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Gap analysis of the power transmission infrastructure in the Western Balkans

Final Report

January 2026

Technical Assistance to Connectivity in the Western Balkans 2 (CONNECTA 2) - NEAR/2022/EA-RP/0081

Implemented by MOTT MACDONALD in consortium with COWI

Issue and revision record

Revision	Date	Originator	Checker	Approver	Description
0	Dec 2025	Admir Shala, Milos Golubovic, Nenad Jovanovic, Astrit Saraqini, Adnan Elshani.	Admir Shala	Ole Johansen	Draft for comments
1	Jan 2026	Admir Shala, Milos Golubovic, Nenad Jovanovic, Astrit Saraqini, Adnan Elshani.	Admir Shala	Ole Johansen	Final

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List of Abbreviations

AMI	Advanced Metering Infrastructure
BESS	Battery Energy Storage Systems
CGES	Crnogorski elektroprenosni sistem (TSO in Montenegro)
CACM	Capacity Allocation and Congestion Management Guideline
DA/ID	Day-Ahead / Intraday market coupling
CONNECTA 2	Technical Assistance to Connectivity in the Western Balkans 2
DLR	Dynamic Line Rating
(E)HV	(Extra) High Voltage
EIA	Environmental Impact Assessment
EMS	Elektromreža Srbije (TSO in Serbia)
ESIA	Environmental and Social Impact Assessment
ENTSO-E	European Network of Transmission System Operators for Electricity
EB GL	Electricity Balancing Guideline
FCA	Forward Capacity Allocation
KOSTT	Kosovo Operatori i Sistemit, Transmisionit dhe Tregut te energjise elektrike
HVDC	High Voltage Direct Current
NECP	National Energy and Climate Plan
NEMO	Nominated Electricity Market Operator
NOS BiH	Nezavisni Operator Sistema BiH
OHL	Overhead Line
OPGW	Optical Ground Wire
OST	Operatori i Sistemit te Transmetimit (TSO in Albania)
PPE	Personal Protective Equipment
PSHPP	Pumped Storage Hydro Power Plant
PyPSA	Python for Power System Analysis
RES	Renewable Energy Sources
RCC	Regional Coordination Centre
SCADA	Supervisory Control and Data Acquisition
SECI	Southeast Europe Cooperation Initiative
TYNDP	Ten-Year Network Development Plan
TSO	Transmission System Operator
T&D	Transmission and Distribution
SOR	System Operation Region

SYNOPSIS

Project Title:	Technical Assistance to Connectivity in the Western Balkans - 2
Project Number:	NEAR/2022/EA-RP/0081 (CONNECTA 2)
Contract Number:	2023/448-046
Contracting Authority:	European Commission, DG NEAR
Beneficiaries:	Albania, Bosnia and Herzegovina, North Macedonia, Montenegro, Serbia and Kosovo (under UNSCR1244 and the ICJ Opinion on the Kosovo Declaration of Independence)
Region:	South Eastern Europe (SEE)
Contractor:	Mott MacDonald Romania Srl in Consortium with COWI A/S
Contract Signed:	17 November 2023
Full Mobilisation of 3 KE:	07 December 2023 (date of Kick-off Meeting in Brussels)
Project Duration:	48 months
Anticipated Completion:	17 November 2027
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1 Executive summary

The Western Balkans power system is undergoing a rapid and complex transition driven by rising electricity demand, accelerated renewable energy deployment, and the need to modernise ageing transmission infrastructure. The region's installed capacity of power plants now exceeds 19.8 GW, with Serbia and Bosnia and Herzegovina accounting for the largest shares. While thermal and hydro generation still dominate, the expansion of solar and wind is reshaping system dynamics, yet data on small scale RES remains fragmented, complicating planning and operational coordination. The integration of smart-grid technologies is progressing unevenly: SCADA/EMS systems are fully established, and OPGW deployment is widespread at EHV levels, but advanced solutions such as Dynamic Line Rating and demand-side management remain at an early stage.

Electricity storage capacity is currently limited to two pumped storage plants (1,034 MW), with no utility scale BESS in operation. However, significant storage additions are planned by 2030 particularly in Serbia, Kosovo, and Montenegro and further PSHPP capacity is expected by 2040. These storage investments are essential for balancing variable RES, ensuring frequency stability, and supporting peak-load management. Demand is projected to grow from 82.8 TWh in 2030 to nearly 92.8 TWh by 2040, with peak load increasing by 1 GW, further stressing an already constrained transmission network.

The region's grids face substantial challenges. Many 110 kV and 220 kV assets are outdated, redundancy is limited, and N-1 criteria are frequently unmet. The analyses for 2030 and 2040 reveal persistent and emerging bottlenecks along key corridors notably on the Greece - North Macedonia, Bulgaria - Serbia, and Bosnia and Herzegovina internal network routes driven by high cross border power flows and growing RES clusters. N-1 violations are expected to worsen without timely investments, especially around the Albania - Greece interface and the Bosnia and Herzegovina northbound corridors.

To address these issues, a set of priority transmission developments is proposed, including reinforcement of the Serbia - Bulgaria interconnection, refurbishment of major Greece - North Macedonia 400 kV lines, upgrading critical 220 kV corridors to 400 kV in Bosnia and Herzegovina, and constructing a new Greece - Albania interconnection. These projects align with national TYNDPs and ENTSO-E's strategic objectives, providing a targeted pathway to enhance reliability, support higher RES penetration, and strengthen regional integration within the evolving European energy landscape.

The Initial Environmental and Social Examination (IESE) identified key risks for the proposed transmission projects, particularly biodiversity impacts, river-crossing sensitivities, and land-acquisition challenges. Several corridors intersect protected areas, migratory bird routes, and high-value agricultural land, requiring measures such as micro-routing, bird diverters, and strict construction controls. Cross-border coordination will also be essential. Integrating these findings into the capacity analysis ensures that planned grid upgrades account for environmental constraints, social acceptance, and climate-related risks that may affect feasibility and implementation timelines.

Electricity demand across the Western Balkans is projected to rise sharply, from around 82.8 TWh in 2030 to 92.8 TWh by 2040, driven by economic expansion, electrification and changing consumption patterns. Peak demand is expected to approach 18 GW by 2040, reinforcing the need for substantial new generation, stronger transmission corridors and enhanced system flexibility. The region's generation mix is undergoing fundamental transformation: renewables will supply nearly 70% of total electricity by 2030 and 74% by 2040, with hydropower remaining central and considering a rapid growth in wind and solar, particularly in Serbia, Bosnia and Herzegovina, Albania and North Macedonia. Despite this shift, several countries will continue to rely on must-run coal capacity during winter, even as neighbouring markets increase exports through low-cost renewable generation.

Energy storage will become a critical enabler of system stability, with battery capacity expected to grow from 170 MW in 2030 to almost 1 GW by 2040, led by Serbia, Montenegro and North Macedonia. Nevertheless, balancing markets remain fragmented, with limited cross-border coordination, low Net

Transfer Capacities and insufficient reserve-sharing mechanisms. Price trends[1] indicate falling average electricity prices from ~€100/MWh in 2030 to ~€65/MWh in 2040 yet volatility will rise sharply, with zero-price hours increasing due to high renewable penetration. Demand response remains negligible across the region, constrained by outdated grid codes, limited digitalisation and a lack of aggregator frameworks.

The region faces structural challenges: ageing assets, grid congestion, low smart-meter penetration, and insufficient deployment of advanced grid technologies such as Dynamic Line Rating, Wide Area Monitoring and digital substations. Demographic decline across all six countries will further affect long-term demand growth and labour availability. While transmission investments are progressing, they remain largely reactive and insufficiently coordinated regionally. Strategic priorities include expanding high-voltage networks, accelerating RES integration, implementing coordinated balancing markets, scaling BESS deployments and strengthening smart-grid capabilities. Legal and regulatory reforms are urgently needed to define demand-side participation, enable storage integration and align market operations with EU electricity market rules. Coordinated planning, regional cooperation and proactive investment are essential to ensure a secure, flexible and decarbonised electricity system by 2040.

The regulatory and policy frameworks[2] governing electricity transmission in the Western Balkans partners; Albania, Bosnia and Herzegovina, Kosovo, Montenegro, North Macedonia, and Serbia show partial alignment with the EU's Clean Energy Package and the Energy Community's Electricity Integration Package (EIP). Efforts focus on regional market and grid integration, renewable energy deployment, and energy storage development.

All Western Balkans partners have committed to climate neutrality by 2050, reinforced through the 2022 Declaration on Energy Security and Green Transition. However, transposition of the EIP is delayed: only Serbia and N. Macedonia have made major amendments to primary legislation, while other countries are lagging. Secondary legislation is only partially aligned, with key gaps including regional coordination centres (RCCs/CCRs), EU-wide methodologies (TCMs), balancing market reforms, and cross-zonal capacity rules; the 70% minimum cross-zonal capacity requirement is transposed only in Serbia, but full implementation is yet to come.

Day-ahead markets operate in Albania, Montenegro, North Macedonia, and Serbia through designated NEMOs, but full regional coupling and intraday integration are incomplete. Renewable energy integration is moderately supported, with transposed grid connection codes, priority access, and eased connection conditions, though advanced methodologies for flexibility, curtailment compensation, and cost allocation remain missing.

Energy storage regulation is uneven: absent in Bosnia and Herzegovina, minimal in Albania and Kosovo, and more advanced in Montenegro, North Macedonia, and Serbia, though secondary legislation still limits practical market participation.

Overall, Western Balkans partners have established a foundation for competitive electricity markets, but full EIP compliance, essential for integration into the EU internal electricity market, requires further legislative updates, stronger regional coordination, and accelerated implementation of market, grid, and flexibility mechanisms.

Transmission infrastructure in the Western Balkans faces a range of investment, technological, regulatory, climate, and social risks. Key challenges include administrative and permitting delays, reliance on international financing, macroeconomic volatility, and cross-border coordination difficulties. Technological uncertainties arise from limited energy storage, uneven digitalisation, and cybersecurity vulnerabilities, while incomplete transposition of EU energy legislation and variable regulatory capacity present policy risks. Climate and environmental pressures, such as extreme weather, flooding, erosion, and wildfire affect lines, substations, and corridors, compounded by potential land acquisition conflicts,

[1] Including carbon prices of 113.4 €/ton in 2030 and 147 €/ton in 2040 as per IEA 2022 used in ENTSO-E TYNDP 2024

[2] The analysis and the assessment refer to the status as of 30th April 2025

economic displacement, and impacts on vulnerable communities. Mitigation measures focus on harmonised permitting, climate resilient design, predictive maintenance, digitalisation upgrades, environmental protection, early land screening, inclusive stakeholder engagement, and financial risk sharing strategies to ensure resilient and socially responsible project implementation.

2 Capacity Analysis

2.1 Key Findings

2.1.1 Power Generation Capacity

The region's total installed capacity exceeds 19.8 GW, with Serbia and Bosnia and Herzegovina accounting for the largest shares. While thermal and hydro still dominate, RES deployment is accelerating, particularly in solar and wind. However, public data on smaller-scale RES remains fragmented and incomplete, complicating network planning.

2.1.2 Transmission Infrastructure

The transmission networks vary significantly in condition and configuration. Aging 110 kV and 220 kV assets, limited redundancy and inadequate N-1 reliability are widespread. While 400 kV corridors are being strengthened, major investments are still needed to relieve existing and expected bottlenecks.

2.1.3 Smart Grid Integration

All countries operate SCADA/EMS control systems and are making gradual progress in other areas, such as OPGW deployment (widespread) or substation digitalisation. However, advanced technologies like Dynamic Line Rating (DLR) are scarcely implemented (only one 110 kV line in Serbia currently) and demand-side management capabilities remain limited. Advanced metering infrastructure (AMI) rollout is uneven across the Western Balkans partners.

2.1.4 Electricity Storage

The current storage capacity is limited to two operational PSHPPs: Bajina Bašta (614 MW) in Serbia and Čapljina (420 MW) in Bosnia and Herzegovina. There is no utility-scale BESS operational as of 2025. However, planning is underway:

- PSHPP pipeline (by 2040):
    - Moglicë (Albania, up to 800 MW),
    - Bistrica (Serbia, 646 MW),
    - Čebren (North Macedonia, 330 MW);
- BESS pipeline (by 2030):
    - Kosovo: 45 MW (TSO), 125 MW (private).
    - Serbia: 650 MW / 1,300 MWh (linked to RES obligations).
    - Montenegro: 120 MW / 240 MWh (feasibility stage).
    - North Macedonia: 52 MW / 104 MWh (private investment).
    - Other countries (Albania, BiH): plans are less advanced.

Electricity storage is increasingly recognised as critical for system balancing, RES integration and frequency control. Despite their net energy consumption, PSHPP and BESS greatly enhance the value and flexibility of electricity by shifting supply to high-demand periods.

2.1.5 Demand Growth

Regional electricity demand is projected to increase from ~82 TWh in 2030 to nearly 92.8 TWh by 2040, with a corresponding peak load increase from 15.1 GW to 18 GW. This growth, coupled with higher RES penetration, will stress the existing transmission systems unless reinforced.

2.2 Overview of the existing Infrastructure

2.2.1 Power Generation Capacities

The Western Balkans region possesses a diverse energy mix, with a significant reliance on coal-fired power plants. However, there is a growing focus on integrating renewable energy sources (RES), driven by decarbonization targets and the need to address climate change. The shift towards RES is evident in the increasing number of wind and solar power plants being developed across the region.

A summary of power generation capacities is presented in the table below. Note that the thermal power plant category also includes all other power plants that use fossil fuels as the main source (gas power plants, combined heat and power, etc.), and hydro power plants include pumped hydro storage.

Table 2-1: Western Balkans partners power generation capacity per country and technology (MW)

	Thermal	Hydro	Wind	Solar	Total
ALB	0	2,628	0	48	**2,676**
BIH	1,888	2,158	135	30	**4,210**
MNE	225	649	118	0	**992**
MKD	1,310	645	72	506	**2,533**
SRB	4,279	3,110	607	30	**8,026**
KOS	1,147	87	137	11	**1,383**
Total	**8,849**	**9,277**	**1,069**	**625**	**19,820**

2.2.2 Smart grid and Energy storages

The analyses referring to the existing infrastructure in this area covered the following components:

- **Smart Grid Implementation** Development and integration of RES at large scale, including BESS installations, together with the strategy towards decarbonization of the electricity industry, triggered a fundamental transformation of power systems. "Smart grids" encompass all technological improvements that support this transition while reducing the need for costly new grid infrastructure.
- **Grid Automation and Control:** All regional power systems have their own well-equipped and fully operational control centres with SCADA/EMS systems that are regularly upgraded.
- **Digitalisation (OPGW):** Regional EHV networks are almost completely equipped with OPGW, but going down to lower HV voltage levels this percentage reduces.
- **Dynamic Line Rating (DLR):** While there are plans to implement DLR to increase available capacity based on real-time meteorological conditions, in practice it is currently implemented at only one 110 kV OHL in Serbia.
- **Advanced Metering Infrastructure (AMI):** Implementation is vital for better utilisation of existing capacities and facilitating distributed generation, but current progress varies by country.

- **Energy Storages** All existing electricity storages in the Western Balkans region are owned by the generation incumbents and are exclusively Pumped Storage Hydro Power Plants (PSHPPs). There are no utility-scale BESS operational so far, although plans exist.
- **Existing PSHPP:** PSHPP Bajina Bašta in Serbia (614 MW) and PSHPP Čapljina in BiH (420 MW).
- **Planned PSHPP (by 2040):** Moglicë in Albania (up to 800 MW), Bistrica in Serbia (646 MW) and Čebren in North Macedonia (330 MW).

Table 2-2 – Overview of PSHPP capacities

	2025 MW	2030 MW	2040 MW
Albania	0	0	800
Bosnia & Herzegovina	420	420	420
Kosovo	0	0	0
Montenegro	0	0	0
North Macedonia	0	0	330
Serbia	642	614	1,260
TOTAL	**1,062**	**1,034**	**2,810**

- **Battery Energy Storage Systems (BESS):** Currently, there are only small installations in distribution networks. However, national plans are evolving:
  - **Kosovo:** The KOSTT TYNDP clearly plans for TSO-owned BESS (45 MW / 90 MWh) and private installations (125 MW / 250 MWh).
  - **Serbia:** EMS TYNDP indicates significant new BESS installations (estimated 650 MW / 1,300 MWh) due to legal requirements for large RES producers.
  - **Montenegro:** Estimations for 120 MW / 240 MWh based on EPCG decisions.

Table 2-3 – Overview of BESS capacities

	2025		2030		2040	
	TSO MW/MWh	Others MW/MWh	TSO MW/MWh	Others MW/MWh	TSO MW/MWh	Others MW/MWh
Albania	0	0	0	0	TBD	TBD
Bosnia & Herzegovina	0	0	0	0	TBD	TBD
Kosovo	0	0	45/90	125/250	TBD	TBD
Montenegro	0	0	0	120/240	TBD	TBD
North Macedonia	0	0	0	52/104	TBD	TBD
Serbia	0	0	0	650/1,300	TBD	TBD
TOTAL	**0**	**0**	**45/90**	**947/1,894**	**TBD**	**TBD**

2.2.3 Transmission network

The Western Balkans transmission network comprises a network of high-voltage transmission lines and substations, facilitating the transfer of electricity from generation sources to load centres. However, the network faces challenges in accommodating the anticipated significant growth of RES and ensuring grid

stability. Moreover, the issue of aging 110 kV and 220 kV transmission infrastructure is present throughout the region.

Table 2-4 – Summary of the transmission network in Western Balkan partner´s

Country	Voltage Level	Number of Lines	Total Length of Lines (km)	Number of Substations
Albania	110 kV	101	2,126	72
	220 kV	11	578	11
	400 kV	9	848	15
	Total	**121**	**3,552**	**98**
Bosnia and Herzegovina	110 kV	179	4,225	133
	220 kV	25	1,167	32
	400 kV	11	833	17
	Total	**215**	**6,225**	**182**
Kosovo	110 kV	81	1,554	76
	220 kV	17	741	21
	400 kV	4	308	7
	Total	**102**	**2,603**	**104**
Montenegro	110 kV	61	1,018	58
	220 kV	6	198	7
	400 kV	4	317	8
	Total	**71**	**1,533**	**73**
North Macedonia	110 kV	87	1,906	64
	400 kV	10	667	14
	Total	97	2,573	78
Serbia	110 kV	270	7,268	276
	220 kV	48	2,360	65
	400 kV	31	2,497	44
	Total	**349**	**12,125**	**385**
Total	**110 kV**	**779**	**18,097**	**679**
	220 kV	**117**	**5,044**	**150**
	400 kV	**69**	**5,470**	**105**
	Total	**965**	**28,611**	**934**

A country-specific network overview, based on the available information referred to within this study is as follows:

- **Albania:** Operated by OST, the network connects to Montenegro, Kosovo, and Greece. Major corridors include the North-South corridor and the Tirana Ring. The network is generally in good condition, but faces challenges with N-1 reliability and aging 110 kV infrastructure.
- **Bosnia and Herzegovina:** Operated by transmission system company Elektroprenos BiH, with NOS BiH as the independent system operator. The 400 kV level is the backbone, reinforced by 220 kV lines connecting to Croatia, Serbia, and Montenegro. Key challenges include the need to replace aging 110 kV equipment from the 1960s/70s and managing the integration of growing RES in the south.

- **Kosovo:** Managed by KOSTT, the network is well-developed with 400 kV interconnections to Albania, Serbia, Montenegro, and North Macedonia. It is undergoing modernization to meet growing demand and integrate renewables, with specific focus on meeting N-1 security criteria.
- **Montenegro:** Managed by CGES. The 400 kV network includes the strategic HVDC submarine link to Italy (600 MW operational). Modernization is needed for aging 110 kV infrastructure and to handle RES integration, particularly wind farms.
- **North Macedonia:** Operated by MEPSO. The network features a strong 400 kV backbone interconnecting with Greece, Bulgaria, Serbia, and Kosovo (with Albania under construction). Priorities include upgrading aging lines and enhancing cross-border trade capacity.
- **Serbia:** Managed by EMS. This is a central network in the region with interconnections to eight neighbours. The focus is on the 400 kV Trans-Balkan Corridor, new interconnections with Romania and Hungary, and smart grid implementation.

2.3 Overview of the planned developments

ENTSO-E TYNDP 2024 and its Relevance to the Western Balkans

The ENTSO-E Ten-Year Network Development Plan (TYNDP) 2024 is a crucial document for the development of the European electricity transmission network. A core component of this process is the "Identification of System Needs" (IoSN) study, which provides a systematic, top-down assessment of the infrastructure required to meet Europe's energy and climate goals. The TYNDP process is guided by high-level strategic objectives for market integration. For instance, a European Commission Expert Group report on interconnection targets suggested that, to improve market functioning, the net transfer capacity for alternating current (AC) interconnectors should "indicatively be doubled".

While such broad, indicative targets highlight the scale of the challenge, they also underscore the necessity for detailed, bottom-up technical assessments—like the analysis in this report—to identify specific, economically viable, and technically sound projects that can achieve these goals in a structured manner. A pertinent example of this process is the recent Memorandum of Understanding between North Macedonia and Kosovo to jointly strengthen their transmission interconnection, an action directly informed by the needs identified within the TYNDP framework.

The TYNDP 2024 includes several projects of particular importance to the Western Balkans, such as the Trans-Balkan Corridor, the Central Balkan Corridor, and the Italy-Montenegro Interconnection.

National TYNDPs and Key Planned Developments

The national TYNDPs of the Western Balkans partners provide a detailed roadmap aligned with ENTSO-E priorities.

- **Albania:** Plans include closing the 400 kV Internal Ring and constructing the new 400 kV line to Greece (Fier – Arachtos). Renovations of 110 kV lines are also prioritized.
- **Bosnia and Herzegovina:** Focus is on the 400 kV interconnection Višegrad–Bajina Bašta and upgrading the 220 kV interconnection Trebinje–Perućica. Significant investments are planned for voltage compensation (shunt reactors) and substations in major load centres (Banja Luka, Mostar, HPP Visegrad, Tuzla).
- **Kosovo:** Priorities include the reconfiguration of the 400 kV grid and the new interconnection with Albania (Phase 2), alongside upgrades to SS Kastrioti and SS Fushë Kosova. Consistent with regional planning, Kosovo has signed a Memorandum of Understanding with North Macedonia to strengthen their mutual transmission interconnection.
- **Montenegro:** Key projects include the Trans-Balkan Corridor (400 kV Pljevlja–Bajina Bašta) and the second pole of the HVDC cable to Italy. Upgrades to the 110 kV coastal network are also critical.

- **North Macedonia:** Construction of the 400 kV Bitola–Elbasan line is a major ongoing project. Additionally, reflecting the strategic needs identified in the TYNDP, North Macedonia has signed a Memorandum of Understanding with Kosovo to jointly strengthen the transmission lines between the two countries.
- **Serbia:** EMS is implementing the Trans-Balkan Corridor and planning new 400 kV interconnections with Romania (North CSE Corridor) and Hungary (Pannonian Corridor). Smart grid technologies like DLR are being deployed.

2.4 Identified Critical Issues for further development

Several critical issues have been identified that require further investigation and analysis in the next phases:

- **Data Gaps and Inconsistencies:** Some TYNDPs lack comprehensive data on smart grid technologies and energy storage. There are often inconsistencies between national TYNDPs and official NECP documents regarding RES uptake scenarios.
- **Analytical Challenges:** Assessing the impact of renewable energy sources requires high-level analysis, as detailed stability studies are beyond the current scope. Additionally, evaluating cross-border capacity is complex due to the lack of full market integration and flow-based allocation methods in the region.
- **Network model limitations:** The absence of publicly available, up-to-date 400 kV and 220 kV grid models for the entire region required the Consultant to build models based on available data and open-source repositories (PyPSA-Eur), which carries inherent limitations.
- **Climate change considerations:** Natural hazards such as floods, landslides, and extreme temperatures are not sufficiently addressed in existing transmission development plans, despite the region's exposure to such risks.

2.5 Identified Bottlenecks

The network analyses performed within this assignment resulted in general and focused conclusions on the bottlenecks for the selected generation scenarios (2030 and 2040).

2.5.1 Bottlenecks identified for Year 2030

The analysis for 2030 reveals that despite the implementation of major projects like the Trans-Balkan and Mid Continental East corridors, congestion persists along key corridors.

- **Congestion in Steady-State (Base Case):**
  - The hourly power flow simulations identified three 400 kV lines as being consistently heavily loaded. The primary bottlenecks are:
    - **400 kV Interconnection between Greece and North Macedonia (Bitola – Meliti):** This line is identified as a major bottleneck, frequently operating at high capacity due to significant power exports from Greece towards the north.
    - **400 kV Interconnection between Bulgaria and Serbia (Sofia West – Niš 2):** This line also shows consistently high loading, driven by power flows from Bulgaria into Serbia.
  - These bottlenecks are primarily caused by large power transits from Greece and Bulgaria towards the rest of the Balkan Peninsula.
- **N-1 Security Analyses:**
  - The N-1 contingency analysis identified a critical vulnerability in the corridor connecting Greece, Albania and North Macedonia towards Montenegro.

- Specifically, during the maximum export scenario from this corridor (Hour 4,267 – summer season), the following overloads occur:
  - The outage of the **400 kV OHL Zemlak (AL) – Kardia (GR)** line causes:
    - an overload on the **400 kV OHL Bitola (MK) – Meliti (GR)** line, reaching **103.3%** of its rated capacity.
    - an overload of the **150 kV OHL Mourtos (GR) – Bistrica (AL)** line to **104.4%** of its rated capacity.
  - The outage of the 400 kV OHL Zemlak (AL) – Elbasan (AL) line cause:
    - an overload of the 400 kV OHL Bitola (MK) – Meliti (GR) line, reaching **103.3%** of its rated capacity.

Based on the notified issues for 2030 in the Western Balkans region, congested border AL – GR, MK – GR and RS – BG should be reinforced with new interconnections as soon as possible.

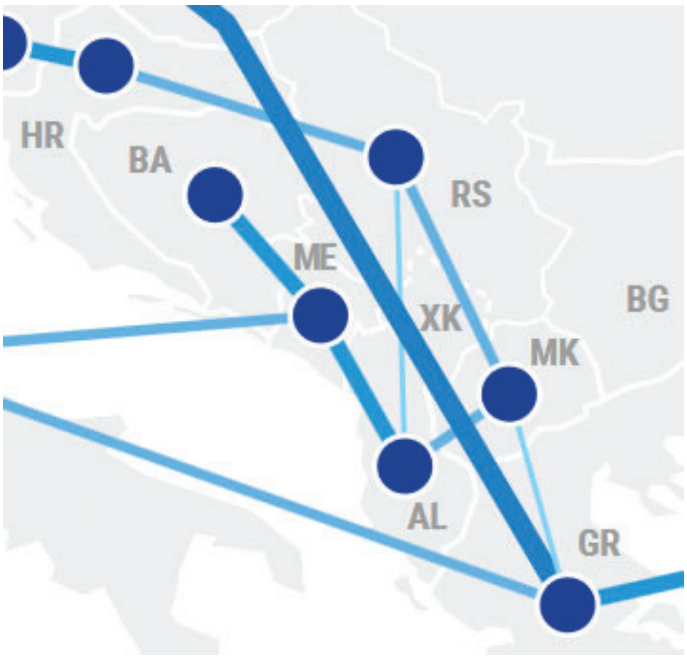

Figure 2-1 – Identified cross-border capacity increases needs for 2030

MW	OHL 400 kV Sofia (BG) - Nis 2 (RS)	OHL 400 kV Bitola (MK) - Meliti (GR)	OHL 400 kV Mladost (RS) - Sr. Mitrovica 2 (RS)
0-599	3905	6430	7335
600-699	1922	903	1176
700-799	1533	657	223
800-899	913	489	24
900-999	401	245	2
1000-1099	73	34	0
1100-1199	13	2	0
>1200	0	0	0

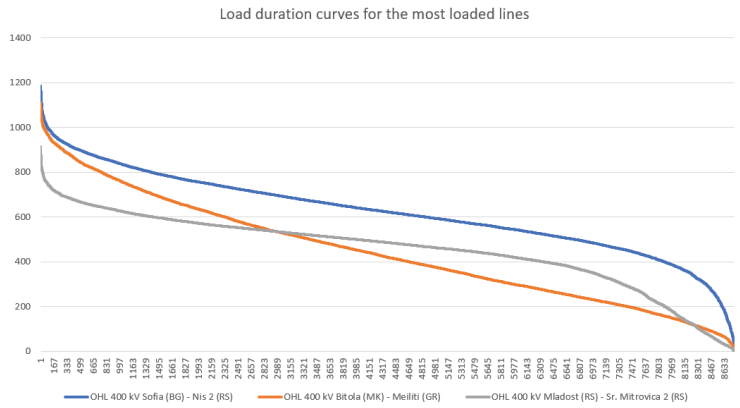

Figure 2-2 – Load histograms and duration curves for the most heavily loaded lines in Western Balkans countries in 2030

Figure 2-3 – Geographic location of the most heavily loaded lines in Western Balkans countries in 2030

2.5.2 Bottlenecks identified for Year 2040

The analysis for 2040, which includes additional planned infrastructure, identifies an increased number of bottlenecks distributed across the region, driven by higher RES penetration and evolving power flows.

- **Congestion in Steady-State (Base Case):**
  - Eight transmission lines were identified as exceeding the loading threshold. The most critical are:
    - **400 kV Interconnection GR-MK (Bitola – Meliti):** This remains a heavily loaded line, despite a planned refurbishment.

- **400 kV Interconnection BG-RS (Sofia West – Niš 2):** This line also continues to be a bottleneck.
- **Internal 400 kV OHL Tuzla – Ugljevik (Bosnia and Herzegovina):** This line emerges as a new, critical internal bottleneck. It is driven by the significant increase of RES capacity in southern BiH, creating high northbound power flows that converge in Tuzla.
- **Internal 220 kV OHL Jablanica – Kakanj (Bosnia and Herzegovina):** This 220 kV line is identified as overloaded in the base case, reaching **106%** of its capacity during peak RES generation in the country, indicating a bottleneck in evacuating power from hydro plants in Herzegovina northwards.

- **N-1 Security Violations:**
  - **Greece-North Macedonia Border:** An outage of the **400 kV Bitola – Meliti** line leads to an overload of **110.2%** on the **400 kV Miletkovo – Thessaloniki** interconnection.
  - **Bulgaria-Serbia Border:** This border shows significant vulnerability.
    - The outage of the planned **400 kV Bobov Dol (BG) – Leskovac 2 (RS)** line causes the existing **400 kV Sofia West – Niš 2** line to overload to **125.5%**.
    - Conversely, an outage of the **400 kV Sofia West – Niš 2** line overloads the new **Bobov Dol – Leskovac 2** line to **110%**.
  - **Bosnia and Herzegovina Internal Network:** The concentration of RES leads to multiple N-1 violations within BiH during peak generation scenarios:
    - An outage of a 400 kV line in Croatia (Tumbri-Melina) causes the critical **400 kV Tuzla – Ugljevik** line to overload to **112%**.
    - Several 220 kV lines in the corridor from Herzegovina to Tuzla become overloaded under various contingencies, with overloads reaching **102%**, **104.6%**, **105%** and **123%** on different sections, confirming this corridor as a major bottleneck.

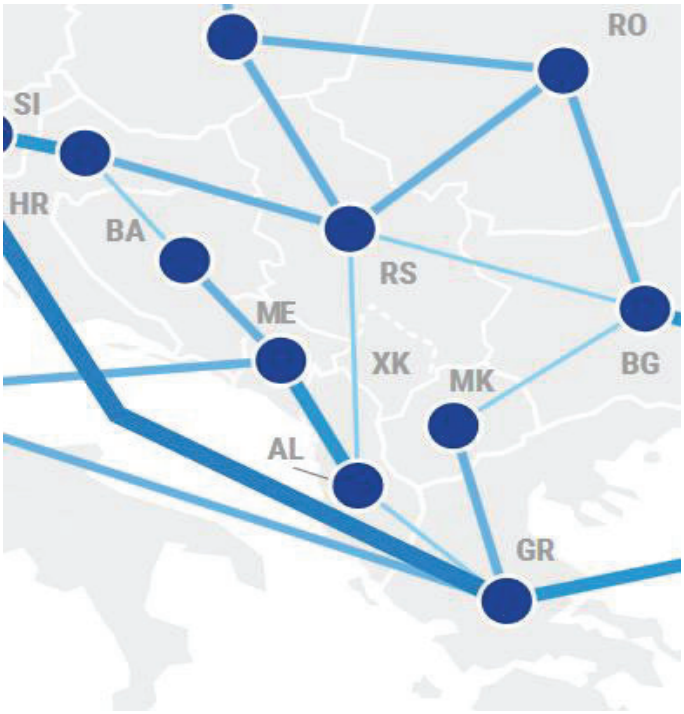

Figure 2-4 – Identified cross-border capacity increases needs for 2040

MW	OHL 400 kV Sofia (BG) - Nis 2 (RS)	OHL 400 kV Bitola (MK) - Meliti (GR)	OHL 400 kV Mladost (RS) - Sr. Mitrovica 2 (RS)
0-599	3905	6430	7335
600-699	1922	903	1176
700-799	1533	657	223
800-899	913	489	24
900-999	401	245	2
1000-1099	73	34	0
1100-1199	13	2	0
>1200	0	0	0

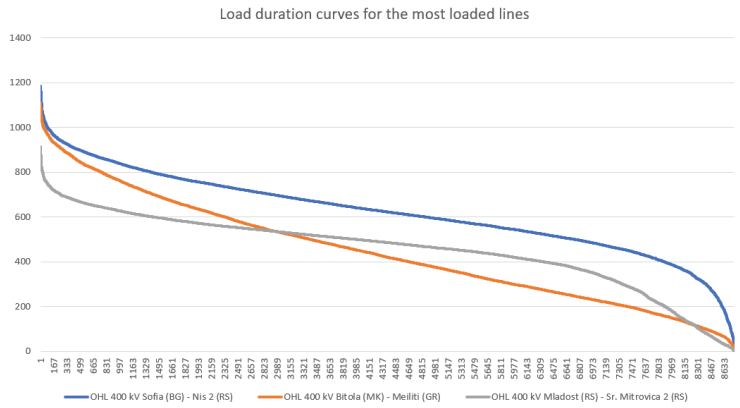

Figure 2-5 – Load histograms and duration curves for the most heavily loaded lines in Western Balkans countries in 2030

Figure 2-6 – Geographic location of the most heavily loaded lines in Western Balkans countries in 2030

2.6 Proposed transmission developments

To address the identified bottlenecks, a set of priority projects has been selected based on technical effectiveness, financial feasibility, and strategic alignment.

The table with the identified Bottlenecks and Proposed Transmission Enhancements in the Western Balkans region (2030–2040) is presented in the following page and summarizes the following developments:

1. **Central-Balkan Corridor / Section II:** Strengthening the Serbia-Bulgaria interconnection (Leskovac 2 – Bobov Dol) and internal Serbian lines. This project addresses severe N-1 overloads projected for 2040.
2. **Refurbishment of 400 kV Meliti (GR) – Bitola (MK):** Involves reconductoring to enhance transfer capacity. Its acceleration is a high priority to address the 2030 bottleneck.
3. **Refurbishment of 400 kV Thessaloniki (GR) – Miletkovo (MK) – Dubrovo (MK):** A new 400 kV double-circuit OHL to serve as a strategic reinforcement for the north-south corridor.
4. **Upgrading of 220 kV lines between HR and BA to 400 kV:** This project creates a new 400 kV corridor (Đakovo-Tuzla/Gradačac) to relieve severe internal congestion in Bosnia and Herzegovina projected for 2040.
5. **New 400 kV interconnection Greece – Albania:** A greenfield cross-border project (Fier-Arachtos/Thesprotia) intended to resolve severe N-1 security violations identified in the Albania-Greece corridor for the 2030 scenario.

Table 2-5 – Identified Bottlenecks and Proposed Transmission Enhancements in the Western Balkans region (2030–2040)

ID	Project / Corridor	Project Elements	Western Balkans partners / Promoters	Identified Need (Bottleneck)	Proposed Action / Enhancement	Key Benefits	Urgency / Priority
1	**Central-Balkan Corridor / Section II**	400 kV OHL SS Leskovac 2 (RS) – SS Bobov Dol (BG) and 400 kV lines Vardište – Požega – Kraljevo – Kruševac - Kraljevo	Serbia (EMS), Bulgaria (ESO EAD)	Severe N-1 overloads (up to 125.5%) are projected for the BG-RS border in 2040, even with the planned new 400 kV line.	Equip the planned new 400 kV line Bobov Dol–Leskovac 2 with a second set of conductors during implementation.	Alleviates critical border congestion; Increases market transfer capacity; Improves regional security of supply.	**High (2040 Critical Bottleneck)**
2a	**Refurbishment of the 400kV Meliti (GR) - Bitola (MK) interconnector**	400 kV OHL Meliti (GR) - Bitola (MK)	North Macedonia (MEPSO), Greece (IPTO)	The Bitola–Meliti line is a bottleneck in 2030 and the parallel Miletkovo–Thessaloniki line overloads in N-1 conditions in 2040.	Accelerate the refurbishment of the Bitola–Meliti line (ENTSO-E TYNDP Project 376) for completion before 2030. Extend the project scope to also include strengthening of the Miletkovo–Thessaloniki line.	Resolves N-1 violations; Reduces RES curtailment from Greece; Increases cross-border capacity.	**High (2030 Bottleneck)**
2b	**Refurbishment of the 400 kV Thessaloniki (GR) – Miletkovo (MK) – Dubrovo (MK) interconnector**	400 kV OHL Thessaloniki (GR) – Miletkovo (MK) - Dubrovo (MK)	North Macedonia (MEPSO), Greece (IPTO)	The Thessaloniki – Miletkovo - Dubrovo line is a bottleneck in 2040.	Reassess and reactivate the previously analysed project "WB21-MKD-ENE-03 North Macedonia, Strengthening the Transmission Network in the Southeast Region of North Macedonia - Component 1"		**High (2040 Bottleneck)**
3	**Upgrading of existing 220 kV lines between HR and BA to 400 kV lines**	220 kV OHL Đakovo (HR) - Tuzla (BA) 220 kV OHL Đakovo (HR) - Gradačac (BA)	BiH (Elektroprenos BiH, NOS BiH), Croatia (HOPS)	A critical internal bottleneck is projected for 2040 on the 400 kV Tuzla–Ugljevik line and the 220 kV North-South corridor in BiH due to massive RES evacuation.	Reassess and reactivate the previously planned upgrade of the 220 kV corridor between Croatia and BiH to 400 kV (ENTSO-E Project 241 from TYNDP 2016).	Resolves major internal BiH congestion; Enables RES evacuation; Enhances regional supply security.	**High (2040 Critical Bottleneck)**
4	**New interconnection line 400 kV Greece - Albania**	New 400 kV interconnection line Albania (SS Fier) - Greece (SS Arachtos or SS Thesprotia)	Albania (OST), Greece (IPTO)	N-1 analysis for 2030 shows severe overloads (up to 108.1%) on the AL-GR corridor during certain contingencies.	Accelerate the implementation of the new 400 kV interconnection (ENTSO-E Project 377) to be completed around 2030 (although critical).	Resolves N-1 security violations; Improves market integration; Enhances grid resilience for the AK control block.	**High (2030 Bottleneck)**
5	**Reconfiguration of 400 kV grid and new 400 kV interconnection**	400 kV OHL SS Nashec - SS Fierza (Albania) Reconfiguration of SS Prizren 2 into SS Nashec	Albania (OST), Kosovo (KOSTT)	Overall need for increased transmission capacity and operational stability within the AK Control Block.	Implement Phase 2 of the interconnection, including a new 400 kV line and substation as defined in PECI 2024.	Enhances security of supply for both partners; Facilitates market coupling for ALPEX;	Moderate*

ID	Project / Corridor	Project Elements	Western Balkans partners / Promoters	Identified Need (Bottleneck)	Proposed Action / Enhancement	Key Benefits	Urgency / Priority
	Albania-Kosovo / Interconnection Albania-Kosovo (Phase 2)	(SS Prizren 4), with local developments in XK				Improves resource and balancing sharing.	
6	**Increasing the capacity of existing 220 kV interconnection between BA and ME**	Reconstruction of 220 kV OHL Trebinje – Perućica	Bosnia and Herzegovina (Elektroprenos BiH), Montenegro (CGES)	Capacity limitations on an important secondary interconnection corridor, which becomes more critical as the 400 kV network is more heavily loaded.	Increase capacity by reconductoring the existing 220 kV OHL Trebinje–Perućica with HTLS conductors.	Enhances regional grid resilience and flexibility by providing an alternative route for power flows.	Moderate*
7	**North CSE Corridor / Inteconn. Serbia - Romania** **Portile de Fier - Đerdap Interconnection**	400 kV OHL from SWY Đerdap 1 to SS Portile de Fier (RO)	Serbia (EMS), Romania (Transelectrica)	Expected congestion from massive RES integration (>3 GW) in the Banat region of Serbia and the need for improved East-West power flows.	Implement the doubling of the existing 400 kV interconnection as part of the North CSE Corridor project.	Enables large-scale RES connection; Enhances market integration with Romania; Increases security of supply.	Moderate*

2.7 Feasibility Assessment of Projects

A high-level financial assessment was conducted for the priority projects using Discounted Cash Flow (DCF) methodology with a 25-year projection period and a 5% discount rate. Within this section, a brief summary of the feasibility assessment of the priority projects is presented, also within the summary tables of the assessment.

Project ID 1: Central-Balkan Corridor / Section II

The project is expected to yield significant benefits from increased cross-border trading and reduced transmission losses.

- **Leskovac 2 – Bobov Dol:** NPV of **€12.8m – €75.1m**, IRR of **6.9% – 13.0%**, and a payback period of 9–13 years. It avoids 300-500 $ktCO_2$ annually.
- **Internal Serbian Lines:** While the NPV is negative due to high CAPEX, the project is essential for system stability and enables integration of 500+ MW of RES.

400 kV OHL SS Leskovac 2 (SRB) – SS Bobov Dol (BG)				
Financial Benefits	**Description**	**Estimated Measures**	**min**	**max**
Increased Cross-Border Trading Capacity[3]	Enables additional NTC capacity MW between RS and BG. This generates congestion rent revenues for TSOs through auctioned cross-border capacities	600–800 MW	€5.0 million /year	€10.0 million/year
Reduced Transmission Losses	Modern 400 kV lines reduce grid losses (compared to 220 kV or older infrastructure), resulting in lower electricity procurement costs for TSOs	15–30 GWh/year	€1.05 million/year	€2.1 million/year
Reduced Redispatch and Balancing Costs	Enhanced grid flexibility reduces costs of out-of-merit generation to balance demand and maintain voltage levels.		€1.0 million/year	€3.0 million/year
Financial Costs				
Capex			€70 million	€90 million
Opex (Maintenance costs)			€1.0 million/year	

Net Present Value (25 years, 5% discount)	€12.8 million	€75.1 million
Internal Rate of Return	6.9%	13.0%
Payback Period	≈13 years	≈9 years

[3] Congestion rent revenues were calculated by applying the standard formula: hourly congestion rent = NTC × actual scheduled flow (up to the NTC) × price difference between RS and BG. These hourly values were summed annually, with revenues allocated between TSOs according to the regional sharing rules. The same approach was followed in the other projects.

Project ID 2a: Refurbishment of 400 kV Meliti (GR) – Bitola (MK)

This project shows strong financial viability due to low CAPEX (refurbishment) and high benefits in cross-border capacity.

- **Metrics:** NPV of **€34.3m – €152.9m**, IRR of **10.1% – 20.7%**, and a payback period of 6–10 years.
- **Environmental:** Avoids 300-500 ktCO2 annually.

400 kV OHL Meliti (GR) – Bitola (MKD)				
Financial Benefits	**Description**	**Estimated Measures**	**min**	**max**
Increased Cross-Border Trading Capacity	Enables additional NTC capacity which generates congestion rent revenues for TSOs through auctioned cross-border capacities	600–800 MW	€5.0 million/year	€12.0 million/year
Reduced Transmission Losses	Modern 400 kV lines reduce grid losses (compared to 220 kV or older infrastructure), resulting in lower electricity procurement costs for TSOs	20 - 40 GWh/year	€1.5 million/year	€3.0 million/year
Reduced Redispatch and Balancing Costs	Enhanced grid flexibility reduces costs of out-of-merit generation to balance demand and maintain voltage levels.		€2.0 million/year	€4.0 million/year
Financial Costs				
Capex			€65 million	€85 million
Opex (Maintenance costs)			€1.2 million/year	

Net Present Value (25 years, 5% discount)	€34.3 million	€152.9 million
Internal Rate of Return	10.1%	20.7%
Payback Period	≈10 years	≈6 years

Project ID 2b: Refurbishment of 400 kV OHL Thessaloniki (GR) – Miletkovo (MKD) – Dubrovo (MKD)

This project represents a strategic north-south corridor reinforcement connecting the Greek and North Macedonian transmission systems and enhancing both cross-border trade and internal grid flexibility.

400 kV OHL Thessaloniki (GR) – Miletkovo (MK) – Dubrovo (MK)				
Financial Benefits	**Description**	**Estimated Measures**	**min**	**max**
Cross-Border Congestion Revenue	Adds 600–800 MW of Net Transfer Capacity (NTC); monetized via SEE Coordinated Auction Office (CAO) / JAO platform.	600–800 MW	€6.0 million/year	€12.0 million/year
Grid Loss Reduction	Lower resistance and improved flow paths reduce technical losses.	20 - 40 GWh/year	€1.5 million/year	€3.0 million/year
Reduced Redispatch and Balancing Costs4	Enables better control over generation dispatch and reduces need for costly balancing generation.		€2.0 million/year	€4.0 million/year
Reserve Margin Optimization	Enhanced cross-border support reduces national reserve requirements.		€1.0 million/year	€2.0 million/year
Financial Costs				
Capex			€90 million	€120 million
Opex (Maintenance costs)			€1.5 million/year	€2.0 million/year
Net Present Value (25 years, 5% discount)			€32.6 million	€135.4 million
Internal Rate of Return			8.6%	15.3%
Payback Period			≈11 years	≈8 years

Project ID 3: Upgrading of existing 220 kV lines between HR and BA

This project is crucial for the Tuzla region's transition from coal.

- **Đakovo – Tuzla:** NPV of **€11.6m – €44.2m**, IRR of **9.6% – 16.4%**.
- **Đakovo – Gradačac:** NPV of **€7.24m – €34.5m**, IRR of **8.6% – 15.5%**.

220 kV OHL Đakovo (HR) - Tuzla (BIH)				
Financial Benefits	**Description**	**Estimated Measures**	**min**	**max**

[4] The monetisation was done by simulating reductions in MWh of redispatch/balancing multiplied by assumed €/MWh costs, benchmarked against historical and TYNDP-consistent data.

220 kV OHL Đakovo (HR) - Tuzla (BIH)				
Cross-Border Trading Revenue	Additional NTC capacity (estimated 200–300 MW) monetized via market-based capacity allocation	200–300 MW	€1.5 million/year	€3.0 million/year
Grid Loss Reduction	Shorter and stronger transmission path reduces system losses in both countries.	10 - 20 GWh/year	€0.7 million/year	€1.4 million/year
Reduced Redispatch and Balancing Costs	Improved dispatch efficiency, lower reliance on balancing power.		€1.0 million/year	€2.0 million/year
Financial Costs				
Capex			€25 million	€35 million
Opex (Maintenance costs)			€0.5 million/year	

Net Present Value (25 years, 5% discount)	11.6 million	44.2 million
Internal Rate of Return	9.6%	16.4%
Payback Period	≈11 years	≈7 years

220 kV OHL Đakovo (HR) - Gradačac (BIH)				
Financial Benefits	**Description**	**Estimated Measures**	**min**	**max**
Cross-Border Trading Revenue	Additional NTC capacity monetized via market-based capacity allocation	125–250 MW	€1.0 million/year	€2.5 million/year
Grid Loss Reduction	Shorter and stronger transmission path reduces system losses in both countries.	8 – 15 GWh/year	€0.6 million/year	€1.2 million/year
Reduced Redispatch and Balancing Costs	Improved dispatch efficiency, lower reliance on balancing power.		€0.8 million/year	€1.5 million/year
Financial Costs				
Capex			€20 million	€30 million
Opex (Maintenance costs)			€0.4 million/year	

Net Present Value (25 years, 5% discount)	€7.24 million	€34.5 million
Internal Rate of Return	8.6%	15.5%

220 kV OHL Đakovo (HR) - Gradačac (BIH)			
	Payback Period	≈11 years	≈8 years

Project ID 4: New 400 kV interconnection Greece – Albania

This greenfield project demonstrates high strategic value and financial viability.

- **Metrics:** NPV of **€71.9m – €194.5m**, IRR of **12.6% – 19.3%**, and a payback period of 7–9 years.
- **Environmental:** Key enabler for RES in Southern Albania, avoiding 500-700 ktCO2 annually.

400 kV interconnection between Albania (SS Fier) and Greece (SS Arachtos or SS Thesprotia)				
Financial Benefits	**Description**	**Measures**	**min**	**max**
Cross-Border Trading Revenue	Additional NTC monetized via SEE CAO / JAO platform (post-market coupling).	800–1000 MW	€8.0 million/year	€16.0 million/year
Grid Loss Reduction	Optimized long-distance transmission reduces technical losses in both systems.	30 – 50 GWh/year	€2.0 million/year	€4.0 million/year
Reduced Redispatch and Balancing Costs	Lower need for out-of-merit generation and reactive power compensation.		€3.0 million/year	€5.0 million/year
Financial Costs				
Capex			€90 million	€120 million
Opex (Maintenance costs)			-€1.0 million/year	-€1.5 million/year

Net Present Value (25 years, 5% discount)	€71.9 million	€194.5 million
Internal Rate of Return	12.6%	19.3%
Payback Period	≈9 years	≈7 years

2.8 Initial Environmental and Social Examination of Projects

2.8.1 Overview of Assessed Risks and Mitigation Measures

A high-level Initial Environmental and Social Examination (IESE) was conducted to identify key risks and mitigation measures.

We identified and analysed relevant data for each project and conducted a generic IESE assessment to support the initial screening phase.

The preparation of the IESE for each proposed transmission project is based on:

- Applicable environmental and sectoral regulations across Western Balkans countries

- EU and IFI requirements
- Relevant international conventions
- Available thematic maps (slope stability, soil and agricultural land, watercourses, natural habitats, cultural heritage, Natura 2000 zones, forest protected areas, specific location notes, risk matrix and recommendations etc.)
- Google Earth imagery and additional online resources

Key Risks Identified:

- **Biodiversity:** Most projects involve crossing sensitive areas. For example, the Greece-Albania line may impact the Vjosa River basin and bird flyways. The Central Balkan Corridor crosses sensitive mountain areas like Stara Planina.
- **Watercourses:** Projects involve multiple river crossings (e.g., Morava, Ibar, Sava, Vardar/Axios) requiring strict sediment and pollution control.
- **Social:** Land acquisition for new Rights of Way (RoW) and potential displacement of agricultural activities are key social risks, particularly for greenfield projects like ID 4 and ID 1.

Proposed Mitigation Measures:

- **Micro-routing:** Essential to avoid Natura 2000/Emerald sites and critical habitats.
- **Bird Protection:** Installation of bird diverters and insulation is required for all lines crossing migratory corridors.
- **Cross-Border Coordination:** Transboundary ESIA and stakeholder engagement are required for all interconnection projects to align environmental standards between countries.

2.8.2 Project Specific Risk Matrices

On a project level, for each priority project a risk matrix was developed, to summarize the relevant E&S aspects of a specific project. Here below, these summaries are presented for each priority project.

Project ID 1 - Central-Balkan Corridor: High risks identified for habitat fragmentation and disturbance to protected fauna.

Impact	Likelihood	Severity	Risk Level	Mitigation Priority
Habitat fragmentation	Medium	High	High	High
Disturbance to protected fauna	High (if not mitigated)	High	High	High
Soil erosion	Medium	Medium	Moderate	Medium
Water contamination	Low	Medium	Low–Moderate	Medium
Land acquisition conflict	Medium	Medium–High	Moderate–High	High
EMF public concern	High	Low	Moderate	Medium
Archaeological disturbance	Low	High	Moderate	Medium
Visual impact	High	Medium	Moderate–High	Medium

Project ID 2a - Refurbishment of the 400 kV Meliti (GR)-Bitola (MK) interconnector: High risks for bird collision/mortality due to proximity to Prespa Lakes and Pelister National Park.

Impact	Likelihood	Severity	Risk Level	Mitigation Priority
Disruption of Ramsar/Natura habitats	Medium	High	High	High
Bird collision/mortality	High	Medium–High	High	High
Watercourse pollution during construction	Medium	Medium	Medium	Medium
Deforestation and erosion	Medium	Medium	Medium	Medium
Visual impact	High	Low	Low	Low
Land acquisition disputes	Low	Medium	Low–Medium	Low–Medium
Cultural heritage damage	Low	High	Medium	Medium

Project ID 2b - Refurbishment of the 400kV Thessaloniki (GR)-Miletkovo (MK) – Dubrovo (MK) interconnector

Impact	Likelihood	Severity	Risk Level	Mitigation Priority
Disruption of Natura 2000 / Ramsar zones	Medium	High	High	High
Bird collisions (especially Axios–Vardar corridor)	High	Medium–High	High	High
Contamination of water bodies	Medium	Medium	Medium	Medium
Deforestation and erosion	Medium	Medium	Medium	Medium
Community opposition/land disputes	Medium	Medium	Medium	Medium
Cultural heritage finds	Low	High	Medium	Medium
Visual impact	Medium	Low	Low–Medium	Low–Medium

Project ID 3 - Upgrading of existing 220 kV lines between HR and BA to 400 kV lines

Impact	Likelihood	Severity	Risk Level	Mitigation Priority
Loss of wetland or riparian habitat	Medium	High	High	High
Bird mortality from collisions	High	Medium	High	High
Watercourse pollution during construction	Medium	Medium	Medium	Medium
Forest/hedgerow clearing impacts	Medium	Medium	Medium	Medium
Impact on agricultural operations	High	Low	Medium	Medium
Cultural/archaeological disturbance	Low	Medium	Low–Medium	Low–Medium
Community resistance or grievances	Low–Medium	Medium	Medium	Medium

Project ID 4 - New interconnection line 400 kV Greece – Albania: High risks for encroachment on Natura/Emerald sites and damage to riverine ecosystems (Vjosa/Arachtos).

Impact	Likelihood	Severity	Risk Level	Mitigation Priority
Encroachment on Natura/Emerald sites	Medium	High	High	High
Bird mortality (flyway crossing)	High	Medium–High	High	High
Damage to riverine ecosystems (Vjosa, Arachtos)	Medium	High	High	High
Deforestation and soil erosion	Medium	Medium	Medium	Medium
Disruption of archaeological sites	Medium	Medium	Medium	Medium
Community resistance or land disputes	Medium	Medium	Medium	Medium
Visual impact on tourism/natural landscape	Medium	Low–Medium	Low–Medium	Low–Medium

2.8.3 Integration of IESE findings into the capacity analysis

The Initial Environmental and Social Examination (IESE) was integrated into the Capacity Analysis to ensure that technical assessments of the transmission system also consider environmental sensitivities, land-use constraints, specific constraints notes and potential social impacts that may affect current operational capacity and future network expansion.

The IESE identified several environmental and socio-economic factors that have a direct or indirect influence on transmission capacity, system resilience, and corridor availability. These include land-use restrictions, environmentally sensitive zones, community exposure, and areas requiring enhanced mitigation measures. Incorporating these findings into the Capacity Analysis allows for a more realistic evaluation of the system's ability to absorb additional power flows, including renewable energy integration.

2.8.4 Environmentally sensitive corridors affecting capacity

The IESE highlighted that certain transmission corridors cross or are located in proximity to:

- Protected or high-biodiversity areas
- Watercourses and flood-prone zones
- Agricultural land with high socio-economic value
- Areas prone to erosion, landslides, or other geohazards

These environmental sensitivities limit the feasibility of uprating lines, adding new circuits, or constructing alternative routes without additional mitigation. Consequently, these constraints reduce flexibility for capacity enhancement in specific segments of the network.

2.8.5 Social constraints relevant to capacity upgrades

From the social perspective, the IESE identified:

- Settlement expansions near existing transmission lines
- Increased public sensitivity toward new energy infrastructure
- Land acquisition challenges along densely inhabited areas
- Potential disruption of livelihoods in agricultural communities

These constraints may lead to delays, additional design requirements, or route deviations for capacity-related investments, influencing both planning and implementation timelines.

2.8.6 IESE - Identified risks affecting infrastructure reliability

The environmental risks identified through the IESE—such as extreme weather events, soil instability, vegetation overgrowth, and wildfire hazards—can impact system reliability and, as a result, indirectly influence the available transmission capacity.

Transmission segments exposed to these risks may require:

- Reinforcement of towers.
- Increased maintenance frequencies.
- Targeted vegetation-management programs.
- Adoption of climate-resilient design solutions.

These interventions affect both the cost and the overall feasibility of enhancing transfer capacity in vulnerable parts of the network.

2.8.7 Implications for capacity planning

The integration of IESE findings demonstrates that technical capacity cannot be assessed independently from environmental and social considerations. The combined analysis shows that:

Some transmission corridors may offer technical opportunities for capacity uprating, yet face environmental or social constraints that necessitate mitigation measures.

Expanding infrastructure in sensitive areas may require more detailed routing analyses, increased stakeholder consultations, or the adoption of alternative technical options (such as limited use of underground cabling).

Environmental compliance and social acceptance will play a decisive role in shaping future grid expansion schedules and cost estimates.

2.8.8 Summary

Integrating the IESE results with the Capacity Analysis enables a planning framework in which future transmission-system upgrades are evaluated not only for technical feasibility but also for alignment with environmental and social safeguard requirements. This combined approach promotes sustainable grid development, reduces implementation and permitting risks, and enhances the long-term resilience and reliability of the transmission network.

3 Electricity Market and Balancing Analysis

3.1 Key Findings

Rising Electricity Demand: Demand across the Western Balkans countries is projected to grow significantly by 2040. From approximately 82.8 TWh in 2030 to 92.8 TWh in 2040, driven by electrification and economic growth. Peak demand is expected to reach nearly 18 GW by 2040, necessitating major generation and infrastructure upgrades.

Shift in Generation Mix: The region is transitioning from coal-dominated systems towards a renewable-dominant generation mix. RES is expected to contribute 69% of generation in 2030 and 74% in 2040. Hydropower remains central, while wind and solar capacity are projected to grow rapidly, particularly in Serbia, Bosnia and Herzegovina, and Albania.

  - **Albania** depends almost entirely on hydropower (~98%), with stable consumption (6.2–6.5 TWh/year) and rising prices post-2022.

- **Bosnia and Herzegovina** relies on coal (59%) and hydro (37%), with stable demand (~10–11 TWh) and faster price growth for non-households.
- **Kosovo** generates ~96% of power from coal, with rising prices and demand reaching ~5.4 TWh in 2023.
- **Montenegro** sources ~70% from renewables; prices rose modestly and demand remained around 2.5–2.9 TWh.
- **North Macedonia** is diversifying its energy mix and introduced a block-tariff system in 2022 to manage consumption, which has since declined.
- **Serbia** remains coal-dominant (63%), with steady demand (~28 TWh) and rising prices, especially after 2021.

Energy Storage: As the Western Balkans moves toward large-scale integration of renewable energy sources (RES), energy storage emerges as a critical enabler of power system flexibility, stability and decarbonisation. This report highlights the current status, potential, and future deployment outlook of energy storage systems across the region, in alignment with the 2030–2040 electricity transition scenario.

Table 3-1: Current and Planned Deployment of Battery Storages (2030 vs. 2040)

Country	Battery Storage Capacity (2030)	Battery Storage Capacity (2040)
Albania	0 MW	0 MW
Bosnia and Herzegovina	0 MW	0 MW
Kosovo	170 MW	170 MW
Montenegro	0 MW	120 MW
North Macedonia	0 MW	52 MW
Serbia	0 MW	650 MW
Total	**170 MW**	**992 MW**

2025–2030 Outlook: Kosovo leads early deployment, with 170 MW installed, likely supported by donor-driven investments and urgent system needs.

2030–2040 Growth: Serbia leads regional deployment by 2040 with 650 MW, followed by Montenegro and North Macedonia. Other countries (Albania, BiH) have not yet adopted deployment strategies but are expected to follow due to increasing system needs and EU regulatory alignment.

The Western Balkans are modernising their power sector and boosting renewable energy, yet the region faces significant hurdles on its path to a sustainable future. Below are the main points that must be overcome to secure reliable electricity and long-term development:

- **Electricity Prices and Market Trends:** Regional market prices will trend downward, with average nodal prices (where a node represents one country) falling from ~€100/MWh in 2030 to ~€65/MWh in 2040 due to higher RES penetration. However, volatility will increase, with up to 2,800 hours of zero pricing projected in 2040.
- **Balancing and Cross-Border Integration:** The existing regional market suffers from low Net Transfer Capacities and a lack of coordinated balancing mechanisms. This hampers RES integration and limits cross-border trading. Regional balancing markets and harmonized reserve procurement are essential.
- **Country-Specific Constraints:** While some countries (e.g. North Macedonia) are advancing RES integration, others (e.g. Serbia, Kosovo) remain heavily dependent on lignite, facing both economic and regulatory challenges in reducing coal reliance.
- **Transmission Investment Priorities:** Significant transmission system reinforcements are needed to accommodate future demand and RES deployment. This includes dynamic line

rating, HVDC links and grid digitalisation technologies (e.g., SCADA, smart meters, remote monitoring).

- **Advanced Grid Management:** Adoption of technologies such as SCADA systems, OPGW, digital substations, and smart meters will be essential for improving operational efficiency and demand-side flexibility.
- **Population:** Demographic decline is a shared challenge, with all six countries projected to lose 14–23% of their populations by 2050 due to emigration and low birth rates. Economically, the region showed post-COVID recovery, but sustainable growth will depend on energy diversification and investment.
- **Investments:** Countries are investing in substations, high-voltage corridors and grid upgrades but efforts remain reactive and lack regional coordination. Advanced technologies like Dynamic Line Rating and Wide Area Monitoring are still in early stages.
- **Actions:** Priority actions include strengthening national and cross-border networks, preparing infrastructure for future industrial zones and accelerating smart grid deployment. A proactive, efficiency-driven approach, guided by demand forecasting, cost-benefit analysis and regional cooperation, is key to ensuring reliable supply and supporting long-term energy goals.

3.2 Key Challenges

Key challenges include technical losses, congestion, outdated assets and limited deployment of smart grid technologies. To ensure reliable and efficient supply, the region must shift towards proactive, strategic investments by:

- Expanding national and cross-border high-voltage networks,
- Building infrastructure in future demand zones (e.g. industrial parks),
- Deploying smart grid solutions (e.g. Dynamic Line Rating, Wide Area Monitoring Systems),
- Coordinating regional cooperation and efficiency efforts.

Regional SEE transmission system planning has been operational since 2001, supported by the USAID, and then by ENTSO-E. However, in 2024, the regional planning was stopped, due to the decision of the ENTSO-E. It would be highly beneficial to continue this cooperation between TSOs in order to exchange models, plans, predictions and jointly identify scenarios which would serve as a base for all national transmission network development plans.

Strategic, efficiency-focused investment is essential to support economic growth and energy transition across the region.

Balancing reserves are procured mainly from conventional power plants, with limited participation from demand-side or RES resources. Regional TSOs participate partially in pan-European platforms such as IGCC and act as observers in PICASSO and MARI but full integration remains pending. Demand response programs, where consumers actively adjust electricity use to support grid stability, are largely absent in the Western Balkans. Most countries only rely on emergency load-shedding and current legislation rarely defines demand-side management. To enable future flexibility and integration of renewables, demand-side control must be formally recognized in laws and grid codes, including roles for aggregators and virtual power plants.

Energy storage systems are gaining attention as part of ongoing legal reforms aligned with EU rules. While pump storage has long existed, battery storage (BESS) is still not operational at transmission level, though several projects are in development. Some countries (e.g. Serbia, North Macedonia, Montenegro) have introduced legal definitions and requirements for storage, while others are still revising legislation.

For both demand response and energy storage, updated legal and regulatory frameworks, especially at both transmission and distribution levels, are essential for supporting renewable energy integration, grid flexibility and decarbonization goals.

Smart grid tools like demand response can help balance power systems but their use in the region is minimal due to outdated infrastructure, weak digitalization and missing regulations. Unlocking this potential requires legal reforms, smart meters, aggregator roles and better TSO-DSO coordination.

Transmission networks are relatively modern, while distribution grids lag behind needing major upgrades. Smart meter rollout is uneven with most countries facing investment and regulatory challenges. It is only advanced in Montenegro. Broader adoption of smart technologies is key to enabling flexible, reliable and efficient electricity systems.

Key recommendations include:

- Accelerate RES Integration through national plans aligned with NECPs and the EU Green Deal.
- Invest in Battery Storage to manage short-term variability and support balancing markets.
- Promote Market Coupling to allocate cross-border capacities based on power flows.
- Expand and Upgrade Transmission Infrastructure to resolve bottlenecks and improve reliability.
- Adopt Coordinated Reserve Mechanisms and develop balancing market across the Western Balkans countries.
- Support Digitalisation and Demand Response via targeted incentives and regulatory reform.
- Establish Clear Policy Frameworks for storage, flexibility services and grid access.

The report recommends proactive, coordinated investments guided by comprehensive cost-benefit analyses, accelerated legal and regulatory reforms and enhanced regional collaboration to ensure a reliable, efficient and sustainable electricity system. Future work includes detailed balancing market modelling and expansion planning to address anticipated bottlenecks and support decarbonization goals.

3.3 Forecasting future electricity demand and generation mix

3.3.1 Projected electricity demand for 2030 and 2040

The annual electricity demand in the Western Balkans countries' show a noticeable increase between the years 2030 and 2040. For example, in Albania (AL00), the demand is projected at 8,994 GWh in 2030, rising to 9,752 GWh in 2040, marking an increase of 0.758 GWh over the decade. Similarly, Bosnia and Herzegovina (BA00) sees its demand grow from 12,515 GWh in 2030 to 14,261 GWh in 2040, reflecting an increase of 1,746 GWh. Based on the aggregated data for the Western Balkans region, the projected total electricity demand for the year 2030 is approximately 82,806 GWh, whereas for the year 2040, it is estimated to reach 92,794 GWh. These totals reflect the combined growth patterns across all Western Balkans countries.

This growth in electricity demand underlines the expanding energy needs likely driven by economic growth, population changes and advancements in technology that influence power consumption trends. Such projections are vital for shaping energy policies and infrastructure planning to meet future demand sustainably.

Table 3-2: Annual Electricity Demand for Western Balkans partner´s in 2030 and 2040 (GWh)

Country Code	Year 2030	Year 2040
AL00	8,994	9,752
BA00	12,515	14,261
ME00	4,191	4,621

MK00	8,945	9,534
RS00	41,495	47,484
XK00	6,666	7,142
Total	**82,806**	**92,794**

Source: Mott MacDonald analysis

The data in Table 3-3 clearly illustrates a significant upward trend in peak hourly demand for Western Balkans countries between 2030 and 2040. The numbers suggest a consistent increase across the board, reflecting the growing energy requirements of the region. For instance, peak demand in Albania is projected to rise from 1,966 MW in 2030 to 2,132 MW in 2040, indicating a growth. Similarly, Bosnia and Herzegovina shows an increase from 2,387 MW to 2,606 MW over the same period.

This upward trajectory underscores a pressing need for enhanced generation capacity to meet the future energy demands and avoid potential shortfalls. Without proactive measures to expand and modernize the energy infrastructure, the Western Balkans countries may face challenges in maintaining a reliable supply, particularly during peak hours.

Table 3-3: Peak hourly demand for Western Balkans partner´s in 2030 and 2040 (MW)

Country Code	Peak Demand (2030)	Peak Demand (2040)
AL00	1,966	2,132
BA00	2,387	2,606
ME00	744	920
MK00	1,836	1,951
RS00	7,150	8,853
XK00	1,400	1,491
Total	**15,483**	**17,953**

Source: Mott MacDonald

3.3.2 Generation mixes 2030 and 2040 - fossil fuels vs. renewable energy

The *Figure 3-1* underscores the significant shift toward renewable energy in the generation mix for Western Balkans partner´s. By 2030, renewable energy accounts for 69% of the total annual generation mix, showcasing a decisive move away from fossil fuel dependency. This proportion further climbs to 74% by 2040, reflecting continued investment and advancements in sustainable energy technologies. It is crucial to note, however, that these percentages pertain to the total generated electricity and not the share allocated for demand supply within each country. The dynamics of electricity trade reveal a complex interplay—some countries position themselves as net exporters of electricity, while others rely on imports to balance their annual consumption needs.

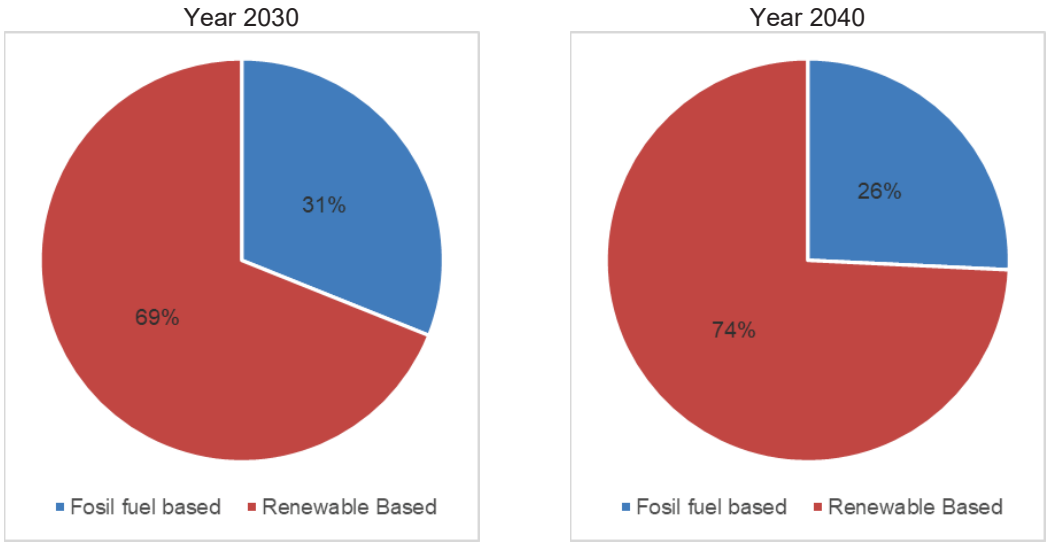

Figure 3-1: Generation mix proportion for Western Balkans partner´s in 2030 and 2040
Source: Mott MacDonald analysis

Examining the generation and demand relationships reveals distinct patterns across the Western Balkans countries in 2030. Countries with higher generation figures compared to their respective demand emerge are net exporters of electricity. Their surplus production allows them to supply neighbouring nations and contribute to regional trade dynamics. Conversely, those countries where demand exceeds the stacked columns representing generation are net importers. They rely on external sources to meet their annual consumption needs, highlighting the disparities in domestic capacity development and resource allocation of market competitive technologies (mainly renewables). This intricate balance underscores the interplay between economic strategies, infrastructure investments and cross-border collaboration in shaping the energy landscape of the Western Balkans partner´s.

In the specific cases of Bosnia and Herzegovina, Serbia and Kosovo, thermal power plants operate under a must-run regime, particularly during the winter months, ensuring an uninterrupted supply of electricity and heat to meet seasonal demand. Despite these operational conditions, neighbouring countries to the Western Balkan Partner´s region are able to export electricity due to significant advancements in cost-effective generation technologies, notably solar and wind. The renewable sources redefine the energy landscape, enabling competitive production that outpaces traditional thermal generation.

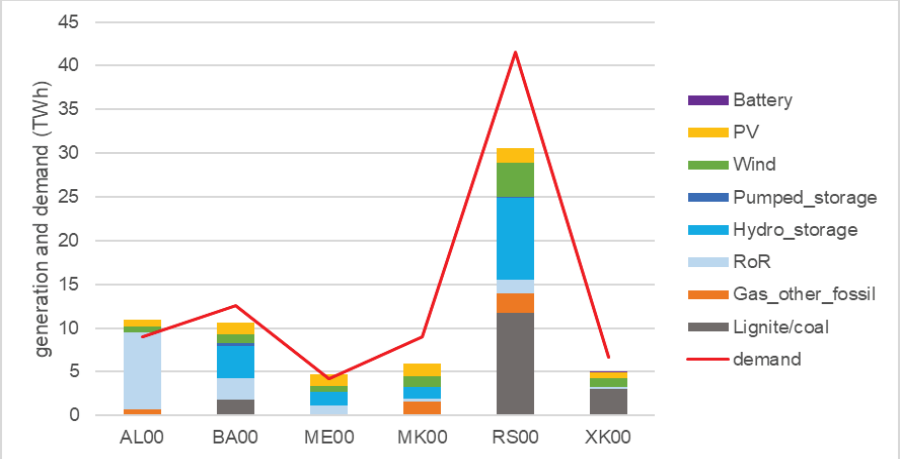

Figure 3-2: Generation and demand in Western Balkans partner´s for 2030 (TWh)
Source: Mott MacDonald analysis

By 2040, the substantial advancements in renewable energy technologies allow the Western Balkans countries' to significantly reduce their reliance on electricity imports. This progress is attributed to the widespread adoption of wind, solar and other renewable sources that enable countries to generate electricity domestically in quantities that approach or even meet their annual demand. Figure 3-3 highlights this equilibrium, showcasing that the majority of Western Balkans countries are nearing self-sufficiency in their generation capacities.

The transformation in energy infrastructure has been driven by investments in competitive renewable technologies and cross-border collaborations. These efforts have not only reduced the environmental impact of energy production but also strengthened the energy security of the region. With minimal dependence on fossil fuels, Western Balkans countries are better positioned to handle potential fluctuations in global energy markets and ensure a steady supply of electricity for their growing populations and economies.

Despite higher CO_2 taxes implemented by 2040, thermal power plants continue to operate under certain must-run conditions, particularly during critical periods such as winter. These operational necessities drive higher generation from these plants, ensuring that demand is met even as renewable energy technologies dominate the generation mix.

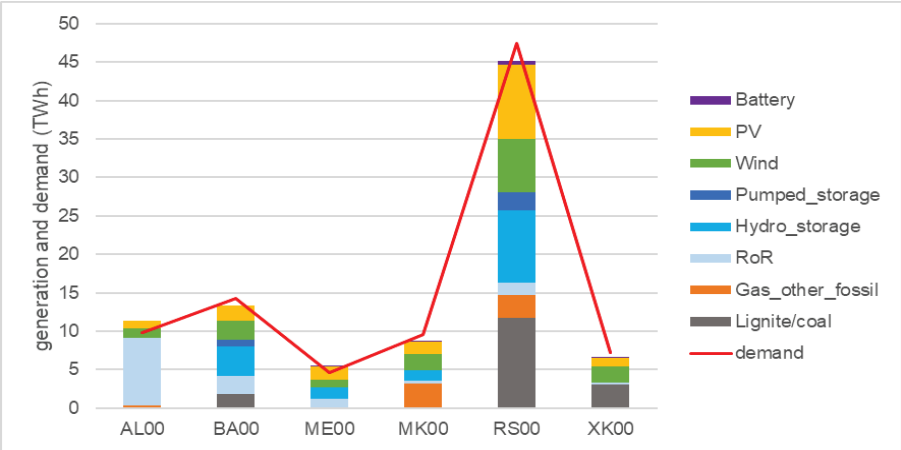

Figure 3-3: Generation and demand in Western Balkans partner´s for 2040 (TWh)
Source: Mott MacDonald analysis

3.4 Analysis of electricity price trends

3.4.1 Key Factors Influencing Electricity Prices

The electricity prices across the Western Balkans countries are shaped by a complex interplay of fundamental drivers, each exerting varying degrees of influence depending on national circumstances and broader regional trends. Understanding these key factors is crucial for interpreting current price levels and anticipating future developments in the region's electricity markets.

Fuel Costs: The cost of primary fuels, especially coal and natural gas, remains a principal determinant of electricity prices. Fossil fuel prices are inherently volatile, subject to global market fluctuations and geopolitical tensions. In contrast, renewable generation sources such as wind and solar require significant capital investment upfront, but their ongoing operational costs are minimal. As countries transition towards renewables, the overall sensitivity of electricity prices to fuel market swings is expected to decrease, though this shift also brings new challenges related to investment and integration.

Transmission and Distribution (T&D) Costs: Expenses associated with maintaining and upgrading the electricity grid are directly passed on to consumers. In regions where infrastructure is ageing or where grid modernisation is necessary to accommodate new renewable generation, T&D costs can be substantial. These costs may drive up end-user electricity prices, particularly in areas requiring extensive investment to ensure reliability and support cross-border electricity trade.

Generation Mix: The composition of each country's generation portfolio significantly affects electricity pricing. Systems reliant on fossil fuels tend to have higher costs due to fuel expenditures and the necessity to comply with environmental regulations, including CO2 taxes. Conversely, countries with a high share of renewables often benefit from more stable generation costs, although they may face challenges related to supply variability and seasonal output fluctuations.

Supply and Demand Dynamics: Electricity prices are highly responsive to shifts in supply and demand. Factors such as economic growth, urbanisation, and seasonal variations can drive demand spikes, while supply constraints can further exacerbate price volatility. High demand or supply shortages, particularly during peak periods, typically result in upward price pressure.

Regulatory and Policy Environment: Government interventions play a pivotal role in electricity pricing. Taxes, subsidies, and various forms of market regulation influence end-user prices. For instance, subsidies may keep prices artificially low, whereas environmental taxes or carbon pricing mechanisms can increase costs. The ongoing alignment with EU energy regulations and gradual market liberalisation across the region are also contributing to pricing dynamics.

Weather and Climate: Weather conditions directly impact both electricity supply and demand. Hydropower output is closely linked to rainfall patterns, while temperature extremes drive spikes in consumption for heating or cooling. As a result, seasonal weather variations are reflected in corresponding electricity price fluctuations, with pronounced effects in markets heavily reliant on weather-sensitive generation technologies.

3.4.2 Population growth rates in the Western Balkans partner's

Across the Western Balkans countries, populations are declining and ageing, with Albania's population dropping from over 3.1 million in the early 2000s to 2.82 million in 2023, and projected to reach 2.25 million by 2050. Bosnia and Herzegovina's population is set to fall from 3.19 million in 2023 to 2.47 million by 2050, while Kosovo's 2024 census records 1.6 million residents, a 12% decrease since 2011, alongside a significant reduction in annual births. Montenegro's population is forecast to decrease from 628,000 in 2023 to 535,000 by 2050, driven by youth emigration and low fertility. North Macedonia has seen its population reduce from 2.1 million in 2002 to 1.84 million in 2023, with a further decline to 1.52 million expected by 2050, and Serbia's population is projected to fall from 6.79 million in 2023 to 5.56 million by 2050, also facing challenges of ageing and youth emigration.

3.4.3 Economic Growth Trend in the Western Balkans partner's

The economic performance of the Western Balkans in 2023 reflected resilience during the recent global uncertainty. With inflation generally easing and moderate GDP growth, the region is poised for gradual recovery. However, long-term growth will require structural reforms, improved governance and sustained investment in infrastructure and human capital. The following table summarises the GDP growth rates for the period 2020-2023.

Table 3-4: GDP growth rates in Western Balkans partner´s (2020-2023) – units in %

Country	2020	2021	2022	2023
Albania	-3.5	n/a	4.8 (e)	3.9 (e)
Bosnia & Herzegovina	-3.0	7.4	4.2	1.7
Kosovo	-5.3	10.7	4.3	3.3
Montenegro	-15.3	13.0	6.4	6.0
North Macedonia	-4.7	4.5	2.2	1.0
Serbia	-0.9	7.7	2.5	2.5

Note: (e)=estimation
Source: Eurostat and other public sources

It should be noted that the COVID-19 pandemic significantly impacted the world economy, causing a global contraction of about 3.4% in 2020, with severe effects on various sectors and increased economic inequality

3.5 Investment Areas for Transmission Infrastructure

The planned sustained economic growth and evolving energy landscape of the Western Balkans partner´s place increasing demands on their electricity transmission infrastructure. Ensuring these networks can reliably meet future demand, driven by industrial development, urbanization and new consumption patterns, while simultaneously enhancing overall system efficiency is of high importance.

Strategic investments in expanding and upgrading transmission infrastructure are therefore crucial enablers of economic progress, security of supply and effective regional market integration. This chapter identifies potential investment areas to achieve these goals, analysing currently available and realistic approaches and proposing methodologies for development.

3.6 Mechanisms for Managing Variability in Renewable Energy Generation and Balancing Supply and Demand

Power System Balancing in the European Context: A fundamental aspect of electricity network operation, ensuring the continuous and reliable supply of power by maintaining system frequency and managing active power exchanges. Its core objective is to guarantee that generation and consumption are matched in real time, preventing instability and safeguarding the security of supply. In the context of evolving European electricity markets, effective balancing has become increasingly important due to fluctuating demand, the integration of renewable energy sources, and the drive towards regional market harmonisation.

Role of Transmission System Operators (TSOs) and Balance Responsible Parties (BRPs): Transmission System Operators (TSOs) are entrusted with the operational responsibility of maintaining system frequency and overseeing the balance between electricity generation and consumption. TSOs monitor the system continuously, identifying deviations caused by unpredictable changes in demand or generation output. In response, they activate balancing services to restore equilibrium. Balance Responsible Parties (BRPs), on the other hand, are market participants accountable for their own energy imbalances. BRPs forecast their production or consumption and are obliged to settle any discrepancies, incentivising accurate scheduling and contributing to overall system stability.

Classification and Procurement of Balancing Services: Balancing services are typically classified into ancillary services, balancing capacity, and balancing energy. Ancillary services encompass frequency containment, frequency restoration, and replacement reserves, each serving specific functions in stabilising system operations. Balancing capacity refers to resources contracted in advance to be available for activation, while balancing energy is the actual energy delivered when called upon. TSOs procure these services through competitive processes, ensuring both cost-effectiveness and reliability. The activation of balancing services is triggered by real-time deviations, with automated and manual mechanisms employed depending on the severity and nature of the imbalance.

Balancing Market Operations and European Integration: The structure of balancing markets in Europe is evolving towards greater integration, promoting cross-border cooperation and optimised resource utilisation. Market operations involve the trading of balancing capacity and energy, facilitated by transparent platforms and harmonised rules. The integration of European balancing markets, underpinned by EU regulations such as the Electricity Balancing Guideline (EB GL), seeks to standardise procedures, enable efficient procurement, and foster liquidity across member states. This process enhances the overall efficiency and resilience of the electricity system, especially as variable renewable generation increases.

Progress and Challenges in the Western Balkans region: Western Balkans countries are making strides in aligning their balancing mechanisms with European standards, yet several challenges remain. Harmonisation of legal frameworks and operational practices is ongoing, with efforts focused on adopting EU network codes and regulatory guidelines. A key challenge is the integration of IT systems, which is essential for real-time data exchange, accurate imbalance settlement, and seamless market participation. Legacy infrastructure and limited digitalisation hinder progress, highlighting the need for investment in modern IT platforms and capacity building. Additionally, the development of clear rules for balancing service procurement and the active involvement of BRPs are vital for effective market operation and regional integration.

3.7 Effectiveness of demand response programs and energy storage systems

Demand response programs and demand-side management are largely absent in Western Balkans countries. Current practices focus mainly on emergency measures like load-shedding, not proactive system operations. Legislation is outdated or vague, with few plans for future improvements and little practical action so far. The lack of clear legal frameworks and supporting rules limits demand response

development, especially as renewables grow. Most potential is at the distribution level, but existing regulations target transmission and overlook aggregators, virtual power plants, and active participation in balancing markets.

- Albania: Demand-side management is not defined in the Energy Law; the Transmission Grid Code only permits demand-side action in emergency conditions. Harmonisation with EU network codes is needed to introduce proper demand-side measures.
- Bosnia and Herzegovina: Demand response is not defined in entity-level primary legislation, but the Transmission Grid Code identifies demand-side management as an operational category.
- Kosovo: The Energy Law does not define demand-side management, though the Demand Control Code covers certain aspects of demand-side control and management.
- Montenegro: Recently adopted Energy Law (March 2025) defines demand-side control and management, but the Transmission Grid Code remains limited to emergency measures.
- North Macedonia: Demand-side management is not defined in the Energy Law; the Transmission Grid Code only allows for emergency and underfrequency load-shedding.
- Serbia: Demand-side management is defined as a strategic objective and sector activity in the Energy Law, but operational provisions in the Transmission Grid Code are still limited to emergency actions.

3.8 Potential for advanced grid management technologies

Advanced grid management technologies, particularly Smart Grid applications, offer significant potential to improve power system balancing in the Western Balkans. The most direct contributions come from demand response programmes, which allow consumers to adjust electricity usage in response to system needs, especially when supported by digitalised networks and smart metering. Currently, this potential is largely untapped, with most active participation limited to large users on the transmission grid due to better-developed infrastructure and clearer regulatory frameworks. In contrast, the distribution grid, despite offering greater theoretical flexibility, faces major challenges from outdated infrastructure, insufficient digitalisation, and a lack of supporting legislation and capacity building.

Modernising the distribution network, through investment in digital control, remote monitoring, and smart meter deployment, is essential to unlock this flexibility. While transmission networks are relatively advanced, distribution systems remain underdeveloped, with limited operational visibility and asset management. Improving cooperation between Transmission System Operators (TSOs) and Distribution System Operators (DSOs) is also critical, as mandated by EU legislation and regional commitments. Overall, the region must focus on legal reform, digital infrastructure, and stakeholder education to fully realise the benefits of advanced grid management and demand-side flexibility.

3.9 Deployment of Energy Storage Facilities

3.9.1 Potential for energy storage facilities

The Western Balkans need greater energy flexibility to meet renewable targets, manage limited resources, and align with the EU electricity market. A mix of Pumped Hydro Storage (PHS) and Battery Energy Storage Systems (BESS) is crucial for system balancing, congestion relief, peak-shaving, load shifting, and backup. Strategic plans call for more storage, with choices based on resources, operations, and economics. By 2030, PHS projects and BESS pilots, especially at solar parks, will progress. In mid-term, BESS will expand in the grid and PHS will grow via upgrades and new sites. Long-term, PHS will dominate large-scale storage as battery costs fall, while hydrogen storage remains uncertain.

Table 3-5: Overview of Energy Storage potential in Western Balkans countries

Country	Storage Potential	Key Projects / Plans
Albania	High (hydro-based PHS, solar + BESS)	Skavica PHS, BESS for solar balancing (Fier region)
Bosnia and Herzegovina	High (hydro + PHS)	Upper Drina system (Buk Bijela), PHS feasibility under study
Kosovo	Low–Medium (grid-constrained, BESS interest growing)	Conceptual studies for solar + storage near Gjakova and Prizren
Montenegro	Medium–High (PHS, flexibility from hydro)	Piva system upgrades, Perućica possible PHS
North Macedonia	Medium (BESS priority)	EU-funded 10 MW battery pilot, RES integration focus
Serbia	Medium–High (BESS and PHS)	PHS Bistrica, 1 GW RES plan includes BESS co-location

3.9.2 Proposals for possible locations and grid connection points for new energy storages facilities

Identifying optimal grid connection points for new energy storage facilities is a central element of the Western Balkans energy transition strategy. Selection criteria emphasise not only technical feasibility, but also broader strategic considerations like enhancing system flexibility, supporting regional balancing, and facilitating cross-border electricity trade. While pumped hydro storage (PHS) is geographically constrained by the need for suitable hydro sites, battery energy storage systems (BESS) offer greater locational flexibility and can be integrated at both transmission and distribution levels. Siting BESS close to renewable generation plants is particularly advantageous for maximising energy arbitrage benefits. Additionally, compliance with EU regulations requires that network operators generally do not own BESS assets, except under specific regulatory exemptions. The following table provides a detailed overview of potential locations for new energy storage facilities across the Western Balkans region, reflecting these strategic and technical priorities.

Table 3-6: Overview of possible locations for energy storages in Western Balkans countries

Country	Proposed Location	Type of Storage	Connection Point / Substation	Rationale
Albania	Fier region (south-west)	BESS (20–50 MW, 2–4h)	SS Fier 220/110 kV	High solar potential; grid congestion; strategic export corridor (Greece interconnection)
	Skavica region (north-east)	Pumped Hydro Storage (300–500 MW)	SS Skavica 400 kV (planned)	PHS potential, supports Albania internal backbone and regional balancing
	Vau i Dejës HPP (retrofit)	PHS or hybrid BESS	Vau i Dejës HPP busbar	Existing hydro, reservoir flexibility, load center proximity
Bosnia and Herzegovina	Buk Bijela / Upper Drina	Pumped Hydro Storage (150–250 MW)	SS Buk Bijela (planned 400 kV)	Regional balancing near RS/ME border, hydro cluster with new HPPs
	Tuzla region	BESS (10–30 MW)	SS Tuzla 400/220/110 kV	Thermal plant phase-out, high industrial load area
	Mostar corridor	BESS + Solar	SS Mostar 220 kV	High solar radiation, load pockets, grid stress area
Kosovo	Gjakova–Prizren solar belt	BESS + PV (5–10 MW pilots)	SS Gjakova, SS Prizren 110 kV	Weak grid area, solar potential, pilot viability
	Obilić (Kosovo B)	BESS (10–20 MW)	SS Kosovo B 400/220 kV	Load center, balancing needs, coal transition node

Country	Proposed Location	Type of Storage	Connection Point / Substation	Rationale
Montenegro	Perućica HPP area	PHS (upgrade)	SS Nikšić 220 kV	Reservoir-based, existing HPP, central system node
	Pljevlja region	BESS (10–20 MW)	SS Pljevlja 220/110 kV	Coal phase-out, peak load support
	Možura area (co-located with wind farm)	BESS (5–10 MW)	SS Možura 110 kV	Wind integration, voltage support in south
North Macedonia	Štip and Negotino area	BESS (10–20 MW)	SS Štip 400/110 kV, SS Negotino 400 kV	RES (PV) integration hub, planned interconnections with BG and AL
	Bitola	BESS or Hybrid Storage (20 MW)	SS Bitola 400/220 kV	Thermal capacity retirement, balancing and inertia support
Serbia	Bistrica area (SW)	PHS (500–700 MW)	SS Bistrica (planned 400 kV)	Major PHS project; connects to RS-ME corridor and internal 400 kV ring
	Niš area	BESS (20–40 MW)	SS Niš 400 kV	Congestion point, cross-border flow with BG/NM
	Vojvodina (Kikinda / Pančevo)	BESS (10–20 MW)	SS Pančevo 220/110 kV	RES absorption, voltage and congestion support

4 Regulatory and Policy Analysis

This section presents a comprehensive review[5] of the regulatory and policy landscape governing the electricity transmission sector across the six Western Balkans partners: Albania, Bosnia and Herzegovina, Kosovo, Montenegro, North Macedonia, and Serbia. It analyses and assesses the extent to which national frameworks align with the EU's Clean Energy Package and the Energy Community's Electricity Integration Package (EIP), with a focus on:

- Regional market and grid integration,
- Renewable energy (RES) deployment, and
- Energy storage development.

A detailed review for of the regulatory and policy landscape governing the electricity transmission sector across the six Western Balkans partners is attached as Appendix 6.3.

4.1 Background and Context

The Western Balkans countries have committed to achieving climate neutrality by 2050 and aligning their energy sectors with the EU acquis under the Energy Community Treaty. In 2022, they reaffirmed this commitment via the Declaration on Energy Security and Green Transition, setting ambitious 2030 targets and pledging to implement the EIP and related Clean Energy for All Europeans package.

[5] The analysis and the assessment refer to the status as of 30th April 2025

4.1.1 Clean Energy Transition in European Contexts

The Energy Union

The EU Energy Strategy contains five interrelated and reciprocally reinforcing pillars: i) energy security, ii) fully integrated internal energy market, iii) energy efficiency, iv) decarbonisation, and v) innovation and competitiveness.

The "Clean Energy for All Europeans" Package (2019)

This legislative package, marked a significant step towards implementing the energy union strategy, underpins market liberalization and integration of RES, setting binding 2030 targets. The package covers: i) energy efficiency, ii) renewable energy, iii) the design of the electricity market; iv) security of supply and governance rules for the Energy Union.

4.1.2 Energy Community (EnC) Framework

EnC seeks to integrate South East European markets with the EU through legally binding rules; following this objective EnC has designed its clean energy transition policies in line with EU and also has adopted essentially similar legal and regulatory framework - EnC acquis communautaire that is basically compliant with relevant EU energy legislation.

Declaration on Energy Security and Green Transition (2022)

The Declaration affirms Western Balkans partners commitment to green energy, electricity market integration, and RES expansion. The actions for creation of the integrated electricity markets are summarised as follows: i) Operationalizing day-ahead and intra-day electricity trading markets and integrating them into SDAC and SIDC; ii) Integrating balancing and forward markets with the rest of Europe; iii) Enhancing flexibility of the Western Balkans partners' electricity systems by maximising utilization of available interconnection capacities; and iv) Steadily open and expand cross-zonal capacities, thereby increasing the volumes of energy exchanges

EnC Acquis Communautaire on Electricity

On December 2022 the Ministerial Council of EnC took an important step forward in adopting a new set of acquis. Most notably, this new set of acquis includes the adoption of ambitious 2030 energy and climate targets that align with the EU's ambition level and the Electricity Integration Package that lays down the foundation for integrating the EnC Contracting Parties into the EU's internal electricity market.

Legal and regulatory framework of EnC pertaining to clean energy transition consists of 2 interrelated pillars as presented in the schematic below:

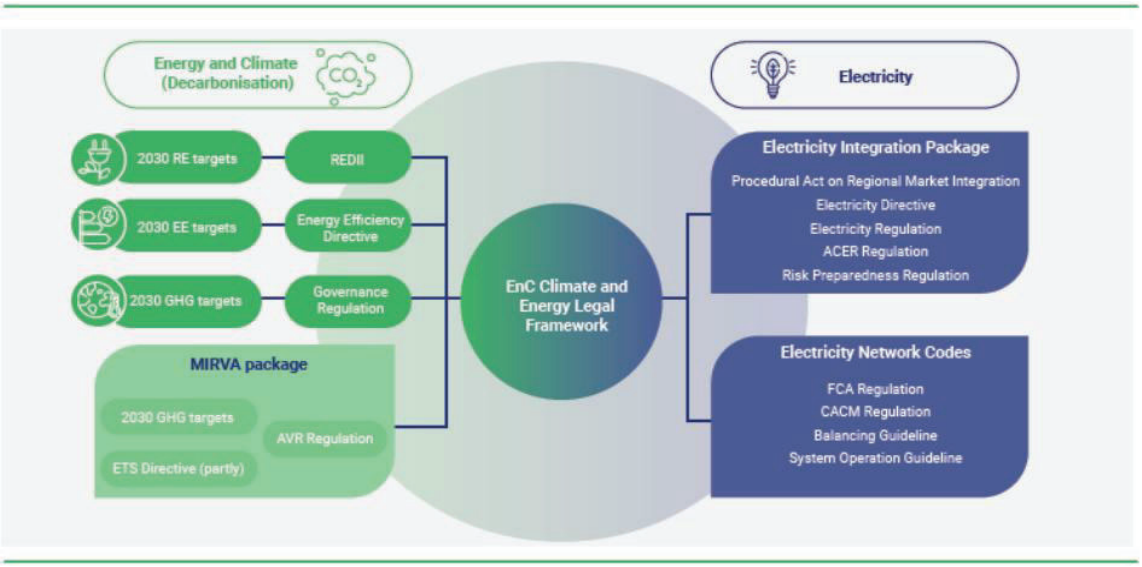

Figure 4-1: EnC framework pillars of clean energy transition – Source: Energy Community Secretariat, www.energy-community.org

4.1.3 Overview of the Electricity Integration Package (EIP)

Nine legislative acts adopted by the EnC Ministerial Council form the EIP, however, in the following is provided a brief overview of the legislative documents, which particularly pertain to market and grid integration, deployment of the RES-E and energy storage:

- **Electricity Directive 2019/944 on Common Rules for Internal market for Electricity** – the Directive establishes common rules for the generation, transmission, distribution, storage and supply of electricity, with a main purpose of creating truly integrated competitive, consumer-centred, flexible, fair and transparent electricity markets in the EnC.
- **Electricity Regulation 2019/943 on the Internal Market for Electricity** – the Regulation set fundamental principles for well-functioning, integrated electricity markets and the basis for climate and energy framework for 2030 by enabling market signals to be delivered for increased efficiency, higher share of renewable energy sources, security of supply, flexibility, sustainability and decarbonisation.
- **Forward Capacity Allocation Guideline (FCA) / Reg. 2016/1719** – The regulation establishes rules for cross-zonal capacity allocation in forward markets, including methodologies for determining long-term cross-zonal capacity and the establishment of a single allocation platform.
- **Capacity Allocation and Congestion Management Guideline (CAMC) / Reg. 2015/122** – the CAMC Guideline provides binding rules for the implementation and operation of market coupling in the day-ahead and intraday timeframes, aiming to maintain operational security, optimize capacity calculation and allocation, and to provide non-discriminatory access to cross-zonal capacity.
- **Electricity Balancing Guideline (EBG) / Reg. 2017/2195** –This Guideline set out common principles and detail rules for the procurement and the settlement of frequency containment reserves, frequency restoration reserves and replacement reserves and a common methodology for the activation of frequency restoration reserves and replacement reserves.

Key elements: cross-border trading, balancing responsibilities, market coupling, RCC establishment, the 70% minimum level of available capacity for cross-zonal trade and 15-minute imbalance settlement periods.

4.1.4 EIP Implementation Roadmap – Summary of most important requirements

The requirements arising for EIP are summarized in the EnC Implementation Roadmap which only reflects main (selected) milestones of high importance; however, in the following table 4-1 only the most important requirements that are relevant to the assignment are listed.

Table 4-1: Main relevant requirements of EIP

Document	Reference	Requirement	Responsibility	Deadline
Directive 2019/944	Art. 5	1. Notify EnCS on public intervention measures in price setting	CP's-NRA's	Feb '23
	Art. 5	2. Report to EnCS on public intervention in market-based supply prices	CP's-NRA's	Jan '25
	Art. 16/33	3. Establish rules i.a. for citizen energy communities, electromobility and energy storage	CP's	Dec '23
Regulation 2019/943	Art. 22	4. New electricity generation capacities emitting more than 550 gCO_2/kWh to be excluded from capacity mechanisms	CP's	Dec '22
	Art. 8	5. Imbalance settlement period to be 15 minutes	TSO's	Jan '23
	Art. 10	6. Submission of the report on measures to prevent wholesale price limitations	CP's	Jan '23
	Annex 5	7. Establishment of System Operation Regions (SOR's)	Concerned TSO's	Dec '23
	Annex 4	8. Establishment of Regional Coordination Centers (RCC's)	Concerned TSO's	Dec '23
	Art. 16	9. Make available 70% of cross-zonal capacities to the market	TSO's	Dec '23
	Annex 4	10. RCC's to present respective NRA's organizational and functional set-up, including plan of operations	RCC's	Jun '24
	Art. 22	11. New electricity generation capacities emitting more than 550 gCO_2/kWh and 350 gCO_2/kWe (electric capacity) to be excluded from capacity mechanisms	CP's – NRA's	Jul '25
	Art. 14	12. Biding Zones Review of EnC CP's	CP's – NRA's	Dec '25
Guideline on Forward Capacity Allocation – 2016/1779	Art. 51	13. Applying harmonized allocation rules for long-term transmission rights	TSO's	Jun '23
	Art. 49	14. Submission of requirements for regional allocation platform	TSO's	Jun '23
	Art. 48	15. Concerned EnC TSO's to conclude bilateral agreements with TSO's of EU member states on usage of allocation platforms (if no agreement, integration in EU Single Allocation Platform)	TSO's	Dec '23
	Art.4	16. Implementation of pan-EU terms, conditions and methodologies (TCM)	TSO's	Dec '23
	Art.10	17. Submission of common cross-zonal capacity calculation methodology	TSO's	Jun '24
	Art.16	18. Submission of methodology / rules for splitting cross-zonal capacity	TSO's	Jun '24
	Art. 21	19. Development of the operational rules for long-term capacity calculation time-frames	TSO's	Jun '24
	Art. 31	20. Submissions of regional design for long-term transmission rights	TSO's	Jun '24
	Art. 59	21. Submission of the methodology for cost-sharing for establishing, developing and operating regional allocation platform	TSO's	Jun '24
	Art. 36	22. TSO's issuing physical transmission rights submits nomination rules for electricity exchange schedules between bidding zones	TSO's	Dec '24
Guideline on Capacity Allocation & Congestion Management – 2015/1222	Annex 1	23. Establishment of Capacity Calculation Regions (CCR)	Concerned TSO's	Dec '22
	Art. 5	24. Notify EnCS in case of monopoly for day-ahead and intra-day trading services	CP's – competent NRA's	Feb '23
	Art. 4	25. Designation of Nominated Electricity Market Operator for day-ahead and intraday trading services	CP's – NRA's	Jun '23

Document	Reference	Requirement	Responsibility	Deadline
	Art. 20	26. Submission of the methodology for cross-zonal capacity calculation for the day-ahead and intra-day time-frames	TSO's	Jun '23
	Annex 1	27. Respective TSO's to conclude cooperation agreement with neighboring EU TSO's per CCR	Concerned TSO's	Jun '23
	Art. 7	28. NEMO's of EU MS's and EnC CP's to develop and submit the Plan for integration in the Market Coupling Operator (MCO) function	NEMO's	Dec '23
	Art. 9	29. Applying pan-EU TCM for SDAC and SIDC	Concerned NEMO's	Dec '23
	Art. 35	30. Submission of the methodology for coordinated re-dispatching (RD) and countertrading (CT)	TSO's	Apr '24
	Art. 44	31. Submission of the Methodology for fallback	TSO's	Apr '24
	Art. 47	32. Submission of the methodology for RD/CT cost-sharing	TSO's	Apr '24
Guideline on Electricity Balancing – 2017/2195	Art. 18	33. Submission of national terms, conditions and methodologies (national TCM) related to electricity balancing	TSO's	Jun '23
	Art. 5	34. Applying pan-EU TCM	TSO's	Dec '23
	Art. 19	35. If applicable TSO's to adhere to TERRE – European platform for the exchange of replacement reserve	TSO's as applicable	Dec '23
	Art. 22	36. If applicable TSO's to adhere to IGCC _ European platform for the imbalance netting process	TSO's as applicable	Dec '23
	Art. 20	37. If applicable TSO's to adhere to MARI – European Platform for the exchange of balancing energy from frequency restoration reserves with manual activation	TSO's as applicable	Dec '24
	Art. 21	38. If applicable TSO's to adhere to PICASSO – European Platform for the exchange of balancing energy from frequency restoration reserves with automatic activation	TSO's as applicable	Dec '24
	Art. 37	39. Submission of the regional methodology for cross-zonal capacity calculation	TSO's	Dec '27

4.2 Overview of relevant national policies and regulatory frameworks

4.2.1 Overview of Western Balkans partners national policies

Western Balkans countries are committed to reforming their energy sectors under international and regional initiatives, including the Berlin Process, Paris Agreement, Energy Community Treaty, and European Green Deal. The goal is carbon neutrality by 2050 and alignment with EU energy and climate targets.

These commitments are reflected to the certain extend into their national energy strategies and integrated national energy and climate plans (NECP's).

National energy strategies

All Western Balkans countries have adopted strategies aligned with EU Energy Union principles, covering:

- Energy security: Diversification of energy sources, phasing out coal, and increasing renewables.
- Energy efficiency: Improved energy generation, consumption, and resource use.
- Market liberalization and integration: Strengthened interconnections, market coupling, transmission development, and system flexibility.

Quantified targets for emissions reduction, renewable energy penetration, and energy savings are included, alongside specific policies to achieve them.

Integrated National Energy and Climate Plans (NECP's)

The National Energy and Climate Plans (NECPs) of the Western Balkans partners outline their strategies and measures to achieve energy and climate objectives for the period from 2025 to 2030, addressing in an integrated way 5 dimensions of the Energy Union: Decarbonisation, energy efficiency, security of energy supply, internal electricity market, and research, innovation & competitiveness.

Concerning the dimension: internal electricity market, the NECP's addresses several key areas:

- **Infrastructure:** Development and modernization of transmission/distribution networks and interconnections.
- **Market integration:** Integration of national electricity markets with regional and EU markets by applying market coupling, removal of barriers for market entry, system flexibility via aggregators, storage, and prosumers.
- **Regulation:** Alignment with EnC Electricity Integration Package to support market integration and ensure fair competition and transparency.

4.2.2 Overview of national legal and regulatory frameworks of Western Balkans partners

Implementation of energy policies requires robust and coherent legal and regulatory frameworks. WBP's have quite comprehensive legal and regulatory frameworks that governs respective electricity sectors, which tend to be aligned with EnC acquis aiming to integrate their national markets into internal EU electricity market; these frameworks focus on energy security, market liberalization and increased competitiveness, regional integration and on promoting renewable energy and energy.

The structure of the WBP's national legal and regulatory frameworks for the electricity sector slightly differs depending on the legal set-up, but typically consists of:

- **Primary legislation:** Energy laws covering electricity, gas, and renewables, or electricity sector specific laws.
- **Secondary legislation:** Regulations and codes issued by regulators and/or TSOs for market operation, grid access, and renewable integration.

Key National Legislative Documents by Country

- **Albania:** Law on Electricity (2015), Renewable Energy Law (2023), Market & Balancing Rules (2020–2022), Interconnection Capacity Allocation Rules (2018), NEMO Designation Regulation (2021), Transmission Grid Code (2022).
- **Bosnia & Herzegovina:** Law on Transmission (2011), Market & Balancing Rules (2021/ 2021), Capacity Allocation Regulations between BIH and neighbouring countries, Connection Rules & Transmission Grid Code (2017–2021).
- **Kosovo:** Law on Electricity (2016), Renewable Energy Law (2024), Market Rules (2023), NEMO Designation Regulation (2021), Common Settlement Rules (2021), Transmission Grid Code (2018).
- **Montenegro:** Energy Law (2024–2025), the Law on Cross-Border Exchanges of Electricity and Gas (2016), Renewable Energy Law (2024), Market & MEPX Trading Rules (2019–2023), Balancing Rules (2017), A set of Cross-Border Capacity Allocation Rules between Montenegro and neighbouring countries (2017–2022).
- **North Macedonia:** Energy Law (2025), Market & Balancing Rules (2019–2022), General Rules for Operation of the Organized Electricity Market (2022), Cross-Border Allocation Rules / Agreements with neighbouring countries.
- **Serbia:** Energy Law (2024), Renewable Energy Law (2024), Market Rules (2022–2024), Transmission Code (2023), Cross-Border Allocation Rules (2017).

These frameworks provide the solid grounds for developing competitive, and integrated electricity markets, while ensuring the security of supply and promoting renewable energy and energy efficiency.

4.3 Analysis and Assessment of the National Regulatory Frameworks and Identification of Gaps

The analysis and assessment comprehend the legislative documents of each WBP by elaborating and evaluating respective provisions pertaining to integration of national electricity markets with regional and EU markets, particularly applying market coupling as to ensure a competitive and efficient electricity market and enabling cross-border free-flow and trade of electricity. In addition, the analysis and assessment focus on the level of facilitating the deployment and integration of renewable energy and development of energy storage systems, outlining components of legislation particularly addressing connection and access of such technologies to the transmission grid and their equal participation to the electricity markets.

Following the analysis and assessment main gaps regarding transposition and compliance with EIP are identified, including implementation gaps.

4.3.1 Albania

Albania's electricity sector is primarily governed by legislation that transposes the 3rd package. While this provides a solid and moderately advanced foundation, the current framework does not yet fully enable a regionally integrated electricity market, efficient cross-border trade, or large-scale integration of renewable energy and storage.

Further completion of the regulatory framework by transposing and aligning with EIP will be necessary to complete Albania's market development and integration. Actually, the transposition is in its initial phase as the new working draft of the Law intended to transpose the EIP has been prepared and submitted to EnCS for the review, but its adoption is still pending finalization after the review.

Electricity Market and Grid Integration:

- Albania's regulatory framework supports the gradual establishment of a liberalized and competitive electricity market.
- The Law on Electricity promotes bilateral contracting and the creation of day-ahead and intraday markets operated by the designated NEMO, ALPEX.
- Market rules and the NEMO Regulation enable implementation of market coupling and functionalization of ALPEX.
- Balancing responsibilities are assigned to market participants and the TSO, with provisions for regional cooperation; Balancing rules are evaluated as moderately compliant aiming for market-based pricing of balancing services.
- Cross-border capacity allocation is partly aligned with EU FCA and CACM rules, and Albania has adopted Harmonized Allocation Rules for long-term transmission rights. Some congestion-management arrangements exist, notably with Kosovo, supporting future market coupling.

Despite these steps, major elements of EU market integration remain unaddressed. Missing areas include full participation in regional coordination structures (RCCs, CCRs), adoption of EU-wide methodologies (TCMs) for balancing and capacity calculation, preparation of common cross-zonal capacity methodologies, rules for re-dispatching and countertrading, fall-back mechanisms, and the 70% cross-zonal capacity requirement.

Connection and Access for Renewables:

- The framework reasonably facilitates renewable energy integration by ensuring priority access and dispatching.
- RES generators receive the most favourable connection point but bear connection costs up to that point.
- The 2022 update of the transmission grid code transposed the relevant Energy Community connection codes.

Energy Storage:

- Albania lacks a dedicated legal framework for energy storage systems, since storage is not defined as a distinct activity, and no tariffs, incentives, or participation rules exist.
- Only the Renewable Energy Law allows priority producers to use storage to manage imbalance risks.

Identified Gaps:

- The new draft Electricity Law intending to transpose the EIP isn't finalized and submitted for adoption.
- This fact hinders complete transposition of the EIP into secondary legislation; namely the following EIP documents: Electricity Regulation 2019/943, CACM, FCA and EB Guidelines.
- In particular, the following critical components missing from the framework: i) Provisions on functionalization of RCCs and CCRs, and adherence to European balancing platforms; ii) National TCM and implementation of pan-EU TCM for system balancing; iii) Cross-zonal capacity calculation methodologies and pan-EU TCM for long-term, day-ahead, and intraday capacity allocation; iv) Methodologies for re-dispatching, countertrading, and fall-back procedures; v) Obligation to make 70% of cross-zonal capacities available to the market.
- Market framework doesn't sufficiently support large-scale renewable energy integration: i) Lack of advanced methodologies for connection costs and related charges; ii) Absence of TSO rules for purchasing flexibility services from renewable energy sources; and iii) No compensation mechanisms for curtailment of renewable energy
- Energy storage is not legally recognized outside the renewable energy law, leading to: i) Lack of market access for energy storage systems (ESS); and ii) No TSO rules for purchasing flexibility services from energy storage.

4.3.2 Bosnia and Hercegovina (BIH)

BIH electricity sector is shaped by a decentralized governance model, with responsibilities divided between the state and the entities. Transmission system regulation, however, is handled at the state level, which is the focus of this assessment. BIH has not yet fully transposed the 3rd Package, and transposition of the EIP is in the early phase of initiation. This slow progress limits the transposition and alignment of secondary legislation, which hinders regional market integration, efficient cross-border electricity flows, and the deployment of renewable energy and storage. Despite this, existing state-level legislation provides a starting point and solid base for future transposition and harmonization with the Energy Community acquis particularly with EIP.

Electricity Grid and Market Integration:

- Existing legislation tackles few aspects that supports liberalized and competitive national market and its integration at regional level.
- Market rules and the Balancing rulebook partially transpose the EB Guideline by introducing auctions for balancing services, assigning balance responsibility, and enabling day-ahead and intraday trading.
- However, important aspects remain unaddressed, including regional balancing cooperation, functionalization of RCC and participation in European platforms, and adoption of Pan-EU TCMs.
- Cross-border capacity allocation is regulated through TSO rules that partially transpose the FCA Guideline but lack transposition of CACM and do not address key elements such as: Functionalization of CCR's, cross-zonal capacity calculation methodologies, re-dispatching and countertrading rules, fall-back mechanisms, or the 70% cross-zonal capacity requirement.
- Additionally, the current framework is not conducive to establishing day-ahead and intraday markets, and no NEMO has been designated.

Connection and Access to the Network:

- The state regulator has transposed the connection code, reflected in the updated (2021) Transmission Network Code.

- The Grid Connection Methodology provides to RES generators a benefit from a reduced connection fee (50% of the fixed component), but the framework does not provide priority access or dispatching for renewable energy.

Energy Storage:

Energy storage is entirely absent from the legal and regulatory framework. It is not recognized as an asset class or market participant, which prevents the development of storage projects.

Identified Gaps:

- Absence of a new electricity transmission law transposing and aligned with the EIP, which consequently prevents the transposition into corresponding state-level secondary legislation.
- Specifically, the following EIP Regulations and Guidelines aren't or partially transposed: Electricity Regulation 2019/943, CACM, FCA and EB Guidelines.
- In particular, the following critical components missing from the framework: i) Provisions on functionalization of RCCs and CCRs, and adherence to European balancing platforms; ii) National TCM and implementation of pan-EU TCM for system balancing; iii) Cross-zonal capacity calculation methodologies and pan-EU TCM for long-term, day-ahead, and intraday capacity allocation; iv) Methodologies for re-dispatching, countertrading, and fall-back procedures; v) Obligation to make 70% of cross-zonal capacities available to the market.
- Electricity framework doesn't elaborate designation of NEMO and doesn't support development of day-ahead and intraday markets.
- Insufficient support for large-scale renewable energy integration – absence of priority access and dispatching, no flexibility or curtailment mechanisms for RES.
- Absence of legal recognition of energy storage, impeding market access for different ESS.

4.3.3 Kosovo

Kosovo's electricity sector is largely governed by the 3rd Package, since the new Law on Electricity intended to transpose and be aligned with EIP has not been yet adopted. This limits full compliance with EIP requirements and partially supports regional market integration, efficient cross-border electricity flows, and large-scale deployment of renewable energy and energy storage development.

Nonetheless, Kosovo's regulatory framework moderately addresses the basic requirements for a competitive, transparent and sustainable electricity market, providing solid grounds to further completing it by transposing and aligning with EIP.

Electricity Market and Grid Integration:

- The legal framework, particularly the Electricity Law, outlines key principles for liberalizing the internal electricity market through bilateral contracting and the establishment of day-ahead and intraday markets.
- Market rules assign responsibilities to power exchanges and offer a basis for NEMO designation, with a NEMO Regulation defining the procedures and conditions; this segment of legislation is evaluated that moderately transposes EIP.
- Balancing provisions partially align with EIP: balancing responsibilities are defined and market-based pricing is permitted, yet regional cooperation and functionalization of RCC, participation in European balancing platforms, and adoption of Pan-EU TCMs remain unaddressed; The balancing market still relies on long-term contracts and daily auctions.
- Cross-border capacity allocation rules provide general principles and include auctions for ATC, but only 50% of capacity is allocated at borders outside SEE CAO. Important EU requirements—such as common cross-zonal capacity calculation methodologies, re-dispatching and countertrading rules, fall-back mechanisms, platform-based congestion management, and the 70% capacity

availability obligation—are not fully implemented. As a result, Kosovo is only partially aligned with FCA and CACM guidelines.

Connection and Access for Renewables:

- The Transmission Code which transposes EnC connection codes sufficiently regulates connection to the transmission network.
- The new Renewable Energy Law supports renewable integration by granting priority access and dispatch, limiting curtailment to last-resort actions, and ensuring favourable connection points. RES developers pay connection and reinforcement costs but benefit from eased access rules.

Energy Storage:

- Energy storage is minimally addressed in legislation – only the Renewable Energy Law permits priority producers to use storage to mitigate imbalance risks.
- Storage is not legally recognized as an asset class, energy activity, or market participant, preventing its deployment and participation in balancing and ancillary services markets.

Identified Gaps:

- The new draft Electricity Law intending to transpose the EIP isn't finalized and submitted for adoption – the draft was submitted for the review by EnCS.
- This has hindered complete transposition into secondary legislation of the major EIP documents such as: Electricity Regulation 2019/943, FCA, CACM and EB Guidelines.
- Specifically, the absence of the following critical components is noted: i) Provisions on functionalization of RCCs and CCRs, and adherence to European balancing platforms; ii) National TCM and implementation of pan-EU TCM for system balancing; iii) Cross-zonal capacity calculation methodologies and pan-EU TCM for long-term, day-ahead, and intraday capacity allocation; iv) Methodologies for re-dispatching, countertrading, and fall-back procedures; v) Obligation to make 70% of cross-zonal capacities available to the market.
- Although the market framework moderately supports the integration and deployment of a large scale of the renewable energy, it lacks several components: i) advanced methodologies and practices for determining the costs of connection and related charges; ii) lack of specific rules on purchase of flexibility services from RES plants; and iii) no compensation schemes (mechanisms) for intended curtailment of the renewable energy.
- Absence of legal recognition of energy storage - except the Law on RES, the remaining legislation doesn't cover energy storage at all.

4.3.4 Montenegro

Montenegro has made notable progress in transposing and aligning its framework with the EIP, especially with the adoption of amendments to the Law on Energy in March 2025, while the Law on cross-border exchanges, after being reviewed by the EnCS and public consultation, is waiting for final adoption by the Parliament. While these reforms significantly advance compliance, the secondary legislation has not yet been updated, meaning the current framework only partially supports regional market integration, efficient electricity flows, and large-scale deployment of renewable energy and storage.

Electricity Market and Grid Integration:

- The amended Law on Energy establishes a solid basis for a competitive and liberalized market, covering day-ahead, intraday, and balancing markets, and providing criteria for NEMO designation and organizing market coupling.
- Montenegro already operates a functional day-ahead market through its designated NEMO, MEPX. However, the 2019 market rules lack modern mechanisms needed for full regional integration.
- Balancing provisions remain weak: although balancing responsibility is assigned, the framework does not define standard EBG-compliant balancing services, nor does it address regional

coordination, RCC functionalization, participation in European balancing platforms, or development of national TCM and implementation of Pan-EU TCMs for system balancing.
- Cross-border capacity allocation rules partially transpose FCA and CACM Guidelines, enabling long-term and daily auctions. Still, they do not include EU-required common cross-zonal capacity calculation methodologies, re-dispatching and countertrading rules, fall-back procedures, or the obligation to offer 70% of cross-zonal capacity to the market.

Connection and Access for Renewables:

- The market framework moderately supports the integration and deployment of a large scale of the renewable energy; The Transmission Code (updated in 2022) transposes Energy Community connection codes, ensuring priority access and dispatch for renewable electricity.
- The new RES Law provides certain relief for "privileged producers" concerning balancing responsibility; however, advanced methodologies for connection costs and RES flexibility rules are still missing.

Energy Storage:

- Relevant provisions of the new Energy Law mark a major step forward by explicitly defining energy storage as a standalone energy activity and a network asset.
- In addition, the storage is recognized as a tool for balancing, peak-load reduction, and improving system reliability. Nevertheless, secondary legislation and TSO rules have not yet been updated to enable market participation or flexibility service procurement.

Identified Gaps:

- Montenegro still lacks final adoption of the second key law (cross-border exchanges) needed for full primary-level EIP transposition.
- Secondary legislation has not been aligned with core EIP regulations and guidelines (Electricity Regulation 943/2019, FCA, CACM, EB).
- Several components of the EIP are not or limitedly transposed: i) distinct definition of standard balancing services; ii) functionalization of RCC and participation to the EU balancing platforms; iii) National TCMs and implementation of Pan-EU TCMs; iv) functionalization of CCRs and common cross-zonal capacity calculation methodologies; v) methodologies related to re-dispatching and countertrading, as well as fall-back methodology; vi) 70% interconnection capacity availability,
- Absence of advanced methodologies for costs of connection, RES flexibility and curtailment compensation rules.
- Pertinent secondary legislation doesn't detail market participation provisions for energy storage such as purchase of flexibility services.

4.3.5 North Macedonia

North Macedonia's electricity sector remains primarily governed by the 3rd Energy Package, as the delay in adopting the primary legislation[6] has prevented transposition and full alignment of secondary regulations with EIP requirements, although many secondary acts are already fairly compliant with EIP. Overall, the existing legislation provides a moderately developed basis for a competitive, transparent, and sustainable electricity market, providing solid grounds to further completing it by transposing and aligning with EIP.

Electricity Market and Grid Integration:

- The actual framework elaborates quite extensively several aspects intended to develop liberalized, competitive and more regionally integrated electricity market.

[6] This statement refers to a situation at the end of April 2025. In May 2025, N. Macedonia adopted the new Energy law which largely transposes the EIP.

- The Law on Energy establishes day-ahead and intraday markets, and MEMO functions as the designated NEMO operating a functional day-ahead market. However, outdated market rules (last updated in 2019) limitedly support full regional market integration through market coupling.
- Balancing market rules are relatively well developed and include auctions, defined balancing responsibilities, and trading timeframes, reflecting partial transposition of the EB Guideline. Still, regional cooperation, RCC functionalisation, participation in European platforms, and development of national/European TCMs remain unaddressed.
- Cross-border capacity allocation rules also follow a market-based approach through long-term and daily auctions but only partially align with FCA and CACM, lacking regionally harmonised capacity calculation, re-dispatching and countertrading methodologies, fall-back procedures, and the 70% cross-zonal capacity requirement.

Connection and Access for Renewables:

- The Law on Energy has directly transposed EnC connection codes, and the updated Transmission Grid Code implements them.
- RES projects included in the national indicative plan are exempt from connection costs; priority access and dispatching are ensured, and 'preferential producers' are exempted from balancing responsibility.

Energy storage:

- The energy storage is formally recognised in primary legislation, which defines storage as a distinct asset class and market activity and assigns rights and responsibilities to storage operators, including the ability to provide balancing services.
- Yet secondary legislation has not been updated to enable practical market participation or flexibility procurement.

Identified Gaps:

- Delays in transposition of primary legislation impede full transposition into secondary legislation of essential EIP components – Electricity Regulation 2019/943, FCA, CACM, and EB Guidelines.
- Most important segments of the EIP aren't or partially transposed into the legislation, including: i) elements include regional balancing cooperation, functionalization of RCCs and participation to EU balancing platforms; ii), National TCMs and implementation of Pan-EU TCM's for system balancing and capacity allocation; iii), common cross-zonal capacity calculation methodologies, re-dispatching and countertrading methodologies, and fall-back methodology; and iv) and the 70% cross-zonal capacity availability obligation.
- Insufficient support to integration and deployment of a large scale of the renewable energy; in particular: i) absence of advanced methodologies for connection costs and related charges; ii) lack of specific rules for purchase of flexibility services; and iii) no compensation schemes for intended curtailment.
- Lack of detailed market and balancing rules enabling market participation of energy storage.

4.3.6 Serbia

Serbia has made substantial progress in aligning its electricity sector with the EIP, particularly through amendments to the Law on Energy adopted by the end of 2024. These amendments introduce key provisions aimed at strengthening regional market integration, improving market functioning, and supporting renewable energy and energy storage development. While the primary legislation is now largely aligned with the EIP, full compliance will depend on updating secondary legislation, much of which still reflects the 3rd Energy Package.

Electricity Market and Grid Integration:

- Actual framework elaborates sufficiently most important issues that are considered crucial for developing a competitive, liberalized and regionally integrated electricity market.

- Serbia operates a functional day-ahead market and an emerging intraday market through SEEPEX as the designated NEMO; the amended Law defines these markets clearly and emphasises regional cooperation to ensure efficient functioning.
- Concerning balancing, the Law establishes market-based principles, non-discriminatory access, and defined balancing responsibilities, while Balancing Market Rules further detail roles, services, and procedures. Although Serbia's balancing framework is advanced and partially aligned with the EB Guideline, regional coordination remains insufficiently elaborated, and balancing capacity prices remain regulated, limiting market-based pricing.
- Cross-border capacity allocation rules in the primary legislation are highly compliant with the EIP, introducing explicit and implicit auctions, continuous intraday trading, transferable transmission rights, and the 70% cross-zonal capacity requirement. The Law also supports regional cooperation on structural congestion and bidding-zone reviews. However, secondary legislation—national allocation rules and bilateral agreements—does not yet reflect full alignment with FCA and CACM Guidelines since doesn't covers all aspects of regionally harmonized capacity allocation.

Connection and Access for Renewables:

Existing framework significantly supports RES integration and the access to the grid and market, specifically:

- The connection to the transmission network is regulated mainly by the Transmission Code, updated in 2023, implementing EnC connection codes, while the Law ensures non-discriminatory access and establishes the conditions for connection.
- For renewables, the Law advances market access by requiring adjustments to balancing rules, enabling RES participation in balancing, and defining ancillary services in a technology-neutral manner, supporting higher RES integration.

Energy storage:

- Energy storage is clearly recognised and defined in the amended Law as a separate energy activity; in addition, it restricts TSO storage ownership except for grid-integrated assets,
- The related provisions assign storage operators responsibilities such as providing balancing services to the TSO, thereby laying the foundation for participation of the storage to the market.

Identified Gaps:

- Despite the recent transposition of the EIP into the Law on Energy, the secondary legislation is still not fully transposing the EIP[7] - particularly the Electricity Regulation 2019/943, FCA, CACM, and EB Guidelines.
- Regional balancing cooperation and deregulation of balancing capacity prices require further explicit elaboration in the secondary legislation.
- The market framework for cross-zonal capacity allocation doesn't specifically address: i) common cross-zonal capacity calculation methodologies and implementation of pan-EU TCM capacity allocation; ii) methodologies of re-dispatching and countertrading, and fall-back methodology.
- Market rules do not fully support large-scale RES or storage integration, specifically: i) absence of advanced Connections Costs Methodologies and related charges; ii) lack of specific rules for the purchase of flexibility services; iii) no compensation schemes for intended curtailment of renewable energy.

[7] As of the end of April 2025. In the meantime, Serbia adopted secondary legislation (Governmental Acts) which transposes the EIP completely.

4.4 Key findings

4.4.1 Assessment Summary (as of the end of April 2025)

- Western Balkans partners electricity sectors remain mostly aligned with the EU 3rd Energy Package due to delays in transposing the Electricity Integration Package (EIP), with all partners missing the December 2023 deadline.
- Moderate progress is ongoing: Serbia and Montenegro have adopted major amendments to primary legislation. Other countries are at final stage of adoption. Bosnia and Herzegovina is in the process of drafting the new law in transposing the EIP. It should be also noted that in May 2025 North Macedonia has also adopted new Law on Energy.
- Delays in primary legislation slowed alignment of secondary legislation, which remains only partially compliant with the EIP.
- Current frameworks moderately support competitive, market-based electricity markets; full regional compliance for integration into the Pan-European electricity market is expected by 2026.
- Actual frameworks reasonably support functioning of national balancing markets on market-based principles, although not fully with free price formations and doesn't entirely address regionally integrated balancing.
- Similarly, the frameworks provide solid basis for market-based approach of capacity allocation through long-term and daily auctions, although several aspects of regionally coordinated capacity allocation and harmonized available capacity calculation remain unelaborated sufficiently; Serbia is the most advanced, introducing obligations such as the 70% minimum cross-zonal capacity availability.
- A notable progress in transposition relates to the day-ahead an intraday market coupling – actual frameworks reasonably elaborate designation of NEMO's and establishment and operation of the DAMs and IDMs.
- This resulted in significant progress in newly established power exchanges in Albania – ALPEX (market coupling with Kosovo), Montenegro – MEPX and North Macedonia – MEMO, in addition to SEPEEX-Serbia established earlier in 2016; these Power Exchanges are designated as NEMO's for operation of respective DAM's and IDM's.
- Actual frameworks of WB Partners moderately support and facilitates renewable energy by providing different tools and approaches for easing the connection and access to the network:
    - All countries have partially transposed EnC grid connection codes and established technical rules for network connections, but different approaches and mechanisms are applied for easement of connection of RES Generators.
    - Access to Transmission networks is fairly elaborated reasonably facilitating the access to the network of renewable energy by mainly stipulating priority access and dispatching priority and in some cases the temporarily release from balancing responsibility.
- The current frameworks of WB Partners partially cover energy storage, thus providing little to moderate support for development of the energy storage – regulation of energy storage is inconsistent across the region: i) not recognized at all in BIH; ii) minimally addressed in Albania and Kosovo; fairly advanced in North Macedonia, Montenegro, and Serbia.

Implementation activities beyond legislation are advancing:

- TSOs, NEMOs, and NRAs actively participate in regional market coupling and CCR implementation, as well as in the implementation projects for adherence to the European market coupling platforms.
- Cross-zonal capacity allocation is largely conducted through SEE CAO, though usage varies among countries.

- Regional balancing cooperation is active across multiple control blocks.
- Several TSOs/NEMOs participate in the SEE Market Coupling initiative to align with the broader European market coupling process.

4.4.2 Summary if identified gaps

- Limited transposition of the EIP into primary legislation (laws):
  - Only Serbia and Montenegro have partially transposed EIP provisions into their energy laws.
  - Albania and Kosovo, have drafted but not yet adopted EIP-aligned laws, while North Macedonia has adopted new Law on energy in May 2025.
  - Montenegro's Law on cross-border exchanges is still awaiting parliamentary adoption.
  - Bosnia and Herzegovina has just recently initiated drafting the new law for transposing the EIP, but finalization and adoption still pending.
- Partial or no transposition into secondary legislation (regulations and bylaws) of the main EIP documents: Electricity Regulation (2019/943), and FCA, CAMC and EIB Guidelines; major elements not or limitedly transposed include:
  - Coordinated regional balancing, RCC functionalization and participation in European balancing platforms.
  - Preparation of national TCMs and implementation of pan-EU balancing rules (except Serbia's framework that introduced national TCM's for balancing.
  - Harmonized cross-border capacity allocation frameworks, particularly: common cross-zonal capacity calculation methodologies, and implementation of pan-EU TCMs for capacity allocation.
  - Re-dispatching and countertrading methodologies, and the fall-back methodology.
  - The 70% minimum cross-zonal capacity availability requirement (except Serbia's newly amended Law has specifically set it.
- Framework insufficiently supporting for accelerating deployment large scale renewable energy:
  - Lack of a uniform, harmonized regional approach to grid connection and access.
  - Differences in technical standards and facilitation mechanisms for RES grid integration.
  - Absence of advanced methodologies for connection costs linked to grid reinforcement and expansion.
  - Limited market-access facilitation for RES producers (e.g., balancing exemptions, favourable market conditions).
  - Lack of TSO rules for purchasing flexibility services from RES producers.
- Deficient Energy Storage regulation significantly varying from country to country:
  - No recognition of storage as an asset class or activity in BIH.
  - Very little coverage of the energy storage in Albania's and Kosovo's frameworks.
  - Moderately advanced frameworks in Serbia, Montenegro, and North Macedonia, though secondary legislation still lacks clarity on balancing responsibilities and provision of system balancing services.
  - Generally, absence of TSO rules for purchasing flexibility services from energy storage operators.

4.5 Recommendations

The ultimate preconditions for implementation of the EIP requirements and reaching the goal of grid and market integration, is full and reliable transposition of EIP into the national and legal frameworks. This in particular includes:

- Full and reliable transposition of relevant EIP provisions into the primary legislation (laws);
- Complete transposition of the relevant EIP documents into the secondary legislation, particularly properly addressing:

  - Coordinated and integrated activities at regional level for regional balancing.
  - Regionally harmonized cross-border capacity allocation that inter alia includes limitations of available cross-border capacities by imposing the binding target of 70% minimum available cross-zonal capacity.

- Enforcing implementation of full market coupling of the Western Balkans region with the single European market and particularly functionalization of intraday markets in addition to day-ahead markets.
- In order of facilitating connection and access to the grid of renewable energy national frameworks should be further completed and harmonised, namely to introduce:
  - Regionally harmonised approaches and mechanisms for facilitating the connection and access to respective transmission networks.
  - Uniform facilitation across all the Western Balkans partners' region of the market access and participation for the RES electricity.
  - Specific rules for purchasing of the flexibility services from the RES producers.
  - Compensation schemes for intended curtailment of renewable energy – e.g. compensation through re-dispatching.
  - Advanced methodologies for connection costs related to network expansion and reinforcement.
- Develop and complete specific regulatory frameworks for storage, enabling market participation and investment.
- Enhance NRA capacity and coordination, especially in monitoring and enforcement.
- Promote policy incentives (e.g., support schemes for storage, RES grid and market integration) to attract private investment.

The most recent status of the transposition of the entire Electricity Integration Package (EIP) is presented in the table below.

Table 4-2: Status of the legal act transposing fully/partially the Electricity Integration Package, end November 2025

Directive / Regulation	Albania	Bosnia and Herzegovina	Kosovo	Montenegro	North Macedonia	Serbia
Electricity Directive (EU) 2019/944	public consultation	in the parliamentary procedure	drafting	adopted	adopted	adopted
Electricity Regulation (EU) 2019/943	public consultation	in the parliamentary procedure	drafting	in the governmental procedure	adopted	adopted
Risk-Preparedness Regulation (EU) 2019/941	public consultation	in the parliamentary procedure	drafting	in the governmental procedure	adopted	adopted
ACER Regulation (EU) 2019/942	public consultation	in the parliamentary procedure	drafting	in the governmental procedure	adopted	adopted
Commission Regulation (EU) 2015/1222 (CACM)	adopted	in the parliamentary procedure	drafting	in the governmental procedure	adopted	adopted
Commission Regulation (EU) 2016/1719 (FCA)	adopted	pending	pending	in the governmental procedure	drafting	adopted
Commission Regulation (EU) 2017/2195 (EBGL)	adopted	pending	pending	in the governmental procedure	drafting	adopted
Commission Regulation (EU) 2017/1485 (SOGL)	in the regulatory procedure	pending	pending	drafting	drafting	adopted
Commission Regulation (EU)	in the regulatory procedure	pending	pending	drafting	drafting	adopted

Directive / Regulation	Albania	Bosnia and Herzegovina	Kosovo	Montenegro	North Macedonia	Serbia
2017/2196 (ERNC)						

Source: Energy Community Secretariat

5 Risk Analysis

The Risk Analysis outlines the objectives, guiding the risk analysis of electricity transmission infrastructure across the Western Balkans. It sets the stage for understanding the broader context in which these projects are planned and implemented, referencing national legislation, EU directives, and international safeguard standards relevant to infrastructure investment and environmental and social compliance.

It assesses risks, uncertainties, and social implications related to forthcoming transmission infrastructure investments in the Western Balkans. The analysis draws on desk reviews of national legislation, EU guidance (TEN-E, REPowerEU), NECP project pipelines, climate projections, environmental and social safeguard standards (EBRD, WB), and findings from other tasks (market integration, grid constraints, financial assessments).

5.1 Key Risk Categories

5.1.1 Investment – Related Risks

Transmission project implementation across the region faces:

- Administrative and permitting delays, often leading to prolonged project timelines.
- Dependence on external financing from IFIs and EU grants, which are essential for lowering capital costs and enabling gradual tariff reforms.
- Macroeconomic pressures (inflation, exchange rate volatility) increasing capex and operational costs.
- Challenges in cross-border project coordination, particularly for jointly operated lines and substations.

5.1.2 Technological and Infrastructure Uncertainties

- Limited flexibility infrastructure: no operational utility-scale BESS in the region (as of 2025) and minimal use of Dynamic Line Rating.
- Digitalisation gaps between TSOs increase interoperability and cybersecurity risks.
- Low storage capacity (only two PSHPPs regionally) affects renewable integration and balancing capability.

5.1.3 Regulatory and Policy Risks

- Uncertainty in timing and completeness of EU energy package transposition within Energy Community Contracting Parties.
- Political shifts affecting sector priorities.
- Unclear long-term cost recovery mechanisms for major grid investments.
- Limited regulatory capacity in tariff reform, market integration, and oversight.

5.1.4 Environmental. Climate and Social Risks

Transmission assets face increasing climate pressures:

- Overhead line exposure to wind, icing, wildfire, heat, and extreme events.
- Underground cable risks related to erosion and water ingress.

- Substations located in flood-prone zones without sufficient protection. Initial mitigation focuses on climate-resilient design, improved predictive maintenance, and risk-informed routing.
- Climate hazards: rising temperatures, altered precipitation patterns, more frequent extreme events, and hydrological changes.

5.1.5 Land Use, Displacement & Social Impacts

New transmission corridors create risks related to:

- Expropriation and land fragmentation, especially in rural and mountainous zones.
- Economic displacement of farmers and informal land users.
- Impacts on minority and vulnerable groups (Roma, Vlach, Gorani) where tenure security is weak.
- Risk of community conflict where property rights are unclear. Mitigation emphasizes early land screening, inclusion of informal users, culturally appropriate engagement, and livelihood restoration.

5.2 Preliminary Project Specific Screening

Five priority transmission projects were analysed, covering technical, regulatory, environmental, climate, and social risks.

Shared risks include complex terrain, exposure to protected areas, potential land disputes, aging infrastructure, and the need for cross-border regulatory alignment.

Mitigation measures focus on improved feasibility analysis, harmonised permitting, DLR deployment, bird protection and erosion measures, robust compensation processes, and public engagement mechanisms.

The tables below summarize the main risks for transmission projects - investment, technology, regulatory, climate, and social/land and the corresponding mitigation measures, including improved permitting, technical resilience, environmental protection, social safeguards, and financing strategies.

Table 5-1: Summary of Key Risks Across Categories

Risk Area	Main Issues Identified
Investment	Permitting delays; reliance on IFIs/EU funds; macroeconomic volatility; cross-border coordination challenges
Technological	No operational BESS; limited smart-grid deployment; uneven digitalisation; cybersecurity vulnerabilities
Regulatory	Delayed EU acquis transposition; political instability; unclear cost recovery; limited TSO/NRA capacity
Climate & Environment	Exposure to wind/ice/fire/flooding; substation flood risks; habitat sensitivities; erosion impacts
Social & Land	Land acquisition conflicts; economic displacement; minority impacts; informal tenure; resettlement risks

Table 5-2: Summary of Initial Mitigation Measures

Area	Recommended Measures
Regulatory & Institutional	Cross-border permitting alignment; early EU taxonomy alignment; one-stop permitting; stronger NRA–TSO coordination
Technical & Infrastructure	Climate-resilient design; DLR deployment; predictive maintenance; digitalisation and cybersecurity upgrades
Environmental & Climate	Micro-routing to avoid protected areas; bird diverters; erosion control; flood/fire mapping; restoration of habitats
Land & Social	Early land screening; inclusion of informal users; minority-sensitive engagement; fair compensation; grievance mechanisms

Area	Recommended Measures
Financial & Operational	Scenario planning; PPP feasibility evaluation; blended financing with IFIs/EU; risk-sharing frameworks

6 Appendices

6.1 Capacity Analysis report

<separate report>

Task 1 Capacity Analysis Report_202

6.2 Electricity Market and Balancing report

<separate report>

Task 2 Electricity Market and Balancir

6.3 Regulatory and Policy Analysis report

<separate report>

Task 3_Report_Regulator

6.4 Risk Analysis report

<separate report>

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