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Enhance Energy Cross-Border Trading in the Balkan Region

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Abstract: A key development in the southeast European energy sector is the agreement between Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Macedonia, Kosovo, Romania, Serbia and Montenegro to develop a regional electricity market. As will be explained benefits would arise from competition and co-ordination in a regional electricity market considering the diverse resources of the countries involved, difference in demand shapes and the possibility for sharing capacity reserves. Benefits would be displayed in the form of lower end-user prices for a given level of system security. In this context, one key issue is the regional electricity balance and potential for cross-border trading between the countries in the region. Under this framework, the concept of a *Balkan Benelux* has been developed regarding regional energy co-operation and views on the western Balkan six (WB6) countries initiative: Albania, Bosnia and Herzegovina, Kosovo, Macedonia, Montenegro and Serbia. This led to the WB6 countries' transmission system operators, national regulatory authorities, energy ministries and power exchanges signing a memorandum of understanding (MoU) on 27 April 2016 (Energy Community, 2016). The MoU signatories agreed to implement day-ahead market integration between the six countries with the aim of achieving market coupling of national day-ahead markets with at least one neighboring WB6 or EU country by July 2018 and cross-border balancing co- operation between the WB6 countries by December 2018. The purpose of this paper is to provide an analysis of cross-border trade in SEE based on economic electricity exchange and to bring together the latest available knowledge on energy developments in the region and provide comprehensive data on energy demand, system characteristics, market integration and cross-border exchange between the Balkan countries challenging. In this framework, the energy crisis gave rise to strengthening market integration and paving the way to decarbonization in the Energy Community as well as in the Balkan Countries. The energy transition continues to unfold in the Contracting Parties in the EU, showing positive trends with regard to boosting renewables, investing into energy efficiency and reducing emissions, even though it was not driven by political or business decisions to phase out coal; (i) Reducing the carbon footprint, (ii) Making the energy market fit for decarbonization (iii) Boosting deployment of renewables (iv) Making energy efficiency the first fuel; (vi) Reaching a decarbonized energy future.

Keywords: cross border; energy transition; generation capacity

1. Literature Review

In Europe, interconnections of electricity systems were seen as backup capacity for ensuring security of supply. The purpose of interconnections was the establishment of an internal energy market (IEM) in the EU as interconnection of electricity systems of EU facilitating the physical exchange of electricity which is a necessary precondition for cross-border trade. As discussed by Meisen and Mohammadi (2010), there are economic and environmental benefits from the interconnection of grids related. Furthermore, Meisen and Mohammadi (2010) suggest that

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interconnections allow planned maintenance outages at generation and transmission facilities to be coordinated so that overall costs and reliability of the interconnected network are optimized. The most important benefit of regional integration, co-ordination, and optimization is the cost saving (Nexant, 2009). The potential economic benefits of the interconnection of power systems (considered either individually or together) include fuel cost savings and avoiding generation capacity costs, operating costs, and costs for transmission system improvements (UN, 2006). Savings in these areas arise largely because the operation of the interconnected system can be optimized for resource utilization in all systems to satisfy load at the lowest possible cost.

As the UN (2006) explains, grid interconnections offer opportunities to reduce generation fuel costs per unit of electricity delivered by allowing generation plants with low fuel costs to run more intensively when facing a flatter load curve. Matsukawa and Mulder (2009) illustrate how power trade across an interconnection affects two wholesale electricity markets during the peak and super peak periods of the Netherlands. Matinga (2005) states that depending on how the capital investment in the interconnection infrastructure itself is designed, the importing country may be spared, or able to defer, the financial burden of the costs associated with new domestic power plants (required for energy, serving peak power needs, or spinning reserves), instead making payments for electricity supplied by the interconnection. As (Zachmann, 2013) observes, there are significant redistributive effects from integration. As the balance between consumers and producers is shifted, certain power plants become redundant, and countries become mutually dependent. Depending on the level of integration, different generation technologies are preferable. While the countries rely on different sources of energy production, they will rely more on sources that provide comparative advantages in a competitive regional market. Bahar and Sauvage (2012) confirm, from an examination of the European electricity market, the importance of cross-border electricity trade in increasing the effective capacity factor of intermittent plants in the context of a growing share of intermittent renewables in the power sector.

2. Energy Balances: Opportunities for Increased Cross-Border Trading in the Balkans

There is a need to understand the geopolitical and geographical aspects within which the SEE countries operate economically, but also to define and evaluate in an objective manner the major policy challenges of the energy sector in the region. The main challenge in this section is to bring together the latest available knowledge on energy developments in the region and provide comprehensive data on energy demand, system characteristics, market integration and cross-border exchange between the Balkan countries. The section also assesses the status of the energy market and provides insight on future developments. In the framework of regional integration in SEE where the development of economic relations and co-operation is based on mutually beneficial policies, the energy sector would serve as their common denominator. Energy data for the region, as shown below and that include primary energy supply for each country, are of interest in order to understand the region's diverse energy outlook. As mentioned above, geographical aspects affect national energy systems. Given its geopolitical location in the middle of energy transportation routes, the Balkan region can be considered a transit location between Europe and other energy resource-rich regions. Although the area is reach in terms of water and forest resources, the Balkan countries are not considered rich in terms of energy resources or power generation technology, especially when compared with the major suppliers of oil and gas to central and western Europe — the countries in the Caspian basin, the Middle East, and North Africa (IEA, 2008). On the other hand, these countries have increasing power and energy demand that should be balanced with cost-

effective, reliable, and long-term resources. The same applies to the whole southeast Europe region, which is a significant importer of natural gas and oil, and electricity in some countries (IEA, 2008; Hroneska, 2014). This places these countries at a disadvantage in terms of natural gas import prices. However, as will be observed below, some countries are able to expand their electricity production beyond domestic needs, making them net energy exporters. The benefits that can be achieved by a joint pool in terms of regional least cost capacity expansion are further analyses in the following section. There is generally a lack of economic analysis of the effects of increased competition and market integration in the western Balkans, which have yet to be fully exploited. Furthermore, the infrastructure for cross-border electricity exchange is a significant bottleneck, although several new transmission projects will alleviate this over time. Consequently, there are significant benefits that can be derived from further integration of the national electricity markets in SEE by removing transmission constraints and administrative and physical barriers to cross-border electricity exchange. Moreover, the benefits of market integration increase with the amount of renewable energy in the system. If renewable electricity generation doubles from current levels, the efficiencies increase disproportionally (IRENA, 2014), so the ambitious European renewable targets justify greater cross-border transmission capacity. In this context, limiting market integration to regions with similar renewable production patterns means missing out on substantial trading benefits. Natural gas and oil-bearing regions are generally outside Europe and the SEE region. The EU is an importer of all forms of energy and looking to transport energy through the SEE countries (IEA, 2008; Yuecekaya, 2012). Implementation of the Trans Adriatic Pipeline (TAP) would fulfil this role, transporting Caspian natural gas to SEE, as illustrated in the following picture. TAP will ensure diversification for these markets and create a more competitive environment. Connecting with the Trans Anatolian Pipeline (TANAP) at the Greek-Turkish border, TAP will cross northern Greece, Albania, and the Adriatic Sea before arriving onshore in southern Italy to connect to the Italian natural gas network.

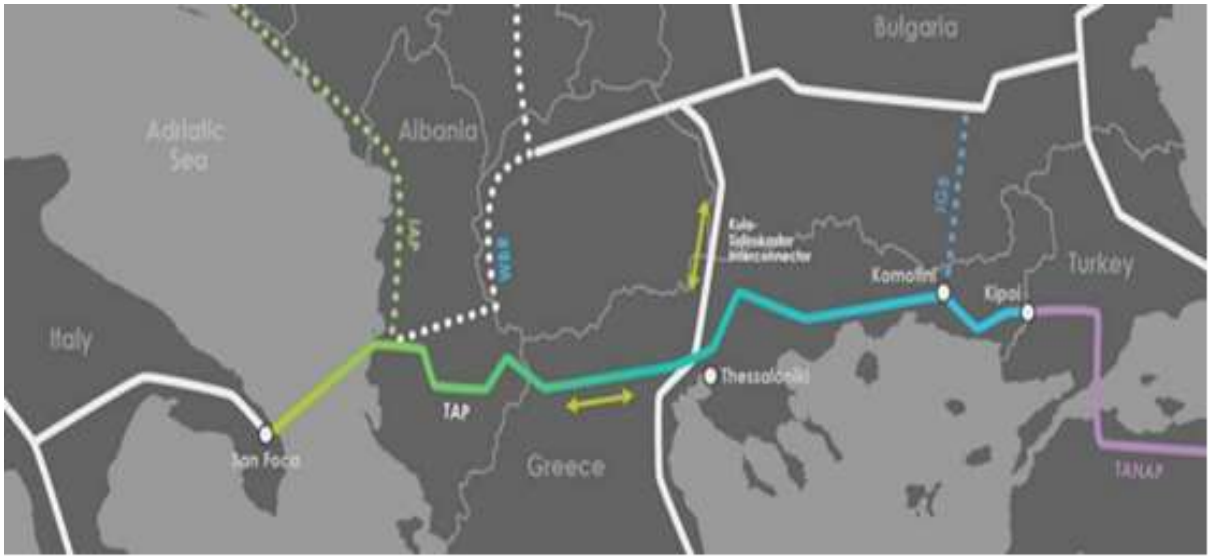

Figure 1. Map of the Trans Adriatic Pipeline (TAP) and its connection to Europe's NG network
Source: https://www.tap-ag.com/the-pipeline/the-big-picture

SEE countries possess substantial reserves of coal or lignite. Studies on the construction of thermal power plants in the region have so far given priority to plants using local cheap coal or lignite due to reliability of supply and lower generation costs (Viskovic and Franki, 2015; Lucquiaud and Gibbins, 2011). The main objectives and scope of this paper include establishing a strategy to develop energy trade among the Balkan countries and determining the trade-offs between imports/exports of

electricity relative to domestic generation. In April 2016, representatives from transmission system operators, national regulatory authorities and energy ministries and power exchanges from the western Balkan 6 countries signed a memorandum of understanding (MoU) setting out the general principles for co- operation and concrete actions to develop the regional electricity market (Energy Community, 2016). In this MoU, the six countries agreed to enhance market integration of the WB6 region through coupling national day-ahead markets with at least one neighboring WB6 or EU country by July 2018, and cross-border balancing co-operation between the WB6 countries by December 2018. Harmonizing such rules, with significant redistributive effects for market participants, is generally required to strike stable arrangements. The energy sector is highly politicized in all countries and private organization of cross-border markets is politically constrained. The following section describes the national energy balances in the Balkans, i.e. demand and supply capacities, exports and imports, and opportunities for increased regional power exchange in the region. We will review the benefits arising from comparative advantages in an integrated market in the following section. The SEE region boasts diverse sources for power generation, the two main types being thermal and hydro. The collection of data focused on establishing an overview of the potential country resources and to prepare energy balances for each country taking current production, exports, imports and consumption into account.

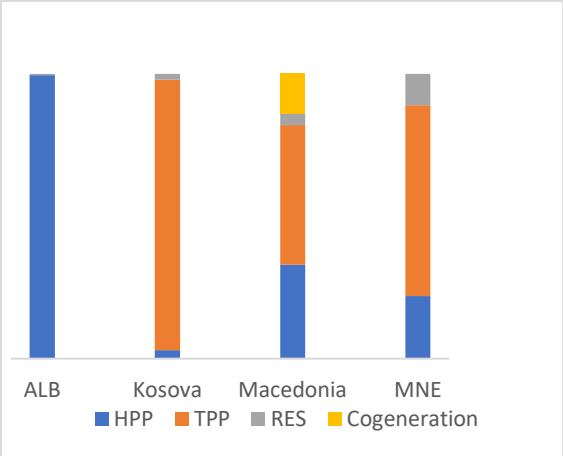

Figure 2. Energy Production for the Countries Under Study
Source: Authors own elaboration

These countries of the Balkan region boast diverse sources for power generation, the two main types being thermal and hydro. Thermal electricity generation dominates in almost all the countries, making the whole region largely dependent on this source of energy. Hydropower plants dominate in Albania but constitute a very small percentage of power supply in Kosovo. Figure shows a more detailed picture regarding the different technologies and primary energy sources used for producing electricity. This indicates that these countries rely on different fuels for electricity production. In creating a common integrated between Albania, Kosovo, North Macedonia and Montenegro. As the SEE energy sector outlook (2015) states, the electricity sector and its further expansion constitute the backbone of the region's economic and energy development. Moreover, the regional electricity mix is diverse as the primary fuel for power generation varies considerably from country to country. In the western Balkans, hydropower and coal (i.e. lignite) form the basis for power generation, with Albania relying almost 100% on hydro while Kosovo depends 100% on lignite. Considering all the potential sources for power generation in Kosovo, the lignite mines are operated at one of the most favorable lignite deposits in Europe due to its geological conditions. With an average stripping ratio of 1.7 m^3 of waste to 1 ton of coal, lignite production at Kosovo mines can

supply very competitive fuel to the power plants compared with international fuel sources and energy prices (ESI, 2002, pp. 1). The other countries operate on a mix of oil, gas, and lignite. Lignite is also a strategic and dominant energy source for Serbia and Macedonia, where the open-cast mines contribute to the countries' stable and secure energy supply. Local and comparatively cheap lignite, therefore, remains one of the main fuels for power generation in current long-term SEE development plans.

Table 1. Electricity Profile of Cross-border Countries (2021) (Production, Consumption, Imports, Exports)

Country	Production (TWh)	Demand (TWh)	Imports (TWh)	Exports (TWh)
Albania	**8.9**	**8.41**	**2.25**	**2.8**
Kosovo	**6.2**	**6.9**	**1.3**	**0.8**
Macedonia	**5.2**	**7.9**	**2.6**	**0.4**
Montenegro	**3.4**	**3.6**	**0.5**	**0.6**

Source: Authors own elaboration

The Albanian electrical energy system bases the production of electrical energy on sources hydro, where during rainy periods it manages to export electricity and during dry periods of the year it imports electricity to cover the demand in the country the profile of production in our country does not always coincide for the same periods with the consumption profile in country, as well as the diversification of energy generating sources would contribute positively electric energy. It is evident that most of the countries are net importers due to consumption being higher than domestic generation. Kosovo is integrated with the Albanian market within 2022 with the launch of ALPEX where OST and KOSTT are the shareholders (already one control area). Main source of electricity from two ageing lignite plants. The state utlilty, KEC, provides close to 100% of the generation. Government's National Action Plan state growth targets to 2031 of 1400MW, these required to replace worn down thermal plants of Energy Community Secretariat report ~300 MW to 2030.

- **Albania**

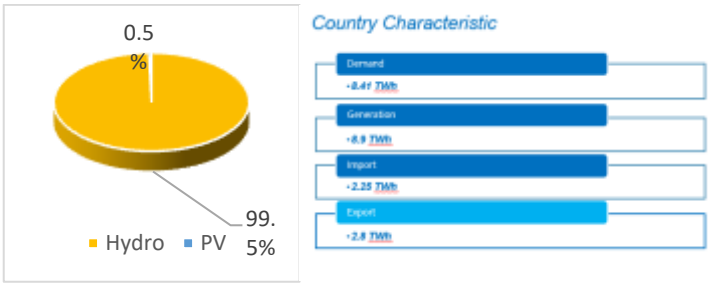

Figure 2. Albania Country Characteristic
Source: Authors own elaboration

- **Kosovo**

Figure 3. Kosovo Country Characteristics
Source:Authors own elaboration

- **North Macedonia**

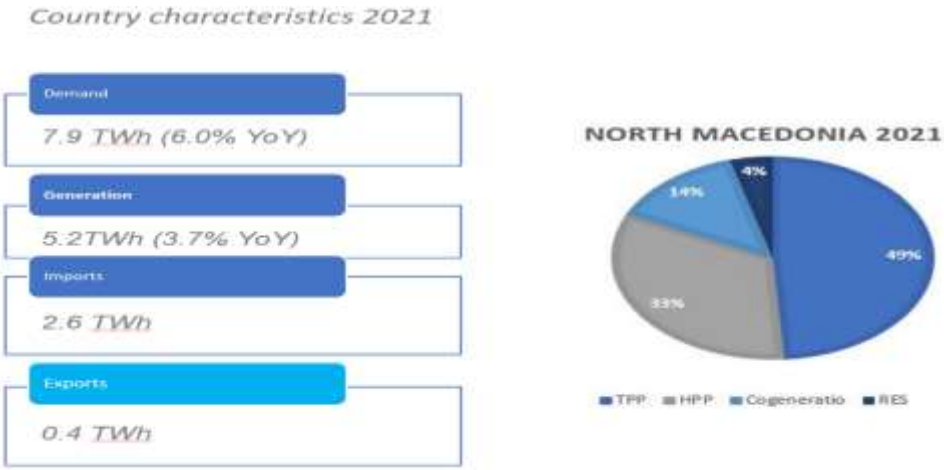

Figure 4. Macedonia Country Characteristic
Source: Authors own elaboration

North Macedonia is the most advanced country in the Balkans to have liberalized industrial consumers. Majority of energy mix is thermal, but 20-40% hydro. State utility Bitola TPP operates 60-80% of the generation. Macedonia is the first country in the region to be party of Energy Community Treaty committing to a date for coal phase out. Initially by 2027, but delayed to 2030 due to Rusian invasion to Ukraine. There is a strong commitment to implement EU ETS by 2031, in light of EU membership as well as a Strong committment to RES deployment. The new interconnection line North Macedonia and Albania in the future plans toward market coupling with Serbia, Bulgaria and Montenegro. Government's National Action Plan growth targets to 2030 is 800MW supported by the Energy Community Secretariat.

- Montenegro

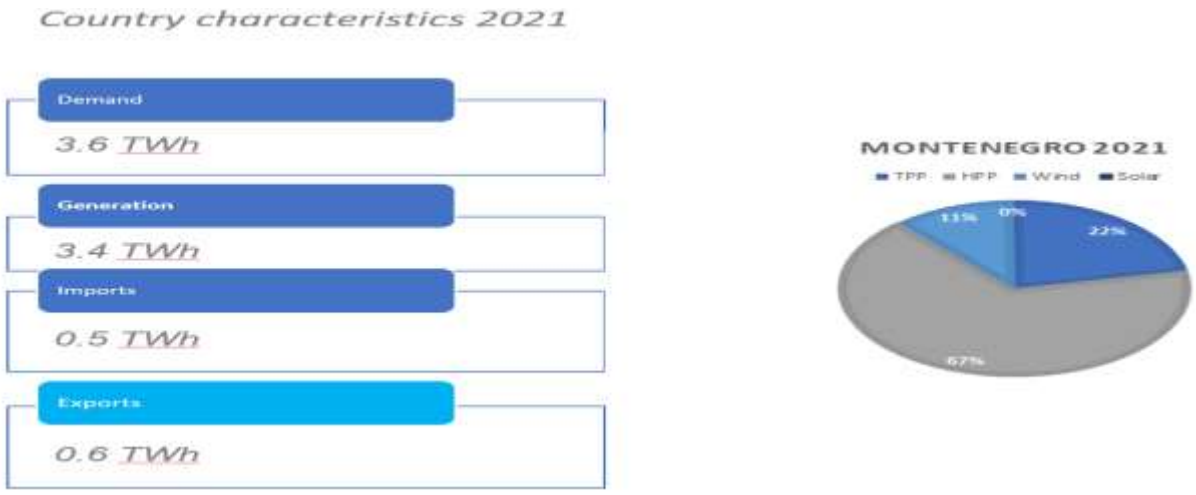

Figure 5. Montenegro Country's Characteristics
Source: Authors own elaboration

Montenegro is a very small market with only 285 000 customers, but a very important transit country due to the MONITA cable and its extension plans. Most of the energy produced from a cascade of hydroplants owned by the state utility EPCG.Montenegro generation mix has already a sizeable share of solar, exeeded its own RES target. The ddecommission of coal was delayed due to security of supply but strongly committed to decarbonize. Montenegro is the only WB country to have fully implemented the EU ETS system legal and regulatory framework. According to the Government's National Action Plan growth target to 2030 is 500MW the same has been reported from the Energy Community Secretariat reports the same. There are Continuous debates on construction of new gas units under the Ionian Adriatic Pipeline Project, Impacting of market coupling with Serbia and Italy under the Trans-Balkan Corridor (Romania-Serbia-BiH-Montenegro-Italy) through MONITA. According to Energy Community Annual Report, 2021 the Western Balkan countries have made significant progress towards establishing a competitive and integrated electricity market. With exception of Bosnia and Herzegovina, and Serbia, the economies have transposed most EU legislation related to establishing an independent transmissions system operator (TSO) and independent distribution systems. In this context, still remaining obstacles in unbundling tend to be with functional implementation.

4. Regional Cross Border Benefits

Based on differences in available resources, the generation mix and pooling of reserves, these countries could benefit from the creation of an interconnected pool. A strong interconnected grid is one of the preconditions for efficient cross-border power exchange. In this context, the least cost solution to meet demand during a certain hour is to start with the cheapest generation sources (wind, solar power, run-of-river hydro and nuclear), then call on other units by merit order based on increasing marginal cost. The overall regional generation cost will then be lower when dispatching over a broader and more diversified portfolio of plants, achieved by cross-border power trade. There are economic and environmental benefits from the interconnection of grids related to: (i) improving reliability and pooling of reserves – the amount of reserve capacity can be reduced by sharing reserves in an interconnected network, (ii) Reducing investment in generating capacity: total investment costs are reduced by sharing and better utilization of generation resources in an interconnected system, (iii) Improving the load factor and increasing load diversity: Power demand is levelled over time, systems operate most economically (iv) Economies of scale in new construction: sharing resources in an interconnected system can allow

for the construction of larger facilities with lower unit costs. (v) Environmental dispatch and new plant siting: interconnections can allow generation units with lower environmental impacts to be used more often while units with higher impacts are used less. (vi) Co-ordination of maintenance schedules. Interconnections allow planned maintenance outages at generation and transmission facilities to be coordinated so that overall costs and reliability of the interconnected network are optimized. The most important benefit of regional integration, co-ordination, and optimization is the cost saving. The potential economic benefits of the interconnection of power systems (considered either individually or together) include fuel cost savings and avoiding generation capacity costs, operating costs, and costs for transmission system improvements. A major incentive to pursue power system interconnection is thus to avoid costs for new generation through a combination of replacing domestic capacity with capacity from power imports, a reduction in power plant siting costs, economies of scale in generation, a flattening of the load curve and related capacity trade-offs between countries, through a reduction of the required reserve margin. In a country that imports electricity, grid interconnection can result in reduced capital costs of electricity generation capacity by displacing the need for new domestic capacity. Additional economic benefits accrue through interconnection resulting from operating costs and transmission system improvements. There are variable cost and fixed operating cost savings, related primarily to the use of an interconnection that reduces the need for capacity additions. The interconnection may be able to serve towns and cities in border regions through or near which the interconnection will pass more easily than service can be provided from the main power grid of the countries, so the grid interconnections would reduce the need for national investments in transmission system improvements. As regards the above-mentioned cost savings, the interconnection allows for the dispatch of the cheapest generation units within the interconnected area, providing an overall cost saving that can be divided among the component systems. Alternatively, it allows inexpensive power from one system to be sold to systems with more expensive power. Additional economic benefits accrue through interconnection resulting from operating costs and transmission system improvements. There are variable cost and fixed operating cost savings, related primarily to the use of an interconnection that reduces the need for capacity additions. Furthermore, the interconnection may be able to serve towns and cities in border regions through or near which the interconnection will pass more easily than service can be without interconnection. Grid interconnections, and particularly interconnections between countries with varied resources, offer the option of sitting power plants where generation resources will be cheapest and to transport power from those areas to load centers. In any power system a “load curve” describes the relationship between the power supplied to meet overall demand in the system in any hour in a year. With an interconnection, the areas joined may be different with respect to the mix of consumers and/or timing of peak demand. This results in a “flattening” of the load curve – an overall reduction in the ratio of annual peak hours to non-peak hours. Taking into consideration the above-mentioned cost savings, the interconnection allows for the dispatch of the cheapest generation units within the interconnected area, providing an overall cost saving that can be divided among the component systems. Alternatively, it allows inexpensive power from one system to be sold to systems with more expensive power. Cross-border electricity trade can enable countries to gain access to more flexible power plants located in a wider geographical area, which can then reduce the costs of balancing power due to increased RES generation. Generation from some RES technologies, however, such as those based on intermittent wind and solar energy, can vary considerably over short periods of time, and thereby introduce instability in the power system. The risk of instability increases with higher shares of intermittent power sources connected to the electricity grid. Different methods have been used to deal with this intermittent problem. Cross-border electricity trade appears to be one of them as it enables countries to gain access to a more diverse portfolio of plants, producing over a wider geographic area.

5. Conclusions

In this article we showed the potential of the integration of the countries sharing common border within the Balkan region. In this paper a descriptive analysis is made in order to observe the characteristics related to power sources and production of the whole SEE region. The rationale for this is to understand and highlight the differences in resource endowments in these countries and bring together the latest available knowledge on energy developments in the region. Moreover, this paper provides comprehensive data on energy demand, generation, exports and imports for the six Balkan countries. In order to assess the importance of the creation of a common market in the SEE region, an analysis of regional co-operation with cross-border trade based on economic. The creation of a regional electricity market between four countries in the Balkan region – Albania, Kosovo Macedonia and Montenegro, as well as analyzing energy exchanges between these four countries and potential benefits associated with operating the power systems as an interconnected pool. rationale for this is to understand and highlight the differences in resource endowments in these countries and bring together the latest available knowledge on energy developments in the region. Cross-border electricity trade can enable countries to gain access to more flexible power plants located in a wider geographical area, which can then reduce the costs of balancing power due to increased RES generation.

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