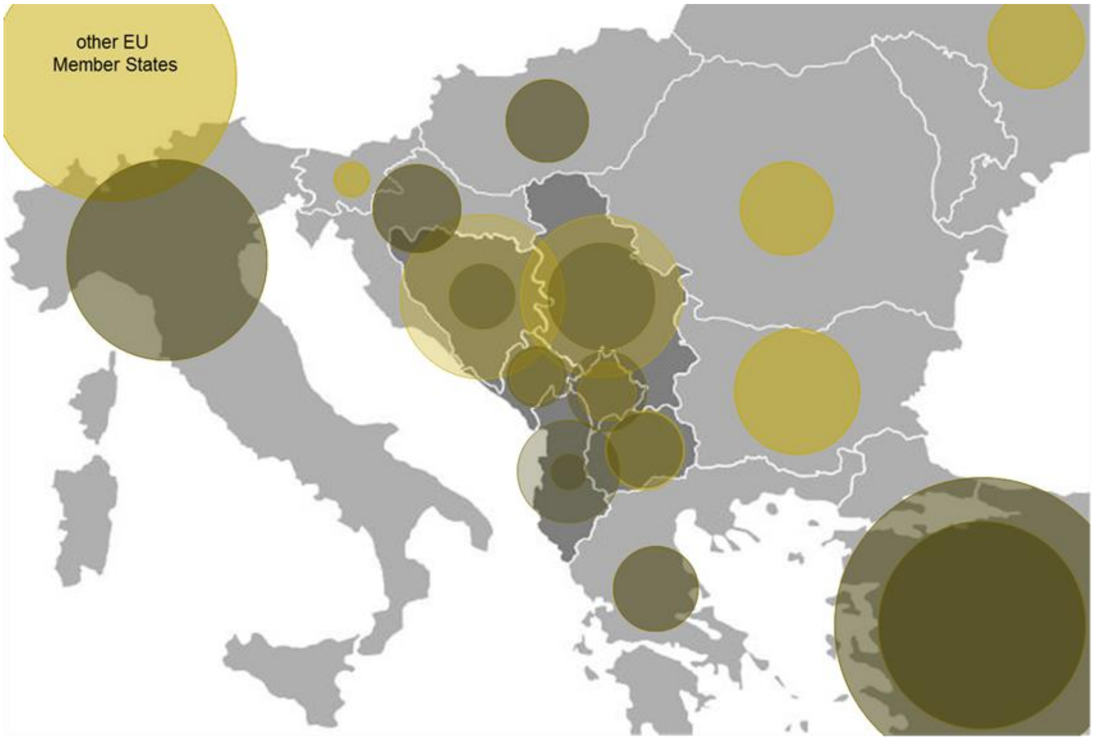


Figure 75 - Region – Comparison of net positions 2024

For evaluating export potentials and stranded assets, a number of relationships need to be described. Transporting electricity is costly: in particular, transfer fees (within countries) and transmission fees (between countries) must be paid. In addition, electricity transportation requires infrastructure. While this report does not extend to these dimensions, it is assumed that the local electricity market in the Western Balkans and the surrounding states are the most important indicator if there is demand for Western Balkan's electricity. In the region, Serbia is in direct competition with Bosnia and Herzegovina, both have most likely a long position and will put pressure on the electricity price.

The EU's long position indicates that there will be other competitors, which can be expected to put pressure on the electricity price, especially for imports into the EU. Given that the Western Balkans are most likely in a long position and most likely to export electricity into the Western Balkans neighbourhood, they might be likely be at risk of incurring stranded assets if other Western Balkan countries do realize most of their planned projects. For this reason, it might be appropriate to take a closer look at the feasibility of investments that are undertaken to satisfy export demand. From this perspective, also a make-or-buy decision should be investigated.

8.4 Concluding remarks

The regional analysis of the Western Balkans shows that the region has significant export ambitions; the long position of 45.000 GWh in the Western Balkans would amount to 56% of its countries demand in 2024.

The peak supply and peak demand analysis shows that there may be important benefits to be gained by collaborating more closely in the region. In the absence of collaboration, supply security remains a concern in the Western Balkans under all supply scenarios and even under supply scenario 4 it can scarcely be ensured. Collaboration improves this situation to the extent that under supply scenario 4 supply security can be ensured. Under supply scenario 3 supply security can also be ensured towards the end of the examination period in case of the medium peak load scenario.

The export analysis shows that there is likely to be substantial competition for the export markets entailing that a situation of excess supply may arise that may put pressure on electricity prices and hence may lead to stranded assets. Investments in electricity capacity should therefore take the energy policy in other countries into account when implementing their own policies. Decisions to make or buy electricity should thus be taken in a strategic fashion that also takes due account of energy security considerations.

Annex I – Generation Capacities (1/3)

Country	Type	Level	Plant	Installed Capacity	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Albania	Hydropower	1	Komani 600 MW	600	2060	2060	2060	2060	2060	2060	2060	2060	2060	2060	2060
Albania	Hydropower	1	Fierza 500 MW	500	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Albania	Hydropower	1	Vau I Dejes 250 MW	250	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Albania	Hydropower	1	Ashta 1 + 2 – 53 MW	53	240	240	240	240	240	240	240	240	240	240	240
Albania	Hydropower	1	Ulez 25 MW – sales to KESH	25	81,2	81,2	81,2	81,2	81,2	81,2	81,2	81,2	81,2	81,2	81,2
Albania	Hydropower	1	Shkopet 24 MW – sales to KESH	24	63,3	63,3	63,3	63,3	63,3	63,3	63,3	63,3	63,3	63,3	63,3
Albania	Hydropower	1	Bistrica 1 – 24 MW – sales to KESH	24	60,2	60,2	60,2	60,2	60,2	60,2	60,2	60,2	60,2	60,2	60,2
Albania	Hydropower	1	Bistrica 2 - 5 MW – sales to KESH	5	23	23	23	23	23	23	23	23	23	23	23
Albania	Hydropower	1	Lana Bregas 5 MW – sales to KESH	5	33,9	33,9	33,9	33,9	33,9	33,9	33,9	33,9	33,9	33,9	33,9
Albania	Hydropower	1	Small hydropower plants under concession (see a	291,67	930	930	930	930	930	930	930	930	930	930	930
Albania	Gas	2	Vlora gas/oil 97 MW	97	0	0	679	679	679	679	679	679	679	679	679
Albania	Hydropower	3	Kalivaci 93 MW (Vjosa 1)	93	0	0	0	0	0	0	350	350	350	350	350
Albania	Hydropower	2	Devoll – Moglice – 172 MW	172	0	0	0	0	0	475	475	475	475	475	475
Albania	Hydropower	2	Devolli 1 (Banja) 70 MW	70	0	0	0	254	254	254	254	254	254	254	254
Albania	Hydropower	2	Fani i Madh and Fani i Vogel (Gojan, FHP2 – Gjegja	110,56	0	0	0	367,6	367,6	367,6	367,6	367,6	367,6	367,6	367,6
Albania	Hydropower	2	Small hydropower plants under construction 283.2	283,23	0	648	1296	1296	1296	1296	1296	1296	1296	1296	1296
Albania	Hydropower	3	Small hydropower plants expected in draft energy	160,77	0	0	0								
Albania	Wind	4	Shengjin-Kodrat e Rencit in Lezha (108+114 MW)	222	0	0	0	56,25	112,5	168,75	225	281,25	337,5	393,75	450
Albania	Wind	4	Bilisht-Kapshtice Wind Farm (150 MW)	150	0	0	0	41,25	82,5	123,75	165	206,25	247,5	288,75	330
Albania	Wind	4	Karaburun, Vlora (500 MW)	500	0	0	0	171,125	342,25	513,375	684,5	855,625	1026,75	1197,875	1369
Albania	Wind	4	Butrinti-Markat (72 MW)	72	0	0	0	8,125	16,25	24,375	32,5	40,625	48,75	56,875	65
Albania	Wind	4	Grykederdhja Shkumbinit – Terpan (145 + 80 MW)	225	0	0	0	60,5	121	181,5	242	302,5	363	423,5	484
Albania	Wind	4	Kryevidh-Kavaja (40 + 150 MW)	190	0	0	0	46	92	138	184	230	276	322	368
Albania	Wind	4	Dajc-Velipoje (75 MW) in 2015	75	0	0	0	0	0	0	0	0	0	0	0
Albania	Wind	4	Barbullush (45 MW)	45	0	0	0	0	0	0	0	0	0	0	0
Albania	Wind	4	Bushat (26 MW)	26	0	0	0	0	0	0	0	0	0	0	0
Albania	Wind	4	Ulcinj (40 MW)	40	0	0	0	0	0	0	0	0	0	0	0
Albania	Hydropower	3	Vjosa1 93 MW	93	0	0	0	0	0	0	0	0	0	0	0
Albania	Hydropower	3	Drini1 48 MW	0	0	0	0	0	0	0	0	0	0	0	0
Albania	Coal/Lignite	3	"New" 300 MW	300	0	0	0	0	0	0	0	0	0	0	0
Albania	Solar	3	Solar Overall	0	0	0	0	0	0	0	0	0	0	0	0
Albania	Wind	3	Overall Wind	0	0	0	0	0	289,0055	315,173	367,508	367,508	367,508	367,508	367,508
Albania	Wind	4	Overall Wind Correction for Level 4	-1545	0	0	0	0	-289,0055	-315,173	-367,508	-367,508	-367,508	-367,508	-367,508
Bosnia and Herzegovina	Hydropower	1	Rama	160	650	650	650	650	650	650	650	650	650	650	650
Bosnia and Herzegovina	Hydropower	1	Capljina	440	200	200	200	200	200	200	200	200	200	200	200
Bosnia and Herzegovina	Hydropower	1	Mostar	72	247	247	247	247	247	247	247	247	247	247	247
Bosnia and Herzegovina	Hydropower	1	Jajce 1	60	232,90	232,90	232,90	232,90	232,90	232,90	232,90	232,90	232,90	232,90	232,90
Bosnia and Herzegovina	Hydropower	1	Jajce 2	30	157	157	157	157	157	157	157	157	157	157	157
Bosnia and Herzegovina	Hydropower	1	Pec-Mlini	30,6	82	82	82	82	82	82	82	82	82	82	82
Bosnia and Herzegovina	Hydropower	1	Jablanica	180	712,00	712,00	712,00	712,00	712,00	712,00	712,00	712,00	712,00	712,00	712,00
Bosnia and Herzegovina	Hydropower	1	Grabovica	114	285,00	285,00	285,00	285,00	285,00	285,00	285,00	285,00	285,00	285,00	285,00
Bosnia and Herzegovina	Hydropower	1	Salakovac	210	405,00	405,00	405,00	405,00	405,00	405,00	405,00	405,00	405,00	405,00	405,00
Bosnia and Herzegovina	Hydropower	1	Trebinje 1	171	393,8	393,8	393,8	393,8	393,8	393,8	393,8	393,8	393,8	393,8	393,8
Bosnia and Herzegovina	Hydropower	1	Dubrovnik	108	647,5	647,5	647,5	647,5	647,5	647,50	647,50	647,50	647,5	647,5	647,5
Bosnia and Herzegovina	Hydropower	1	Visegrad	315	909,2	909,2	909,2	909,2	909,2	909,20	909,20	909,20	909,20	909,20	909,20
Bosnia and Herzegovina	Hydropower	1	Bocac	110	273,9	273,9	273,9	273,9	273,9	273,9	273,9	273,9	273,9	273,9	273,9
Bosnia and Herzegovina	Hydropower	1	Mostarsko Blato	60	167	167	167	167	167	167	167	167	167	167	167
Bosnia and Herzegovina	Coal/Lignite	1	Tuzla G3	100	463	463	463	463	463	0	0	0	0	0	0
Bosnia and Herzegovina	Coal/Lignite	1	Tuzla G4	200	1241	1241	1241	1241	1241	1241	1241	0	0	0	0
Bosnia and Herzegovina	Coal/Lignite	1	Tuzla G5	200	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125	1125
Bosnia and Herzegovina	Coal/Lignite	1	Tuzla G6	215	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200
Bosnia and Herzegovina	Coal/Lignite	1	Kakanj G5	118	645	645	645	645	645	645	645	645	645	645	0
Bosnia and Herzegovina	Coal/Lignite	1	Kakanj G6	110	632	632	632	632	632	632	632	632	632	632	632
Bosnia and Herzegovina	Coal/Lignite	1	Kakanj G7	230	1487	1487	1487	1487	1487	1487	1487	1487	1487	1487	1487
Bosnia and Herzegovina	Coal/Lignite	1	Gacko	300	1619,7	1619,7	1619,7	1619,7	1619,7	1619,7	1619,7	1619,7	1619,7	1619,7	1619,7
Bosnia and Herzegovina	Coal/Lignite	1	Ugljevik	300	1530	1775	1775	1775	1775	1775	1775	1775	1775	1775	1775
Bosnia and Herzegovina	Hydropower	2	Dub and Ustipraca	17,1	0	0	0	74,4	74,4	74,4	74,4	74,4	74,4	74,4	74,4
Bosnia and Herzegovina	Hydropower	2	Ulog	34,4	0	0	0	0	82,3	82,3	82,3	82,3	82,3	82,3	82,3
Bosnia and Herzegovina	Hydropower	3	Sutjeska mini-hydropower plants	19,15	0	0	0	83,6	83,6	83,6	83,6	83,6	83,6	83,6	83,6
Bosnia and Herzegovina	Hydropower	3	Dabar	159,9	0	0	0	0	0	251,8	251,8	251,8	251,8	251,8	251,8
Bosnia and Herzegovina	Hydropower	3	Ustikolina	65,4	0	0	0	0	0	0	0	236,8	236,8	236,8	236,8
Bosnia and Herzegovina	Hydropower	3	Vranduk	19,6	0	0	0	0	96,4	96,4	96,4	96,4	96,4	96,4	96,4
Bosnia and Herzegovina	Hydropower	3	Janjici	13	0	0	0	0	0	0	68	68	68	68	68
Bosnia and Herzegovina	Hydropower	3	Krusevo and Zeleni Vir	13	0	0	0	0	0	0	0	0	40	40	40
Bosnia and Herzegovina	Hydropower	3	Small hydropower plants Republika Srpska – medi	40	0	26,3	31,56	36,82	42,08	47,34	52,6	63,12	73,64	84,16	94,68
Bosnia and Herzegovina	Hydropower	3	Upper Drina (Foca, Paunci, Buk Bijela, Sutjeska)	558	0	0	0	0	0	0	0	783	783	783	783
Bosnia and Herzegovina	Hydropower	3	Mrsovo	43,8	0	0	0	0	0	0	165,1	165,1	165,1	165,1	165,1
Bosnia and Herzegovina	Coal/Lignite	2	Stanari	300	0	0	1500	2000	2000	2000	2000	2000	2000	2000	2000
Bosnia and Herzegovina	Coal/Lignite	3	Tuzla 7	450	0	0	0	0	0	1823	2604	2604	2604	2604	2604
Bosnia and Herzegovina	Coal/Lignite	3	Kakanj 8	300	0	0	0	0	0	0	0	0	0	1456	1820
Bosnia and Herzegovina	Coal/Lignite	3	Ugljevik III	600	0	0	0	0	0	0	4380	4380	4380	4380	4380
Bosnia and Herzegovina	Coal/Lignite	3	Banovici	300	0	0	0	0	0	2047	2047	2047	2047	2047	2047
Bosnia and Herzegovina	Gas	3	KTG Zenica	373,1	0	0	0	0	2593,2	2593,2	2593,2	2593,2	2593,2	2593,2	2593,2
Bosnia and Herzegovina	Wind	2	Trusina	51	0	0	160	160	160	160	160	160	160	160	160
Bosnia and Herzegovina	Wind	3	Mesihovina	55	0	0	0	0	146	146	146	146	146	146	146
Bosnia and Herzegovina	Wind	3	Podvelezje	48	0	0	62	103	103	103	103	103	103	103	103
Bosnia and Herzegovina	Wind	3	Vlasic	48	0	0	0	0	0	59	98	98	98	98	98
Bosnia and Herzegovina	Wind	3	Bitovnja	60	0	0	0	0	0	0	0	0	62	104	104
Bosnia and Herzegovina	Wind	3	Zukica Kosa	15	0	0	0	0	0	0	0	0	0	8	26
Bosnia and Herzegovina	Hydropower	1	Small hydropower existing EPBiH (Modrac, Bogati	13	65	65	65	65	65	65	65	65	65	65	65
Bosnia and Herzegovina	Hydropower	3	New small hydro EPBiH – Neretvica, Una Anex, Ca	43	0	0	0	102	123	123	145	145	145	161	161
Bosnia and Herzegovina	Hydropower	3	Bileca/Nevesinje	91	0	0	0	0	0	0	0	0	0	0	0
Bosnia and Herzegovina	Hydropower	3	HE Kovanići	13	0	0	0	0	0	0	0	0	0	0	68
Bosnia and Herzegovina	Hydropower	3	Srednja Drina 321 MW	160,5	0	0	0	0	0	0	0	0	0	714,55	714,55
Bosnia and Herzegovina	Hydropower	3	Donja Drina (Kozluk, Drina I, II and III), total 365 M	182,5	0	0	0	0	0	794	794	794	794	794	794
Kosovo	Coal/Lignite	1	Kosova A (3x200 MW operational)	600	2140	2171	2171	2148	0	0	0	0	0	0	0
Kosovo	Coal/Lignite	1	Kosova B (2x 339 MW, around 540 MW operational	540	4062	4062	4075	3556	3556	4062	4024	4003	3983	3983	3983
Kosovo	Hydropower	1	Ujmani (35 MW)	35	82	82	82	82	78	78	78	78	78	78	78
Kosovo	Hydropower	1	Lumbardhi (8.8 MW)	8,8	26	27	26	27	27	27	27	27	27	27	27

Annex I – Generation Capacities (2/3)

Country	Type	Level	Plant	Installed Capacity	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Kosovo	Hydropower	1	Dikance+Burimi+Radavci (2.76 MW total)	2,76	23	22	23	22	26	26	26	26	26	26	26
Kosovo	Hydropower	3	Zhuri 305 MW	305	0	0	0	0	0	398	398	398	398	398	398
Kosovo	Hydropower	3	Small HPPs (110 MW by 2020)	273,1	0	0	94,3	97,3	248,3	267,3	345,3	384,3	388,3	388,3	472
Kosovo	Coal/Lignite	3	New Kosova	600	0	0	0	0	0	2100	4200	4200	4200	4200	4200
Kosovo	Wind	3	Zatric, 45 MW	184,8	0	0	127,6	127,6	127,6	127,6	127,6	127,6	127,6	127,6	127,6
Kosovo	Wind	3	Budakova, 45 MW	45	0	0	111	111	111	111	111	111	111	111	111
Kosovo	Wind	3	Kitka 30 MW	30	0	0	74	74	74	74	74	74	74	74	74
Kosovo	Biomass	3	Biomass	20,3	0	0	0	0	11	17	19	23	28	28	28
Kosovo	Solar	3	Planned solar PV	12,7	0	0	0	2	2	2	3	3	3	3	3
Kosovo	Hydropower	2	Deçan, Belaja, Lumëbardhi II	22,9	0	0	83,7	83,7	83,7	83,7	83,7	83,7	83,7	83,7	83,7
Macedonia	Hydropower	1	Tikves (put in operation 1966/1981)	114	184	184	184	184	184	184	184	184	184	184	184
Macedonia	Hydropower	1	Vrutok (1957/1958/1973)	150	350	350	350	350	350	350	350	350	350	350	350
Macedonia	Hydropower	1	Vreben (put in operatio 1959)	12,8	45	45	45	45	45	45	45	45	45	45	45
Macedonia	Hydropower	1	Raven (put in operation 1959/ 1973)	19,2	40	40	40	40	40	40	40	40	40	40	40
Macedonia	Hydropower	1	Globocica (put in operation 1965)	42	191	191	191	191	191	191	191	191	191	191	191
Macedonia	Hydropower	1	Spilje (put in operation 1969)	84	300	300	300	300	300	300	300	300	300	300	300
Macedonia	Hydropower	1	Kozjak (put in operation 2004)	80	150	150	150	150	150	150	150	150	150	150	150
Macedonia	Hydropower	1	Sveta Petka	36,4	66	66	66	66	66	66	66	66	66	66	66
Macedonia	Coal/Lignite	1	TPP Bitola 1 (1982)	225	1466,666667	1466,666667	1466,666667	1466,666667	1466,666667	1466,666667	1466,666667	1466,666667	1466,666667	1466,666667	0
Macedonia	Coal/Lignite	1	TPP Bitola 2 (1984)	225	1466,666667	1466,666667	1466,666667	1466,666667	1466,666667	1466,666667	1466,666667	1466,666667	1466,666667	1466,666667	1466,666667
Macedonia	Coal/Lignite	1	TPP Bitola 3 (1988)	225	1466,666667	1466,666667	1466,666667	1466,666667	1466,666667	1466,666667	1466,666667	1466,666667	1466,666667	1466,666667	1466,666667
Macedonia	Coal/Lignite	1	TPP Oslomej (1980)	125	677	677	677	677	677	677	677	677	677	0	0
Macedonia	Oil	1	TPP Negotino (put in operation 1978)	210	1308	1308	1308	1308	1308	0	0	0	0	0	0
Macedonia	Gas	1	Combined Cycle Cogeneration Power Plant TE-TO	230	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Macedonia	Gas	1	ENERGETIKA Skopje	30	2.197	2.197	2.197	2.197	2.197	2.197	2.197	2.197	2.197	2.197	2.197
Macedonia	Hydropower	3	HPP Cebren Installed capacity (turbine/pump) 333	333	0	0	0	0	0	54	54	54	54	54	54
Macedonia	Hydropower	3	HPP Galiste (installed capacity 193,50 MW)	193,5	0	0	263	263	263	263	263	263	263	263	263
Macedonia	Hydropower	3	HPP Boskov Most (installed capacity 68 MW)	68	0	0	0	0	0	118	118	118	118	118	118
Macedonia	Hydropower	3	HPP Veles (installed capacity 80 MW)	80	0	0	0	0	0	0	0	301	301	301	301
Macedonia	Hydropower	3	HPP Gradec (installed capacity 54.6 MW)	54,6	0	0	0	252	252	252	252	252	252	252	252
Macedonia	Hydropower	3	Babuna (installed 17.34 MW)	17,34	0	0	0	0	0	0	57	57	57	57	57
Macedonia	Hydropower	3	Zgropolci (installed 16.93 MW)	16,93	0	0	0	0	0	0	56	56	56	56	56
Macedonia	Hydropower	3	Gradsko (installed 16.93 MW)	16,93	0	0	0	0	0	0	66,6	66,6	66,6	66,6	66,6
Macedonia	Hydropower	3	Kukurecani (installed 16.93 MW)	16,93	0	0	0	0	0	0	79,5	79,5	79,5	79,5	79,5
Macedonia	Hydropower	3	Krivolak (installed 16.93 MW)	16,93	0	0	0	0	0	0	80	80	80	80	80
Macedonia	Hydropower	3	Dubrovo (installed 16.93 MW)	16,93	0	0	0	0	0	0	80,2	80,2	80,2	80,2	80,2
Macedonia	Hydropower	3	Demir Kapija (installed 24.48 MW)	24,48	0	0	0	0	0	0	116,4	116,4	116,4	116,4	116,4
Macedonia	Hydropower	3	Miletkovo (installed 16.72 MW)	16,72	0	0	0	0	0	0	80,3	80,3	80,3	80,3	80,3
Macedonia	Hydropower	3	Gavato (installed 16.72 MW)	16,72	0	0	0	0	0	0	83,2	83,2	83,2	83,2	83,2
Macedonia	Hydropower	3	Gevgelija (installed 16.93 MW)	16,93	0	0	0	0	0	0	85,1	85,1	85,1	85,1	85,1
Macedonia	Coal/Lignite	3	TPP Mariovo (installed 300 MW)	300	0	0	0	0	0	0	0	2137	2137	2137	2137
Macedonia	Coal/Lignite	3	TPP Bitola 4 (300 MW)	300	0	0	0	0	0	0	0	2210	2210	2210	2210
Macedonia	Coal/Lignite	3	TPP Negotino 2 (installed 300 MW)	300	0	0	0	0	0	0	0	0	0	0	
Macedonia	Wind	1	Wind Park Bogdanci phase 1 (installed 36.8 MW)	36,8	15	100	100	100	100	100	100	100	100	100	100
Macedonia	Wind	2	Wind Park Bogdanci phase 2 (installed 13.8 MW)	13,8	0	0	37	37	37	37	37	37	37	37	37
Macedonia	Hydropower	3	Crn Kamen (installed 5 MW) and other small hydro	5	0	0	0	0	0	0	106	106	106	106	106
Macedonia	Wind	3	Wind power plant with PT	50	0	0	0	0	0	0	0	0	0	0	0
Macedonia	Biomass	3	CHP biomass power plant with PT	5	0	0	0	0	0	0	0	0	0	0	0
Macedonia	Biomass	3	CHP biomass power plant with PT	6,2	0	0	0	0	0	0	0	0	0	0	0
Macedonia	Biomass	2	TPP biogas with PT	7	0	0	0	0	0	0	0	0	0	0	0
Macedonia	Geothermal	3	Geothermal with PT	6	0	0	0	0	0	0	0	0	0	0	0
Macedonia	Photovoltaic	2	Photovoltaic with PT	25	0	0	0	0	0	0	0	0	0	0	0
Macedonia	Hydropower	4	Scenario 4 Correction HPP Cebren Installed capaci	-333				0	0	-54	-54	-54	-54	-54	-54
Macedonia	Hydropower	4	Scenario 4 Correction HPP Veles (installed capacit	-80				0	0	0	0	-300,6	-300,6	-300,6	-300,6
Macedonia	Hydropower	4	Scenario 4 Correction HPP Gradec (installed capaci	-54,6				-252,4	-252,4	-252,4	-252,4	-252,4	-252,4	-252,4	-252,4
Macedonia	Coal/Lignite	4	Scenario 4 Correction TPP Mariovo (installed 300 M	-300				0	0	0	0	-2137	-2137	-2137	-2137
Macedonia	Coal/Lignite	4	Scenario 4 Correction TPP Bitola 4 (300 MW)	-300				0	0	0	0	-2210	-2210	-2210	-2210
Macedonia	Coal/Lignite	4	Scenario 4 Correction TPP Negotino 2 (installed 30	-300				0	0	0	0	0	0	0	0
Macedonia	Hydropower	4	Scenario 4 HPP Boskov Most (installed capacity 68	-68	0	0	0	0	0	-118	0	0	0	0	0
Montenegro	Hydropower	1	Perucica	307	932	932	932	932	978	978	978	978	978	978	978
Montenegro	Hydropower	1	Piva	342	749	762	762	762	762	762	800	800	800	800	800
Montenegro	Hydropower	1	sHPP Slap Zete	1,2	3,5	3,5	3,5	14,6	14,6	14,6	14,6	14,6	14,6	14,6	14,6
Montenegro	Hydropower	1	sHPP Glava Zete	6,56	12	12	12	15	15	15	15	15	15	15	15
Montenegro	Hydropower	1	Other small hydros	3,2	21	21	21	21	21	21	21	21	21	21	21
Montenegro	Coal/Lignite	1	Pljevlja I	210	1407	1179	1179	1179	1179	1179	600	600	600	600	600
Montenegro	Hydropower	3	Moraca	238,4	0	0	0	0	0	0	0	616	616	616	616
Montenegro	Hydropower	3	Komarnica	168	0	0	0	0	0	0	0	0	227	227	227
Montenegro	Hydropower	2	Small hydros	39,3	0	80	126,55	126,55	126,55	126,55	126,55	126,55	126,55	126,55	126,5
Montenegro	Coal/Lignite	3	Pljevlja II	220	0	0	0	0	0	0	0	1360	1360	1360	1360
Montenegro	Wind	2	Mozura	46	0	0	0	105,8	105,8	105,8	105,8	105,8	105,8	105,8	105,8
Montenegro	Wind	3	Krnovo (Niksic)	50	0	0	0	115	115	115	115	115	115	115	115
Montenegro	Wind	3	Krnovo (Savnik)	22	0	0	0	50,6	50,6	50,6	50,6	50,6	50,6	50,6	50,6
Montenegro	Wind	3	Other new wind	39,3	0	0	0	0	17,2	17,2	76,4	76,4	76,4	76,4	76,4
Montenegro	Solar	3	Total new solar PV capacity	31,5	0	5	10	12	13	15	17	19	23	27	31
Montenegro	Incineration	3	Total new incineration capacity	10	0	0	0	0	0	0	70	70	70	70	70
Montenegro	Biomass	3	Total biomass electricity generation	39	0	1,1	6,1	12,1	18,1	24,1	31	43	51	59	66
Montenegro	Hydropower	3	Small hydros	33,655	0	12,0329	24,0658	36,0987	48,1316	60,1645	72,1974	84,2303	96,2632	108,2961	120,329
Serbia	Hydropower	1	Đerdap 1, 1058 MW	1058	5489	5489	5489	5489	5489	5489	5489	5489	5489	5489	5489
Serbia	Hydropower	1	Đerdap 2, 270 MW	270	1504	1504	1504	1504	1504	1504	1504	1504	1504	1504	1504
Serbia	Hydropower	1	Pirot, 80 MW	80	87	87	87	87	87	87	87	87	87	87	87
Serbia	Hydropower	1	Vlasina 129 MW total	129	285	285	285	285	285	285	285	285	285	285	285
Serbia	Hydropower	1	Drin-Lim hydropower plants (Uvac(36), Kokin Brod	680	3275	3275	3275	3275	3275	3275	3275	3275	3275	3275	3275
Serbia	Hydropower	1	Bajina Bašta pumped storage plant 614 MW	614	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001
Serbia	Coal/Lignite	1	Nikola Tesla A1, 210 MW	210	1231	1231	1231	1231	1231	1231	1231	0	0	0	0
Serbia	Coal/Lignite	1	Nikola Tesla A2, 210 MW	210	1198	1198	1198	1198	1198	1198	1198	1198	1198	0	0
Serbia	Coal/Lignite	1	Nikola Tesla A3, 305 MW	305	1923	1923	1923	1923	1923	1923	1923	1923	1923	1923	1923
Serbia	Coal/Lignite	1	Nikola Tesla A4, 309 MW	309	1989	1989	1989	1989	1989	1989	1989	1989	1989	1989	1989
Serbia	Coal/Lignite	1	Nikola Tesla A5, 309 MW	309	1999	1999	1999	1999	1999	1999	1999	1999	1999	1999	1999
Serbia	Coal/Lignite	1	Nikola Tesla A6, 309 MW	309	1987	1987	1987	1987	1987	1987	1987	1987	1987	1987	1987

Annex I – Generation Capacities (3/3)

Country	Type	Level	Plant	Installed Capacity	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Serbia	Coal/Lignite	1	Nikola Tesla B1, 620 MW	620	4151	4151	4151	4151	4151	4151	4151	4151	4151	4151	4151
Serbia	Coal/Lignite	1	Nikola Tesla B2, 620 MW	620	4004	4004	4004	4004	4004	4004	4004	4004	4004	4004	4004
Serbia	Coal/Lignite	1	Kolubara 1, 32 MW	32	175	175	175	175	0	0	0	0	0	0	0
Serbia	Coal/Lignite	1	Kolubara 2, 32 MW	32	116	116	116	116	0	0	0	0	0	0	0
Serbia	Coal/Lignite	1	Kolubara 3, 64 MW	64	135	135	135	135	135	0	0	0	0	0	0
Serbia	Coal/Lignite	1	Kolubara 4, 32 MW	32	0	0	0	0	0	0	0	0	0	0	0
Serbia	Coal/Lignite	1	Kolubara 5, 110 MW	110	626	626	626	626	626	626	0	0	0	0	0
Serbia	Coal/Lignite	1	Morava, 125 MW	125	566	566	566	566	566	566	566	0	0	0	0
Serbia	Coal/Lignite	1	Kostolac A1, 100 MW	100	560	560	560	560	560	560	560	0	0	0	0
Serbia	Coal/Lignite	1	Kostolac A2, 210 MW	210	1196	1196	1196	1196	1196	1196	1196	1196	1196	1196	1196
Serbia	Coal/Lignite	1	Kostolac B1, 348 MW	348	1937	1937	1937	1937	1937	1937	1937	1937	1937	1937	1937
Serbia	Coal/Lignite	1	Kostolac B2, 348 MW	348	1895	1895	1895	1895	1895	1895	1895	1895	1895	1895	1895
Serbia	Gas	1	TE TO Novi Sad 1, 135 MW and 2, 110 MW	245	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
Serbia	Gas	1	TE TO Zrenjanin, 110 MW	110	750	750	750	750	750	750	750	750	750	750	750
Serbia	Gas	1	TE TO Sremska Mitrovica, 32 MW	32	200	200	200	200	200	200	200	200	200	200	123
Serbia	Biomass	1	Existing biogas plants 4.8 MW	4,8	22	22	22	22	22	22	22	22	22	22	22
Serbia	Solar	1	Kladovo 2 MWp	2	1,5	3	3	3	3	3	3	3	3	3	3
Serbia	Solar	1	Beocin 1 MW	1	0	5,5	5,5	5,5	5,5	5,5	5,5	5,5	5,5	5,5	5,5
Serbia	Solar	1	Matarova 2 MWp	2	2,5	2,5	2,5	2,5	2,5	2,5	2,5	2,5	2,5	2,5	2,5
Serbia	Coal/Lignite	3	Kostolac B3 350 MW	350	0	0	0	0	0	0	0	?	?	?	?
Serbia	Coal/Lignite	3	Kolubara B 2x350 MW	350	0	0	0	0	0	0	0	2610	4966	4557	4986
Serbia	Coal/Lignite	3	TENT B3 750 MW	750	0	0	0	0	0	0	0	5000	5000	5000	5000
Serbia	Coal/Lignite	3	Kovin 2x350 MW	350	0	0	0	0	0	0	0	0	?	?	?
Serbia	Coal/Lignite	3	Stavalj 300 MW	300	0	0	0	0	0	0	0	?	?	?	?
Serbia	Gas	3	TE TO Novi Sad 450 MWe	450	0	0	0	0	0	0	3300	3300	3300	3300	3300
Serbia	Hydropower	3	Velika Morava, total 147.7 MW (HPP Ljubicevo, HP	14,77	0	0	0	0	0	0	0	645,5	645,5	645,5	645,5
Serbia	Hydropower	3	Ibar, total 117 MW	117	0	0	0	0	0	480	480	480	480	480	480
Serbia	Hydropower	3	Srednja Drina 321 MW	160,5	0	0	0	0	0	0	0	0	0	714,55	714,55
Serbia	Hydropower	3	Bistrica Pumped Storage Plant, 4x170 MW	680	0	0	0	0	0	0	0,00001	0,00001	0,00001	0,00001	0,00001
Serbia	Hydropower	3	Đerdap 3 Pumped Storage Plant, 2x300 MW	600	0	0	0	0	0	0	0	0	0	0,0001	0,0001
Serbia	Hydropower	3	Donja Drina (Kozluk, Drina I, II and III), total 365 M'	182,5	0	0	0	0	0	794	794	794	794	794	794
Serbia	Hydropower	3	Small hydropower plants, 188 MW total by 2020	188	182	171	216	268	269	377	558	558	558	558	558
Serbia	Wind	2	Plandište, 102 MW	102	0	0	0	0	212	212	212	212	212	212	212
Serbia	Wind	2	Ćibuk 1/Dolovo, 158 MW	158	0	0	0	0	480	480	480	480	480	480	480
Serbia	Wind	2	Alibunar 1, 99 MW	99	0	0	0	0	308	308	308	308	308	308	308
Serbia	Wind	2	Kula, 9.9 MW and La Piccolina, Vrsac, 6.6 MW	6,6	0	0	46,2	46,2	46,2	46,2	46,2	46,2	46,2	46,2	46,2
Serbia	Wind	2	Alibunar, 42 MW	42	0	0	0	0	132	132	132	132	132	132	132
Serbia	Biomass	3	Planned biomass CHP 100 MW	100	0	0	0	66	99	132	640	640	640	640	640
Serbia	Biomass	3	Planned biogas CHP 30 MW	30	0	0	0	0	0	135	305	305	305	305	305
Serbia	Incineration	3	Planned electricity from waste and landfill gas 13	13	0	0	0	17	34	51	68	68	68	68	68

Annex II – Supply/Demand Calculation Albania (GWh)

Demand Scenario	Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Source
Historical	Demand	3670	4618	5377	5673	5657	5760													
	Supply	2788	3797	5201	7567	4132	4725													
	Long/Short	-882	-821	-176	1894	-1525	-1035													
high consumption	Demand prospected								8414	8842	9293	9767	10265	10789	11339	11917	12524	13163	13834	
	Supply Level 1								6292	6292	6292	6292	6292	6292	6292	6292	6292	6292	6292	see Generation Capacities
	Supply Level 2								6292	6940	8267	8888	8888	9363	9363	9363	9363	9363	9363	see Generation Capacities
	Supply Level 3								6292	6940	8267	8888	9177	9678	10081	10081	10081	10081	10081	see Generation Capacities
	Supply Level 4								6292	6940	8267	9271	9655	10513	11246	11629	12013	12396	12779	see Generation Capacities
	S1 Long/Short								-2122	-2551	-3002	-3476	-3974	-4497	-5047	-5625	-6233	-6871	-7542	
	S2 Long/Short								-2122	-1903	-1027	-879	-1377	-1425	-1975	-2553	-3161	-3800	-4471	
	S3 Long/Short								-2122	-1903	-1027	-879	-1088	-1110	-1258	-1836	-2444	-3082	-3753	
	S4 Long/Short								-2122	-1903	-1027	-496	-610	-276	-92	-287	-512	-767	-1055	
medium consumption	Demand prospected								8254	8592	8945	9311	9693	10090	10504	10934	11382	11849	12334	
	Supply Level 1								6292	6292	6292	6292	6292	6292	6292	6292	6292	6292	6292	see Generation Capacities
	Supply Level 2								6292	6940	8267	8888	8888	9363	9363	9363	9363	9363	9363	see Generation Capacities
	Supply Level 3								6292	6940	8267	8888	9177	9678	10081	10081	10081	10081	10081	see Generation Capacities
	Supply Level 4								6292	6940	8267	9271	9655	10513	11246	11629	12013	12396	12779	see Generation Capacities
	S1 Long/Short								-1963	-2301	-2653	-3020	-3401	-3799	-4212	-4643	-5091	-5557	-6043	
	S2 Long/Short								-1963	-1653	-678	-423	-805	-727	-1140	-1571	-2019	-2486	-2971	
	S3 Long/Short								-1963	-1653	-678	-423	-516	-412	-423	-853	-1302	-1768	-2254	
	S4 Long/Short								-1963	-1653	-678	-40	-38	423	743	695	630	547	445	
low consumption	Demand prospected								8096	8347	8606	8873	9147	9431	9723	10024	10335	10655	10985	
	Supply Level 1								6292	6292	6292	6292	6292	6292	6292	6292	6292	6292	6292	see Generation Capacities
	Supply Level 2								6292	6940	8267	8888	8888	9363	9363	9363	9363	9363	9363	see Generation Capacities
	Supply Level 3								6292	6940	8267	8888	9177	9678	10081	10081	10081	10081	10081	see Generation Capacities
	Supply Level 4								6292	6940	8267	9271	9655	10513	11246	11629	12013	12396	12779	see Generation Capacities
	S1 Long/Short								-1805	-2056	-2314	-2581	-2856	-3139	-3431	-3733	-4043	-4364	-4694	-
	S2 Long/Short								-1805	-1408	-339	16	-259	-68	-360	-661	-972	-1292	-1622	
	S3 Long/Short								-1805	-1408	-339	16	30	247	358	56	-254	-575	-905	-
	S4 Long/Short								-1805	-1408	-339	399	507	1082	1523	1605	1678	1741	1794	-

Annex II – Supply/Demand Calculation Bosnia and Herzegovina (GWh)

Demand Scenario	Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Source
Historical	Demand	11171	11575	11001	11725	12186	12122	12016												Data provided by ENTSO-E
	Supply	11783	13220	13991	15554	13694	12234	15712												Data provided by ENTSO-E
	Long/Short	612	1645	2990	3829	1508	112	3696												-
high consumption	Demand prospected								11891	12272	12664	13069	13488	13919	14365	14824	15299	15788	16294	NOSBIH [BiH-01] p. 27 ff.
	Supply Level 1								15370	15615	15615	15615	15615	15152	15152	13911	13911	13911	13266	see Generation Capacities
	Supply Level 2								15370	15615	17275	17932	17932	17469	17469	16228	16228	16228	15583	see Generation Capacities
	Supply Level 3								15370	15641	17369	18257	21119	25636	31096	30886	30998	33245	33061	see Generation Capacities
	S1 Long/Short								3479	3343	2951	2546	2127	1233	787	-913	-1388	-1877	-3028	-
	S2 Long/Short								3479	3343	4611	4780	4444	3550	3104	1404	929	440	-711	-
	S3 Long/Short								3479	3369	4705	5106	7631	11717	16731	16062	15699	17457	16767	-
medium consumption	Demand prospected								11891	12200	12517	12843	13177	13519	13871	14231	14601	14981	15371	NOSBIH [BiH-01] p. 27 ff.
	Supply Level 1								15370	15615	15615	15615	15615	15152	15152	13911	13911	13911	13266	see Generation Capacities
	Supply Level 2								15370	15615	17275	17932	17932	17469	17469	16228	16228	16228	15583	see Generation Capacities
	Supply Level 3								15370	15641	17369	18257	21119	25636	31096	30886	30998	33245	33061	see Generation Capacities
	S1 Long/Short								3479	3415	3098	2772	2438	1633	1281	-320	-690	-1070	-2105	-
	S2 Long/Short								3479	3415	4758	5006	4755	3950	3598	1997	1627	1247	212	-
	S3 Long/Short								3479	3441	4852	5332	7942	12117	17225	16655	16397	18264	17690	-
low consumption	Demand prospected								11891	12069	12250	12434	12621	12810	13002	13197	13395	13596	13800	NOSBIH [BiH-01] p. 27 ff.
	Supply Level 1								15370	15615	15615	15615	15615	15152	15152	13911	13911	13911	13266	see Generation Capacities
	Supply Level 2								15370	15615	17275	17932	17932	17469	17469	16228	16228	16228	15583	see Generation Capacities
	Supply Level 3								15370	15641	17369	18257	21119	25636	31096	30886	30998	33245	33061	see Generation Capacities
	S1 Long/Short								3479	3546	3365	3181	2994	2342	2150	714	516	315	-534	-
	S2 Long/Short								3479	3546	5025	5415	5311	4659	4467	3031	2833	2632	1783	-
	S3 Long/Short								3479	3572	5119	5741	8498	12826	18094	17689	17603	19649	19261	-

Annex II – Supply/Demand Calculation Kosovo* (GWh)

Demand Scenario	Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Source
Historical	Demand	4576	4944	5275	5506	5584	5467													
	Supply	4334	4527	4798	5038	5167	5314													
	Long/Short	-242	-417	-477	-468	-417	-153													
high consumption	Demand prospected								6205	6546	6815	7077	7253	7489	7668	7892	8096	8355	8622	
	Supply Level 1								6333	6364	6377	5835	3687	4193	4155	4134	4114	4114	4114	
	Supply Level 2								6333	6364	6461	5919	3771	4277	4239	4218	4198	4198	4198	
	Supply Level 3								6333	6364	6868	6331	4345	7374	9517	9539	9528	9528	9611	
	S1 Long/Short								128	-182	-438	-1242	-3566	-3296	-3513	-3758	-3982	-4241	-4508	
	S2 Long/Short								128	-182	-354	-1158	-3482	-3212	-3429	-3674	-3898	-4157	-4425	
	S3 Long/Short								128	-182	53	-746	-2908	-115	1849	1647	1432	1173	989	
medium consumption	Demand prospected								5966	6176	6311	6552	6716	6934	7100	7307	7496	7682	7872	
	Supply Level 1								6333	6364	6377	5835	3687	4193	4155	4134	4114	4114	4114	
	Supply Level 2								6333	6364	6461	5919	3771	4277	4239	4218	4198	4198	4198	
	Supply Level 3								6333	6364	6868	6331	4345	7374	9517	9539	9528	9528	9611	
	S1 Long/Short								367	188	66	-717	-3029	-2741	-2945	-3173	-3382	-3568	-3758	
	S2 Long/Short								367	188	150	-633	-2945	-2657	-2861	-3089	-3298	-3484	-3675	
	S3 Long/Short								367	188	557	-221	-2371	440	2417	2232	2032	1846	1739	
low consumption	Demand prospected								5757	5805	5932	6028	6179	6379	6532	6722	6897	7015	7135	
	Supply Level 1								6333	6364	6377	5835	3687	4193	4155	4134	4114	4114	4114	see Generation Capacities
	Supply Level 2								6333	6364	6461	5919	3771	4277	4239	4218	4198	4198	4198	see Generation Capacities
	Supply Level 3								6333	6364	6868	6331	4345	7374	9517	9539	9528	9528	9611	see Generation Capacities
	S1 Long/Short								576	559	445	-193	-2492	-2186	-2377	-2588	-2783	-2901	-3021	-
	S2 Long/Short								576	559	529	-109	-2408	-2102	-2293	-2504	-2699	-2817	-2937	-
	S3 Long/Short								576	559	936	303	-1834	995	2985	2817	2631	2513	2476	-

Annex II – Supply/Demand Calculation Macedonia (GWh)

Demand Scenario	Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Source
Historical	Demand	8566	8643	7796	8328	8986	8488	8049												Data provided by ENTSO-E
	Supply	6070	5863	6252	6598	6327	5813	5638												Data provided by ENTSO-E
	Long/Short	-2496	-2780	-1544	-1730	-2659	-2675	-2411												-
high consumption	Demand prospected								8955	9257	9548	9839	10118	10409	10711	11176	11595	11967	12270	Own calc : Diff between base and energy eff added to base scen in absolut values
	Supply Level 1								11723	11808	11808	11808	11808	10500	10500	10500	10500	9823	8356	see Generation Capacities
	Supply Level 2								11723	11808	11845	11845	11845	10537	10537	10537	10537	9860	8393	see Generation Capacities
	Supply Level 3								11723	11808	12108	12360	12360	11224	12114	16761	16761	16084	14618	
	Supply Level 4								11723	11808	12108	12108	12108	10800	11807	11807	11807	11130	9664	see Generation Capacities
	S1 Long/Short								2768	2551	2260	1969	1690	91	-211	-676	-1095	-2144	-3913	
	S2 Long/Short								2768	2551	2297	2006	1727	128	-174	-639	-1058	-2107	-3876	-
	S3 Long/Short								2768	2551	2559	2521	2242	815	1402	5585	5166	4117	2348	-
	S4 Long/Short								2768	2551	2559	2269	1989	391	1096	631	212	-837	-2606	-
medium consumption	Demand prospected								8583	8839	9083	9327	9560	9804	10048	10374	10676	10944	11176	STRATEGY FOR ENERGY DEVELOPMENT IN THE REPUBLIC OF MACEDONIA, (Ministry of Economy, 2010), page 102, scenario baseline
	Supply Level 1								11723	11808	11808	11808	11808	10500	10500	10500	10500	9823	8356	see Generation Capacities
	Supply Level 2								11723	11808	11845	11845	11845	10537	10537	10537	10537	9860	8393	see Generation Capacities
	Supply Level 3								11723	11808	12108	12360	12360	11224	12114	16761	16761	16084	14618	
	Supply Level 4								11723	11808	12108	12108	12108	10800	11807	11807	11807	11130	9664	see Generation Capacities
	S1 Long/Short								3140	2969	2725	2481	2248	696	452	126	-176	-1121	-2820	-
	S2 Long/Short								3140	2969	2762	2518	2285	733	489	163	-139	-1084	-2783	
	S3 Long/Short								3140	2969	3024	3033	2800	1420	2065	6387	6085	5140	3441	-
	S4 Long/Short								3140	2969	3024	2780	2548	995	1759	1433	1131	186	-1513	-
low consumption	Demand prospected								8211	8420	8618	8816	9002	9199	9385	9571	9758	9920	10083	STRATEGY FOR ENERGY DEVELOPMENT IN THE REPUBLIC OF MACEDONIA, (Ministry of Economy, 2010), page 102, scenario with strengthene
	Supply Level 1								11723	11808	11808	11808	11808	10500	10500	10500	10500	9823	8356	see Generation Capacities
	Supply Level 2								11723	11808	11845	11845	11845	10537	10537	10537	10537	9860	8393	
	Supply Level 3								11723	11808	12108	12360	12360	11224	12114	16761	16761	16084	14618	see Generation Capacities
	Supply Level 4								11723	11808	12108	12108	12108	10800	11807	11807	11807	11130	9664	see Generation Capacities
	S1 Long/Short								3512	3388	3190	2992	2806	1301	1115	929	742	-97	-1727	-
	S2 Long/Short								3512	3388	3227	3029	2843	1338	1152	966	779	-60	-1690	
	S3 Long/Short								3512	3388	3490	3544	3358	2025	2728	7190	7004	6164	4534	-
	S4 Long/Short								3512	3388	3490	3292	3106	1600	2422	2236	2050	1210	-420	-

Annex II – Supply/Demand Calculation Montenegro (GWh)

Demand Scenario	Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Source
Historical	Demand	4654	4583	3642	4044	4183	3900	4652												Data provided by ENTSO-E
	Supply	2061	2691	2574	4005	2632	2778	4049												Data provided by ENTSO-E
	Long/Short	-2593	-1892	-1068	-39	-1551	-1122	-603												-
high consumption	Demand prospected								3424	3552	3698	3859	4025	4074	4350	4507	4673	4834	4999	Basic scneario +1% growthrate p.a.
	Supply Level 1								3125	2910	2910	2924	2970	2970	2429	2429	2429	2429	2429	see Generation Capacities
	Supply Level 2								3125	2990	3036	3156	3202	3202	2661	2661	2661	2661	2661	see Generation Capacities
	Supply Level 3								3125	3008	3076	3382	3464	3484	3093	5095	5346	5370	5393	see Generation Capacities
	S1 Long/Short								-300	-643	-788	-936	-1056	-1104	-1921	-2078	-2244	-2405	-2570	-
	S2 Long/Short								-300	-563	-662	-703	-823	-872	-1689	-1846	-2012	-2173	-2338	-
	S3 Long/Short								-300	-545	-622	-477	-561	-590	-1257	588	673	536	394	-
medium consumption	Demand prospected								3424	3518	3627	3749	3873	3881	4105	4212	4325	4431	4538	Energy Development Strategy of Montenegro, 2014, Table 10.4, page 47
	Supply Level 1								3125	2910	2910	2924	2970	2970	2429	2429	2429	2429	2429	see Generation Capacities
	Supply Level 2								3125	2990	3036	3156	3202	3202	2661	2661	2661	2661	2661	see Generation Capacities
	Supply Level 3								3125	3008	3076	3382	3464	3484	3093	5095	5346	5370	5393	see Generation Capacities
	S1 Long/Short								-300	-609	-718	-825	-903	-911	-1676	-1783	-1896	-2002	-2109	-
	S2 Long/Short								-300	-529	-591	-593	-671	-679	-1444	-1551	-1664	-1770	-1877	-
	S3 Long/Short								-300	-510	-551	-367	-409	-397	-1012	883	1021	939	855	-
low consumption	Demand prospected								3424	3484	3557	3641	3725	3695	3872	3934	4000	4058	4116	Basic scneario -1% growthrate p.a.
	Supply Level 1								3125	2910	2910	2924	2970	2970	2429	2429	2429	2429	2429	see Generation Capacities
	Supply Level 2								3125	2990	3036	3156	3202	3202	2661	2661	2661	2661	2661	see Generation Capacities
	Supply Level 3								3125	3008	3076	3382	3464	3484	3093	5095	5346	5370	5393	see Generation Capacities
	S1 Long/Short								-300	-574	-647	-717	-755	-726	-1443	-1505	-1572	-1630	-1687	-
	S2 Long/Short								-300	-494	-521	-485	-523	-493	-1211	-1273	-1339	-1397	-1455	-
	S3 Long/Short								-300	-476	-481	-259	-261	-211	-779	1161	1346	1312	1278	-

Annex II – Supply/Demand Calculation Serbia (GWh)

Demand Scenario	Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Source
Historical	Demand	37839	38982	40854	39525	40174	39630	39444												
	Supply	38897	39403	41120	40961	41266	39864	43201												
	Long/Short	1058	421	266	1436	1092	234	3757												
high consumption	Demand prospected								39412	39984	40075	40166	40256	40347	40438	40903	41368	41833	42298	
	Supply Level 1								38804	38811	38811	38811	38520	38385	37759	35402	35402	34204	34127	
	Supply Level 2								38804	38811	38857	38857	39698	39563	38937	36580	36580	35382	35305	
	Supply Level 3								38986	38982	39073	39208	40100	41532	45082	50981	53337	52444	52796	
	S1 Long/Short								-608	-1173	-1264	-1355	-1736	-1962	-2679	-5501	-5966	-7629	-8171	
	S2 Long/Short								-608	-1173	-1218	-1308	-558	-784	-1501	-4323	-4788	-6451	-6993	
	S3 Long/Short								-426	-1002	-1002	-957	-156	1185	4644	10078	11969	10611	10498	
medium consumption	Demand prospected								37421	37495	37328	37160	36993	36825	36658	37046	37435	37823	38212	
	Supply Level 1								38804	38811	38811	38811	38520	38385	37759	35402	35402	34204	34127	
	Supply Level 2								38804	38811	38857	38857	39698	39563	38937	36580	36580	35382	35305	
	Supply Level 3								38986	38982	39073	39208	40100	41532	45082	50981	53337	52444	52796	
	S1 Long/Short								1383	1316	1483	1651	1527	1560	1101	-1644	-2033	-3619	-4085	
	S2 Long/Short								1383	1316	1530	1697	2705	2738	2279	-466	-855	-2441	-2906	
	S3 Long/Short								1565	1487	1746	2048	3107	4707	8424	13934	15902	14621	14585	
low consumption	Demand prospected								35429	35006	34580	34155	33729	33304	32878	33190	33502	33813	34125	
	Supply Level 1								38804	38811	38811	38811	38520	38385	37759	35402	35402	34204	34127	see Generation Capacities
	Supply Level 2								38804	38811	38857	38857	39698	39563	38937	36580	36580	35382	35305	see Generation Capacities
	Supply Level 3								38986	38982	39073	39208	40100	41532	45082	50981	53337	52444	52796	see Generation Capacities
	S1 Long/Short								3375	3805	4231	4656	4791	5081	4881	2212	1900	391	2	-
	S2 Long/Short								3375	3805	4277	4702	5969	6260	6059	3390	3079	1569	1180	-
	S3 Long/Short								3557	3976	4493	5053	6371	8229	12204	17791	19835	18631	18671	-

Annex III - Peak Calculation Albania (MW)

Demand Scenario	Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Peak Load	Peak Load - low	1670	1722	1775	1830	1887	1945	2006	2068	2132	2198	2266
	Peak Load - medium	1670	1720	1770	1820	1880	1930	1990	2072	2156	2245	2337
	Peak Load - high	1670	1755	1845	1939	2038	2141	2251	2365	2486	2613	2746
high consumption	Supply Level 1	711,1	711,1	711,1	711,1	711,1	711,1	711,1	711,1	711,1	711,1	711,1
	Supply Level 2	711,1	824,4	824,4	896,6	896,6	965,4	965,4	965,4	965,4	965,4	965,4
	Supply Level 3	711,1	824,4	824,4	896,6	896,6	965,4	1003	1003	1003	1003	1003
	Supply Level 4	711,1	824,4	824,4	910,2	894,7	963,5	1001	1001	1001	1001	1001
	S1 Long/Short	-959	-1044	-1134	-1228	-1326	-1430	-1540	-1654	-1775	-1902	-2035
	S2 Long/Short	-959	-931	-1020	-1042	-1141	-1176	-1285	-1400	-1521	-1647	-1781
	S3 Long/Short	-959	-931	-1020	-1042	-1141	-1176	-1248	-1363	-1483	-1610	-1743
	S4 Long/Short	-959	-931	-1020	-1029	-1143	-1178	-1250	-1365	-1485	-1612	-1745
medium consumption	Supply Level 1	711,1	711,1	711,1	711,1	711,1	711,1	711,1	711,1	711,1	711,1	711,1
	Supply Level 2	711,1	824,4	824,4	896,6	896,6	965,4	965,4	965,4	965,4	965,4	965,4
	Supply Level 3	711,1	824,4	824,4	896,6	896,6	965,4	1003	1003	1003	1003	1003
	Supply Level 4	711,1	824,4	824,4	910,2	894,7	963,5	1001	1001	1001	1001	1001
	S1 Long/Short	-959	-1009	-1059	-1109	-1169	-1219	-1279	-1360	-1445	-1534	-1626
	S2 Long/Short	-959	-896	-946	-923	-983	-965	-1025	-1106	-1191	-1279	-1371
	S3 Long/Short	-959	-896	-946	-923	-983	-965	-987	-1069	-1154	-1242	-1334
	S4 Long/Short	-959	-896	-946	-910	-985	-966	-989	-1071	-1156	-1244	-1336
low consumption	Supply Level 1	711,1	711,1	711,1	711,1	711,1	711,1	711,1	711,1	711,1	711,1	711,1
	Supply Level 2	711,1	824,4	824,4	896,6	896,6	965,4	965,4	965,4	965,4	965,4	965,4
	Supply Level 3	711,1	824,4	824,4	896,6	896,6	965,4	1003	1003	1003	1003	1003
	Supply Level 4	711,1	824,4	824,4	910,2	894,7	963,5	1001	1001	1001	1001	1001
	S1 Long/Short	-959	-1011	-1064	-1119	-1176	-1234	-1294	-1357	-1421	-1487	-1555
	S2 Long/Short	-959	-897	-951	-934	-990	-980	-1040	-1102	-1166	-1232	-1301
	S3 Long/Short	-959	-897	-951	-934	-990	-980	-1003	-1065	-1129	-1195	-1263
	S4 Long/Short	-959	-897	-951	-920	-992	-982	-1005	-1067	-1131	-1197	-1265

Annex III - Peak Calculation Bosnia and Herzegovina (MW)

Demand Scenario	Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Peak Load	Peak Load - low	2230	2135	2154	2174	2193	2213	2233	2253	2274	2294	2315
	Peak Load - medium	2230	2158	2201	2245	2290	2336	2382	2430	2479	2528	2579
	Peak Load - high	2230	2171	2227	2285	2344	2405	2467	2531	2598	2664	2734
high consumption	Supply Level 1	2487	2487	2487	2487	2487	2394	2394	2207	2207	2207	2096
	Supply Level 2	2487	2487	2768	2775	2789	2695	2695	2508	2508	2508	2398
	Supply Level 3	2487	2503	2785	2816	2839	3584	4167	4230	4236	4580	4475
	Supply Level 4	2487	2503	2785	2816	2839	3584	4167	4230	4236	4580	4475
	S1 Long/Short	257	316	260	203	143	-11	-73	-325	-391	-457	-637
	S2 Long/Short	257	316	541	491	445	290	228	-23	-89	-156	-336
	S3 Long/Short	257	332	558	532	494	1179	1701	1699	1638	1916	1741
	S4 Long/Short	257	332	558	532	494	1179	1701	1699	1638	1916	1741
medium consumption	Supply Level 1	2487	2487	2487	2487	2487	2394	2394	2207	2207	2207	2096
	Supply Level 2	2487	2487	2768	2775	2789	2695	2695	2508	2508	2508	2398
	Supply Level 3	2487	2503	2785	2816	2839	3584	4167	4230	4236	4580	4475
	Supply Level 4	2487	2503	2785	2816	2839	3584	4167	4230	4236	4580	4475
	S1 Long/Short	257	329	286	242	197	58	12	-223	-272	-321	-483
	S2 Long/Short	257	329	567	530	499	359	313	78	29	-20	-181
	S3 Long/Short	257	345	584	571	549	1248	1785	1800	1757	2052	1896
	S4 Long/Short	257	345	584	571	549	1248	1785	1800	1757	2052	1896
low consumption	Supply Level 1	2487	2487	2487	2487	2487	2394	2394	2207	2207	2207	2096
	Supply Level 2	2487	2487	2768	2775	2789	2695	2695	2508	2508	2508	2398
	Supply Level 3	2487	2503	2785	2816	2839	3584	4167	4230	4236	4580	4475
	Supply Level 4	2487	2503	2785	2816	2839	3584	4167	4230	4236	4580	4475
	S1 Long/Short	257	352	333	314	294	180	161	-47	-68	-88	-219
	S2 Long/Short	257	352	614	602	595	482	463	255	234	214	83
	S3 Long/Short	257	368	631	643	645	1370	1935	1976	1961	2286	2160
	S4 Long/Short	257	368	631	643	645	1370	1935	1976	1961	2286	2160

Annex III - Peak Calculation Kosovo* (MW)

Demand Scenario	Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Peak Load	Peak Load - low	1218	1257	1284	1300	1324	1334	1354	1365	1404	1430	1456
	Peak Load - medium	1250	1283	1310	1340	1365	1390	1410	1452	1494	1530	1567
	Peak Load - high	1275	64	1349	94	1420	112	1466	174	1584	201,1	1679
high consumption	Supply Level 1	1085	1085	1085	1085	523,5	523,5	523,5	523,5	523,5	523,5	523,5
	Supply Level 2	1085	1085	1085	1085	523,5	523,5	523,5	523,5	523,5	523,5	523,5
	Supply Level 3	1085	1085	1196	1196	648,6	1332	1332	1332	1332	1332	1332
	Supply Level 4	1085	1085	1196	1196	648,6	1332	1332	1332	1332	1332	1332
	S1 Long/Short	-190	-236	-264	-309	-896	-922	-942	-1015	-1060	-1107	-1156
	S2 Long/Short	-190	-236	-264	-309	-896	-922	-942	-1015	-1060	-1107	-1156
	S3 Long/Short	-190	-236	-153	-198	-771	-114	-134	-207	-252	-299	-348
	S4 Long/Short	-190	-236	-153	-198	-771	-114	-134	-207	-252	-299	-348
medium consumption	Supply Level 1	1085	1085	1085	1085	523,5	523,5	523,5	523,5	523,5	523,5	523,5
	Supply Level 2	1085	1085	1085	1085	523,5	523,5	523,5	523,5	523,5	523,5	523,5
	Supply Level 3	1085	1085	1196	1196	648,6	1332	1332	1332	1332	1332	1332
	Supply Level 4	1085	1085	1196	1196	648,6	1332	1332	1332	1332	1332	1332
	S1 Long/Short	-165	-198	-225	-255	-841	-866	-886	-928	-970	-1006	-1043
	S2 Long/Short	-165	-198	-225	-255	-841	-866	-886	-928	-970	-1006	-1043
	S3 Long/Short	-165	-198	-114	-144	-716	-58	-78	-120	-162	-198	-235
	S4 Long/Short	-165	-198	-114	-144	-716	-58	-78	-120	-162	-198	-235
low consumption	Supply Level 1	1085	1085	1085	1085	523,5	523,5	523,5	523,5	523,5	523,5	523,5
	Supply Level 2	1085	1085	1085	1085	523,5	523,5	523,5	523,5	523,5	523,5	523,5
	Supply Level 3	1085	1085	1196	1196	648,6	1332	1332	1332	1332	1332	1332
	Supply Level 4	1085	1085	1196	1196	648,6	1332	1332	1332	1332	1332	1332
	S1 Long/Short	-133	-172	-199	-215	-800	-810	-830	-841	-880	-906	-933
	S2 Long/Short	-133	-172	-199	-215	-800	-810	-830	-841	-880	-906	-933
	S3 Long/Short	-133	-172	-88	-104	-675	-2	-22	-33	-72	-98	-125
	S4 Long/Short	-133	-172	-88	-104	-675	-2	-22	-33	-72	-98	-125

Annex III - Peak Calculation Macedonia (MW)

Demand Scenario	Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Peak Load	Peak Load - low	1540	1580	1617	1654	1689	1726	1761	1796	1830	1861	1892
	Peak Load - medium	1610	1658	1704	1750	1793	1839	1885	1946	2003	2053	2097
	Peak Load - high	1680	157,1	1791	192	1898	226,9	2009	301,1	2175	384	2302
high consumption	Supply Level 1	1169	1169	1169	1169	1169	963,7	963,7	963,7	963,7	846,9	636,5
	Supply Level 2	1169	1169	1169	1169	1169	963,9	963,9	963,9	963,9	847	636,6
	Supply Level 3	1169	1169	1246	1268	1268	1357	1429	2022	2022	1906	1976
	Supply Level 4	1169	1169	1246	1246	1246	1041	1141	1141	1141	1024	1094
	S1 Long/Short	-511	-568	-622	-677	-729	-989	-1046	-1133	-1211	-1398	-1665
	S2 Long/Short	-511	-568	-622	-677	-729	-989	-1046	-1133	-1211	-1398	-1665
	S3 Long/Short	-511	-568	-545	-577	-630	-596	-580	-74	-153	-339	-326
	S4 Long/Short	-511	-568	-545	-599	-652	-911	-868	-955	-1034	-1221	-1207
medium consumption	Supply Level 1	1169	1169	1169	1169	1169	963,7	963,7	963,7	963,7	846,9	636,5
	Supply Level 2	1169	1169	1169	1169	1169	963,9	963,9	963,9	963,9	847	636,6
	Supply Level 3	1169	1169	1246	1268	1268	1357	1429	2022	2022	1906	1976
	Supply Level 4	1169	1169	1246	1246	1246	1041	1141	1141	1141	1024	1094
	S1 Long/Short	-441	-489	-535	-581	-624	-875	-921	-982	-1039	-1206	-1460
	S2 Long/Short	-441	-489	-535	-581	-624	-875	-921	-982	-1039	-1206	-1460
	S3 Long/Short	-441	-489	-457	-481	-525	-482	-456	76	20	-147	-121
	S4 Long/Short	-441	-489	-457	-503	-547	-798	-744	-805	-862	-1029	-1002
low consumption	Supply Level 1	1169	1169	1169	1169	1169	963,7	963,7	963,7	963,7	846,9	636,5
	Supply Level 2	1169	1169	1169	1169	1169	963,9	963,9	963,9	963,9	847	636,6
	Supply Level 3	1169	1169	1246	1268	1268	1357	1429	2022	2022	1906	1976
	Supply Level 4	1169	1169	1246	1246	1246	1041	1141	1141	1141	1024	1094
	S1 Long/Short	-371	-411	-448	-485	-520	-762	-797	-832	-867	-1014	-1255
	S2 Long/Short	-371	-411	-448	-485	-520	-762	-797	-832	-867	-1014	-1255
	S3 Long/Short	-371	-411	-370	-385	-420	-369	-331	227	192	45	84
	S4 Long/Short	-371	-411	-370	-407	-442	-684	-619	-654	-689	-837	-797

Annex III - Peak Calculation Montenegro (MW)

Demand Scenario	Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Peak Load	Peak Load - low	557,9	567,6	579,5	593,2	606,9	602,1	630,8	641	651,8	661,2	670,6
	Peak Load - medium	557,9	573,2	591	610,9	631,1	632,4	668,9	686,3	704,7	722	739,4
	Peak Load - high	557,9	11,16	602,5	35,56	655,9	61,69	708,8	93,33	761,4	126,4	814,5
high consumption	Supply Level 1	460,3	460,3	460,3	460,3	460,3	460,3	460,3	460,3	460,3	460,3	460,3
	Supply Level 2	460,3	476,1	476,1	476,5	476,5	476,5	476,5	476,5	476,5	476,5	476,5
	Supply Level 3	460,3	514,9	514,9	516	516,4	516,4	525,9	826,9	894,1	894,1	894,1
	Supply Level 4	460,3	514,9	514,9	516	516,4	516,4	525,9	826,9	894,1	894,1	894,1
	S1 Long/Short	-98	-118	-142	-168	-196	-203	-248	-274	-301	-327	-354
	S2 Long/Short	-98	-103	-126	-152	-179	-187	-232	-258	-285	-311	-338
	S3 Long/Short	-98	-64	-88	-113	-139	-147	-183	93	133	107	80
	S4 Long/Short	-98	-64	-88	-113	-139	-147	-183	93	133	107	80
medium consumption	Supply Level 1	460,3	460,3	460,3	460,3	460,3	460,3	460,3	460,3	460,3	460,3	460,3
	Supply Level 2	460,3	476,1	476,1	476,5	476,5	476,5	476,5	476,5	476,5	476,5	476,5
	Supply Level 3	460,3	514,9	514,9	516	516,4	516,4	525,9	826,9	894,1	894,1	894,1
	Supply Level 4	460,3	514,9	514,9	516	516,4	516,4	525,9	826,9	894,1	894,1	894,1
	S1 Long/Short	-98	-113	-131	-151	-171	-172	-209	-226	-244	-262	-279
	S2 Long/Short	-98	-97	-115	-134	-155	-156	-192	-210	-228	-245	-263
	S3 Long/Short	-98	-58	-76	-95	-115	-116	-143	141	189	172	155
	S4 Long/Short	-98	-58	-76	-95	-115	-116	-143	141	189	172	155
low consumption	Supply Level 1	460,3	460,3	460,3	460,3	460,3	460,3	460,3	460,3	460,3	460,3	460,3
	Supply Level 2	460,3	476,1	476,1	476,5	476,5	476,5	476,5	476,5	476,5	476,5	476,5
	Supply Level 3	460,3	514,9	514,9	516	516,4	516,4	525,9	826,9	894,1	894,1	894,1
	Supply Level 4	460,3	514,9	514,9	516	516,4	516,4	525,9	826,9	894,1	894,1	894,1
	S1 Long/Short	-98	-107	-119	-133	-147	-142	-171	-181	-191	-201	-210
	S2 Long/Short	-98	-92	-103	-117	-130	-126	-154	-164	-175	-185	-194
	S3 Long/Short	-98	-53	-65	-77	-90	-86	-105	186	242	233	224
	S4 Long/Short	-98	-53	-65	-77	-90	-86	-105	186	242	233	224
Peak Load w/o KAP	Peak Load - low	557,9	483,6	495,5	509,2	522,9	518,1	546,8	557	567,8	577,2	586,6
	Peak Load - medium	557,9	489,2	507	526,9	547,1	548,4	584,9	602,3	620,7	638	655,4
	Peak Load - high	557,9	494,8	518,5	544,8	571,9	579,8	624,8	650,3	677,4	703,6	730,5
gh consumption w/o K	Supply Level 1	460,3	460,3	460,3	460,3	460,3	460,3	460,3	460,3	460,3	460,3	460,3
	Supply Level 2	460,3	476,1	476,1	476,5	476,5	476,5	476,5	476,5	476,5	476,5	476,5
	Supply Level 3	460,3	514,9	514,9	516	516,4	516,4	525,9	826,9	894,1	894,1	894,1
	Supply Level 4	460,3	514,9	514,9	516	516,4	516,4	525,9	826,9	894,1	894,1	894,1
	S1 Long/Short	-98	-34	-58	-84	-112	-119	-164	-190	-217	-243	-270
	S2 Long/Short	-98	-19	-42	-68	-95	-103	-148	-174	-201	-227	-254
	S3 Long/Short	-98	20	-4	-29	-55	-63	-99	177	217	191	164
	S4 Long/Short	-98	20	-4	-29	-55	-63	-99	177	217	191	164
ium consumption w/o	Supply Level 1	460,3	460,3	460,3	460,3	460,3	460,3	460,3	460,3	460,3	460,3	460,3
	Supply Level 2	460,3	476,1	476,1	476,5	476,5	476,5	476,5	476,5	476,5	476,5	476,5
	Supply Level 3	460,3	514,9	514,9	516	516,4	516,4	525,9	826,9	894,1	894,1	894,1
	Supply Level 4	460,3	514,9	514,9	516	516,4	516,4	525,9	826,9	894,1	894,1	894,1
	S1 Long/Short	-98	-29	-47	-67	-87	-88	-125	-142	-160	-178	-195
	S2 Long/Short	-98	-13	-31	-50	-71	-72	-108	-126	-144	-161	-179
	S3 Long/Short	-98	26	8	-11	-31	-32	-59	225	273	256	239
	S4 Long/Short	-98	26	8	-11	-31	-32	-59	225	273	256	239
w consumption w/o K/	Supply Level 1	460,3	460,3	460,3	460,3	460,3	460,3	460,3	460,3	460,3	460,3	460,3
	Supply Level 2	460,3	476,1	476,1	476,5	476,5	476,5	476,5	476,5	476,5	476,5	476,5
	Supply Level 3	460,3	514,9	514,9	516	516,4	516,4	525,9	826,9	894,1	894,1	894,1
	Supply Level 4	460,3	514,9	514,9	516	516,4	516,4	525,9	826,9	894,1	894,1	894,1
	S1 Long/Short	-98	-23	-35	-49	-63	-58	-87	-97	-107	-117	-126
	S2 Long/Short	-98	-8	-19	-33	-46	-42	-70	-80	-91	-101	-110
	S3 Long/Short	-98	31	19	7	-6	-2	-21	270	326	317	308
	S4 Long/Short	-98	31	19	7	-6	-2	-21	270	326	317	308

Annex III – Peak Calculation Serbia (MW)

Demand Scenario	Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Peak Load	Peak Load - low	6852	6770	6688	6606	6523	6441	6359	6419	6479	6540	6600
	Peak Load - medium	6852	6866	6835	6805	6774	6743	6713	6784	6855	6926	6997
	Peak Load - high	6852	6952	6968	6983	6999	7015	7031	7112	7192	7273	7354
high consumption	Supply Level 1	5365	5365	5365	5365	5305	5245	5143	4736	4736	4540	4540
	Supply Level 2	5365	5365	5365	5365	5309	5250	5147	4740	4740	4544	4544
	Supply Level 3	5440	5440	5440	5518	5462	5541	6310	6937	7545	7893	7893
	Supply Level 4	5440	5440	5440	5518	5462	5541	6310	6937	7545	7893	7893
	S1 Long/Short	-1487	-1587	-1602	-1618	-1694	-1769	-1888	-2376	-2457	-2734	-2815
	S2 Long/Short	-1487	-1587	-1602	-1618	-1690	-1765	-1884	-2372	-2452	-2730	-2810
	S3 Long/Short	-1412	-1511	-1527	-1466	-1537	-1474	-721	-174	353	620	539
	S4 Long/Short	-1412	-1511	-1527	-1466	-1537	-1474	-721	-174	353	620	539
medium consumption	Supply Level 1	5365	5365	5365	5365	5305	5245	5143	4736	4736	4540	4540
	Supply Level 2	5365	5365	5365	5365	5309	5250	5147	4740	4740	4544	4544
	Supply Level 3	5440	5440	5440	5518	5462	5541	6310	6937	7545	7893	7893
	Supply Level 4	5440	5440	5440	5518	5462	5541	6310	6937	7545	7893	7893
	S1 Long/Short	-1487	-1501	-1470	-1439	-1469	-1498	-1570	-2048	-2119	-2386	-2458
	S2 Long/Short	-1487	-1501	-1470	-1439	-1465	-1494	-1566	-2044	-2115	-2382	-2454
	S3 Long/Short	-1412	-1426	-1395	-1287	-1312	-1202	-403	154	690	967	896
	S4 Long/Short	-1412	-1426	-1395	-1287	-1312	-1202	-403	154	690	967	896
low consumption	Supply Level 1	5365	5365	5365	5365	5305	5245	5143	4736	4736	4540	4540
	Supply Level 2	5365	5365	5365	5365	5309	5250	5147	4740	4740	4544	4544
	Supply Level 3	5440	5440	5440	5518	5462	5541	6310	6937	7545	7893	7893
	Supply Level 4	5440	5440	5440	5518	5462	5541	6310	6937	7545	7893	7893
	S1 Long/Short	-1487	-1405	-1323	-1241	-1218	-1196	-1216	-1683	-1744	-2000	-2061
	S2 Long/Short	-1487	-1405	-1323	-1241	-1214	-1192	-1212	-1679	-1739	-1996	-2056
	S3 Long/Short	-1412	-1330	-1248	-1088	-1062	-900	-49	518	1066	1353	1293
	S4 Long/Short	-1412	-1330	-1248	-1088	-1062	-900	-49	518	1066	1353	1293

Annex IV – Import Export Calc (GWh) – (1/2)

Country	Supply Scena	Demand Scer	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
EU28	EU		8222,4	6280,2	4338,0	2395,8	453,6	-1488,6	-4914,8	-8341,0	-11767,2	-15193,4	-18619,6	-18403,3	-18187,0	-17970,7	-17754,4
Austria	EU		2326,0	1891,0	1456,1	1021,1	586,2	151,2	362,9	574,5	786,2	997,9	1209,5	1163,0	1116,5	1070,0	1023,4
Czech Republi	EU		-14944,6	-13400,1	-11855,6	-10311,2	-8766,7	-7222,2	-7080,3	-6938,5	-6796,6	-6654,7	-6512,8	-6633,8	-6754,7	-6875,7	-6996,6
Germany	EU		-14956,2	-12230,1	-9504,0	-6778,0	-4051,9	-1325,8	-746,6	-167,5	411,7	990,9	1570,1	2360,9	3151,7	3942,6	4733,4
Poland	EU		-1349,1	-1977,1	-2605,1	-3233,1	-3861,2	-4489,2	-4226,3	-3963,5	-3700,7	-3437,8	-3175,0	-3123,8	-3072,6	-3021,5	-2970,3
Slovakia	EU		1046,7	867,6	688,5	509,4	330,3	151,2	-237,3	-625,7	-1014,1	-1402,6	-1791,0	-1900,3	-2009,7	-2119,0	-2228,3
Bulgaria	EU		-8443,4	-8808,6	-9173,7	-9538,9	-9904,1	-10269,3	-10448,4	-10627,5	-10806,6	-10985,7	-11164,8	-11181,1	-11197,4	-11213,6	-11229,9
Croatia	EU		4768,3	4789,2	4810,2	4831,1	4852,0	4873,0	5028,8	5184,7	5340,5	5496,3	5652,2	5633,6	5615,0	5596,4	5577,7
Greece	EU		5710,3	5619,6	5528,9	5438,2	5347,5	5256,8	5045,1	4833,4	4621,8	4410,1	4198,4	4449,6	4700,8	4952,1	5203,3
Hungary	EU		5198,6	5461,4	5724,3	5987,1	6250,0	6512,8	6354,6	6196,5	6038,3	5880,1	5722,0	5508,0	5294,0	5080,0	4866,0
Italy	EU		44159,1	42468,1	40777,1	39086,1	37395,1	35704,1	35201,7	34699,3	34196,9	33694,4	33192,0	32122,1	31052,1	29982,1	28912,2
Romania	EU		-2279,5	-2526,0	-2772,6	-3019,1	-3265,7	-3512,3	-3623,9	-3735,6	-3847,2	-3958,9	-4070,5	-4596,2	-5121,9	-5647,5	-6173,2
Slovenia	EU		-2116,7	-1949,2	-1781,7	-1614,2	-1446,8	-1279,3	-1163,0	-1046,7	-930,4	-814,1	-697,8	-749,0	-800,1	-851,3	-902,5
Neighbours	EU		55440,2	53863,2	52286,2	50709,1	49132,1	47555,1	46843,3	46131,6	45419,8	44708,0	43996,3	42368,1	40739,9	39111,7	37483,5
Neighbours In	EU		59836,4	58338,4	56840,5	55342,5	53844,6	52346,6	51630,2	50913,8	50197,4	49481,0	48764,6	47713,2	46661,9	45610,5	44559,2
Albania	S1	Long/Short high	0	0	0	0	-2121,91417	-2550,88166	-3001,72029	-3475,54516	-3973,52825	-4496,90127	-5046,95875	-5625,06119	-6232,6385	-6871,19346	-7542,30548
Albania	S2	Long/Short high	0	0	0	0	-2121,91417	-1902,88166	-1026,72029	-878,945163	-1376,92825	-1425,30127	-1975,35875	-2553,46119	-3161,0385	-3799,59346	-4470,70548
Albania	S3	Long/Short high	0	0	0	0	-2121,91417	-1902,88166	-1026,72029	-878,945163	-1087,92275	-1110,12827	-1257,85075	-1835,95319	-2443,5305	-3082,08546	-3753,19748
Albania	S4	Long/Short high	0	0	0	0	-2121,91417	-1902,88166	-1026,72029	-495,695163	-610,428252	-275,551273	-92,358746	-287,211192	-511,538498	-766,843456	-1054,70548
Bosnia Herzig	S1	Long/Short high	0	0	0	0	3479	3343	2951	2546	2127	1233	787	-913	-1388	-1877	-3028
Bosnia Herzig	S2	Long/Short high	0	0	0	0	3479	3343	4611	4780,4	4443,7	3549,7	3103,7	1403,7	928,7	439,7	-711,3
Bosnia Herzig	S3	Long/Short high	0	0	0	0	3479	3369,3	4704,56	5105,82	7630,98	11717,04	16731,4	16061,72	15699,24	17457,31	16766,83
Kosovo	S1	Long/Short high	0	0	0	0	128	-182	-438	-1242	-3566	-3296	-3513	-3758	-3982	-4241,072	-4508,4343
Kosovo	S2	Long/Short high	0	0	0	0	128	-182	-354,3	-1158,3	-3482,3	-3212,3	-3429,3	-3674,3	-3898,3	-4157,372	-4424,7343
Kosovo	S3	Long/Short high	0	0	0	0	128	-182	52,6	-746,4	-2908,4	-115,4	1848,6	1646,6	1431,6	1172,528	988,865696
Macedonia	S1	Long/Short high	0	0	0	0	2767,9	2550,52	2259,77	1969,02	1689,9	91,15	-211,23	-676,43	-1095,11	-2144,27	-3913,31667
Macedonia	S2	Long/Short high	0	0	0	0	2767,9	2550,52	2296,77	2006,02	1726,9	128,15	-174,23	-639,43	-1058,11	-2107,27	-3876,31667
Macedonia	S3	Long/Short high	0	0	0	0	2767,9	2550,52	2559,27	2520,92	2241,8	815,05	1402,37	5584,77	5166,09	4116,93	2347,88333
Macedonia	S4	Long/Short high	0	0	0	0	2767,9	2550,52	2559,27	2268,52	1989,4	390,65	1095,97	630,77	212,09	-837,07	-2606,11667
Montenegro	S1	Long/Short high	0	0	0	0	-299,5	-642,74	-788,323275	-935,583763	-1055,81998	-1104,38902	-1921,26767	-2078,14901	-2244,12406	-2405,37356	-2570,44432
Montenegro	S2	Long/Short high	0	0	0	0	-299,5	-562,74	-661,773275	-703,233763	-823,469983	-872,039019	-1688,91767	-1845,79901	-2011,77406	-2173,02356	-2338,14432
Montenegro	S3	Long/Short high	0	0	0	0	-299,5	-544,6071	-621,607475	-477,435063	-561,438383	-589,974519	-1256,72027	588,431286	673,489137	536,272542	394,184681
Montenegro	S4	Long/Short high	0	0	0	0	-299,5	-544,6071	-621,607475	-477,435063	-561,438383	-589,974519	-1256,72027	588,431286	673,489137	536,272542	394,184681
Montenegro '	S1	Long/Short high	0	0	0	0	-299,5	92,26	-53,3232755	-200,583763	-320,819983	-369,389019	-1186,26767	-1343,14901	-1509,12406	-1670,37356	-1835,44432
Montenegro '	S2	Long/Short high	0	0	0	0	-299,5	172,26	73,2267245	31,7662365	-88,4699827	-137,039019	-953,917672	-1110,79901	-1276,77406	-1438,02356	-1603,14432
Montenegro '	S3	Long/Short high	0	0	0	0	-299,5	190,3929	113,392525	257,564937	173,561617	145,025481	-521,720272	1323,43129	1408,48914	1271,27254	1129,18468
Serbia	S1	Long/Short high	0	0	0	0	-607,7999	-1172,9999	-1263,7999	-1354,5999	-1736,3999	-1962,1999	-2678,9999	-5500,9999	-5965,9999	-7628,9999	-8170,9999
Serbia	S2	Long/Short high	0	0	0	0	-607,7999	-1172,9999	-1217,5999	-1308,3999	-558,1999	-783,9999	-1500,7999	-4322,7999	-4787,7999	-6450,7999	-6992,7999
Serbia	S3	Long/Short high	0	0	0	0	-425,7999	-1001,9999	-1001,5999	-957,3999	-156,1999	1185,0001	4644,20011	10077,7001	11968,7001	10611,2502	10498,2502

Annex IV – Import Export Calc (GWh) – (2/2)

Country	Supply Scena	Demand Scer	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Albania	S1	Long/Short low	0	0	0	0	-1804,74669	-2055,6163	-2314,25924	-2580,91636	-2855,836	-3139,27416	-3431,49481	-3732,77008	-4043,38051	-4363,61538	-4693,77289
Albania	S2	Long/Short low	0	0	0	0	-1804,74669	-1407,6163	-339,259236	15,6836402	-259,235996	-67,6741635	-359,894813	-661,170075	-971,780511	-1292,01538	-1622,17289
Albania	S3	Long/Short low	0	0	0	0	-1804,74669	-1407,6163	-339,259236	15,6836402	29,7695039	247,498836	357,613187	56,3379248	-254,272511	-574,507377	-904,66489
Albania	S4	Long/Short low	0	0	0	0	-1804,74669	-1407,6163	-339,259236	398,93364	507,264004	1082,07584	1523,10519	1605,07992	1677,71949	1740,73462	1793,82711
Bosnia Herzig	S1	Long/Short low	0	0	0	0	3479	3546	3365	3181	2994	2342	2150	714	516	315	-534
Bosnia Herzig	S2	Long/Short low	0	0	0	0	3479	3546	5025	5415,4	5310,7	4658,7	4466,7	3030,7	2832,7	2631,7	1782,7
Bosnia Herzig	S3	Long/Short low	0	0	0	0	3479	3572,3	5118,56	5740,82	8497,98	12826,04	18094,4	17688,72	17603,24	19649,31	19260,83
Kosovo	S1	Long/Short low	0	0	0	0	576	559	445	-193	-2492	-2186	-2377	-2588	-2783	-2900,9387	-3020,89415
Kosovo	S2	Long/Short low	0	0	0	0	576	559	528,7	-109,3	-2408,3	-2102,3	-2293,3	-2504,3	-2699,3	-2817,2387	-2937,19415
Kosovo	S3	Long/Short low	0	0	0	0	576	559	935,6	302,6	-1834,4	994,6	2984,6	2816,6	2630,6	2512,6613	2476,40585
Macedonia	S1	Long/Short low	0	0	0	0	3512,22	3387,88	3190,17	2992,46	2806,38	1300,67	1114,59	928,51	742,43	-97,39	-1726,87667
Macedonia	S2	Long/Short low	0	0	0	0	3512,22	3387,88	3227,17	3029,46	2843,38	1337,67	1151,59	965,51	779,43	-60,39	-1689,87667
Macedonia	S3	Long/Short low	0	0	0	0	3512,22	3387,88	3489,67	3544,36	3358,28	2024,57	2728,19	7189,71	7003,63	6163,81	4534,32333
Macedonia	S4	Long/Short low	0	0	0	0	3512,22	3387,88	3489,67	3291,96	3105,88	1600,17	2421,79	2235,71	2049,63	1209,81	-419,676667
Montenegro	S1	Long/Short low	0	0	0	0	-299,5	-574,26	-647,361525	-717,333688	-755,350006	-725,794696	-1443,12815	-1505,33046	-1571,53107	-1629,56766	-1686,98281
Montenegro	S2	Long/Short low	0	0	0	0	-299,5	-494,26	-520,811525	-484,983688	-523,000006	-493,444696	-1210,77815	-1272,98046	-1339,18107	-1397,21766	-1454,68281
Montenegro	S3	Long/Short low	0	0	0	0	-299,5	-476,1271	-480,645725	-259,184988	-260,968406	-211,380196	-778,580752	1161,24984	1346,08213	1312,07844	1277,64619
Montenegro	S4	Long/Short low	0	0	0	0	-299,5	-476,1271	-480,645725	-259,184988	-260,968406	-211,380196	-778,580752	1161,24984	1346,08213	1312,07844	1277,64619
Montenegro '	S1	Long/Short low	0	0	0	0	-299,5	160,74	87,6384755	17,6663116	-20,3500057	9,20530383	-708,128152	-770,33046	-836,531075	-894,567659	-951,982809
Montenegro '	S2	Long/Short low	0	0	0	0	-299,5	240,74	214,188475	250,016312	211,999994	241,555304	-475,778152	-537,98046	-604,181075	-662,217659	-719,682809
Montenegro '	S3	Long/Short low	0	0	0	0	-299,5	258,8729	254,354275	475,815012	474,031594	523,619804	-43,5807524	1896,24984	2081,08213	2047,07844	2012,64619
Serbia	S1	Long/Short low	0	0	0	0	3374,6001	3805,0001	4230,6001	4656,2001	4790,8001	5081,4001	4881,0001	2212,2001	1900,4001	390,6001	1,8001
Serbia	S2	Long/Short low	0	0	0	0	3374,6001	3805,0001	4276,8001	4702,4001	5969,0001	6259,6001	6059,2001	3390,4001	3078,6001	1568,8001	1180,0001
Serbia	S3	Long/Short low	0	0	0	0	3556,6001	3976,0001	4492,8001	5053,4001	6371,0001	8228,6001	12204,2001	17790,9001	19835,1001	18630,8502	18671,0502
Albania	S1	Long/Short medium	0	0	0	0	-1962,56873	-2300,87022	-2653,03718	-3019,63789	-3401,26393	-3798,53111	-4212,0805	-4642,57943	-5090,72259	-5557,23313	-6042,86385
Albania	S2	Long/Short medium	0	0	0	0	-1962,56873	-1652,87022	-678,037184	-423,037895	-804,66393	-726,931111	-1140,4805	-1570,97943	-2019,12259	-2485,63313	-2971,26385
Albania	S3	Long/Short medium	0	0	0	0	-1962,56873	-1652,87022	-678,037184	-423,037895	-515,65843	-411,758111	-422,972499	-853,471429	-1301,61459	-1768,12513	-2253,75585
Albania	S4	Long/Short medium	0	0	0	0	-1962,56873	-1652,87022	-678,037184	-39,7878948	-38,1639301	422,818889	742,519501	695,270571	630,377415	547,116872	444,736147
Bosnia Herzig	S1	Long/Short medium	0	0	0	0	3479	3415	3098	2772	2438	1633	1281	-320	-690	-1070	-2105
Bosnia Herzig	S2	Long/Short medium	0	0	0	0	3479	3415	4758	5006,4	4754,7	3949,7	3597,7	1996,7	1626,7	1246,7	211,7
Bosnia Herzig	S3	Long/Short medium	0	0	0	0	3479	3441,3	4851,56	5331,82	7941,98	12117,04	17225,4	16654,72	16397,24	18264,31	17689,83
Kosovo	S1	Long/Short medium	0	0	0	0	367	188	66	-717	-3029	-2741	-2945	-3173	-3382	-3567,9008	-3758,41194
Kosovo	S2	Long/Short medium	0	0	0	0	367	188	149,7	-633,3	-2945,3	-2657,3	-2861,3	-3089,3	-3298,3	-3484,2008	-3674,71194
Kosovo	S3	Long/Short medium	0	0	0	0	367	188	556,6	-221,4	-2371,4	439,6	2416,6	2231,6	2031,6	1845,6992	1738,88806
Macedonia	S1	Long/Short medium	0	0	0	0	3140,06	2969,2	2724,97	2480,74	2248,14	695,91	451,68	126,04	-176,34	-1120,83	-2820,09667
Macedonia	S2	Long/Short medium	0	0	0	0	3140,06	2969,2	2761,97	2517,74	2285,14	732,91	488,68	163,04	-139,34	-1083,83	-2783,09667
Macedonia	S3	Long/Short medium	0	0	0	0	3140,06	2969,2	3024,47	3032,64	2800,04	1419,81	2065,28	6387,24	6084,86	5140,37	3441,10333
Macedonia	S4	Long/Short medium	0	0	0	0	3140,06	2969,2	3024,47	2780,24	2547,64	995,41	1758,88	1433,24	1130,86	186,37	-1512,89667
Montenegro	S1	Long/Short medium	0	0	0	0	-299,5	-608,5	-717,5	-825,4	-903,4	-911,4	-1676,4	-1783,4	-1896,4	-2002,4	-2109,4
Montenegro	S2	Long/Short medium	0	0	0	0	-299,5	-528,5	-590,95	-593,05	-671,05	-679,05	-1444,05	-1551,05	-1664,05	-1770,05	-1877,1
Montenegro	S3	Long/Short medium	0	0	0	0	-299,5	-510,3671	-550,7842	-367,2513	-409,0184	-396,9855	-1011,8526	883,1803	1021,2132	939,2461	855,229
Montenegro	S4	Long/Short medium	0	0	0	0	-299,5	-510,3671	-550,7842	-367,2513	-409,0184	-396,9855	-1011,8526	883,1803	1021,2132	939,2461	855,229
Montenegro '	S1	Long/Short medium	0	0	0	0	-299,5	126,5	17,5	-90,4	-168,4	-176,4	-941,4	-1048,4	-1161,4	-1267,4	-1374,4
Montenegro '	S2	Long/Short medium	0	0	0	0	-299,5	206,5	144,05	141,95	63,95	55,95	-709,05	-816,05	-929,05	-1035,05	-1142,1
Montenegro '	S3	Long/Short medium	0	0	0	0	-299,5	224,6329	184,2158	367,7487	325,9816	338,0145	-276,8526	1618,1803	1756,2132	1674,2461	1590,229
Serbia	S1	Long/Short medium	0	0	0	0	1383,4001	1316,0001	1483,4001	1650,8001	1527,2001	1559,6001	1101,0001	-1644,3999	-2032,7999	-3619,1999	-4084,5999
Serbia	S2	Long/Short medium	0	0	0	0	1383,4001	1316,0001	1529,6001	1697,0001	2705,4001	2737,8001	2279,2001	-466,1999	-854,5999	-2440,9999	-2906,3999
Serbia	S3	Long/Short medium	0	0	0	0	1565,4001	1487,0001	1745,6001	2048,0001	3107,4001	4706,8001	8424,20011	13934,3001	15901,9001	14621,0502	14584,6502