COMPASS LEXECON

In collaboration with:

DLA PIPER

System adequacy and capacity mechanisms in South East Europe

A study commissioned by the Energy Community Secretariat

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Energy Community

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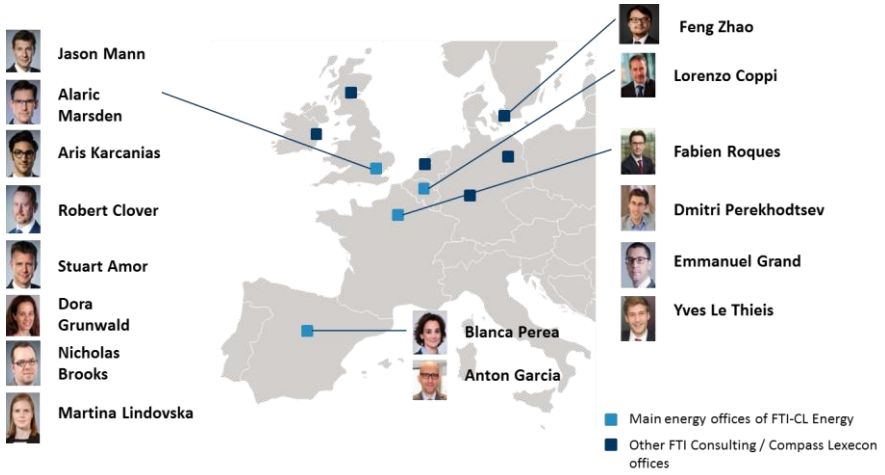

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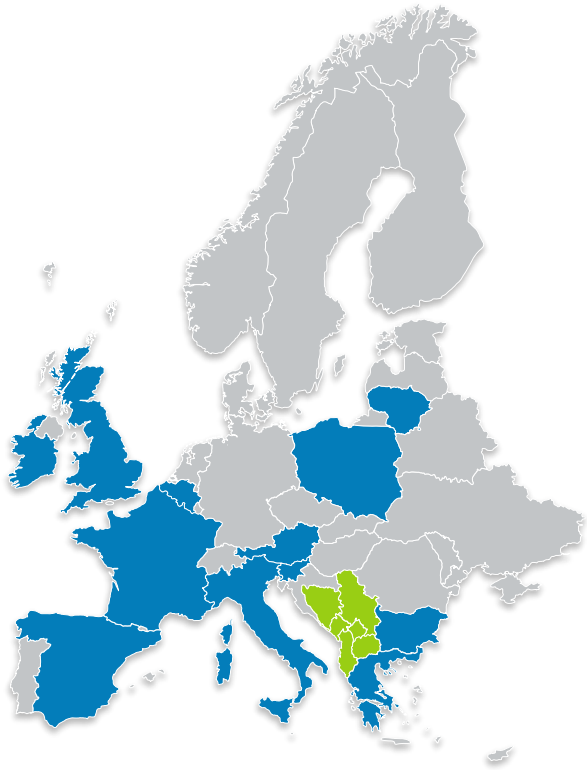
- Offices across the US, South America, Asia-Pacific and Europe
- We have the highest number of competition specialists in the industry, with a global team of over 430 professionals and affiliates. 120 in Europe based in Berlin, Brussels, Düsseldorf, Helsinki, London, Madrid and Paris.
- Many former chief economists at competition authorities.
- 145 PhD economists and econometricians, and faculty from leading universities and institutes including two Nobel Prize winners..

Our involvement in Capacity mechanisms design in Europe

Over the last five years, Compass Lexecon has participated in the design and state aid analysis of the Capacity Mechanisms in at least 12 European countries.

European countries where Compass Lexecon worked on Capacity Mechanisms



CONTENT OF THE PRESENTATION

STUDY CONTEXT: WB6 COUNTRIES ELECTRICITY SECTOR CHALLENGES

The Contracting Parties of the Energy Community in the Western Balkan countries (WB6) are Albania, Bosnia and Herzegovina, Kosovo*, Montenegro, North Macedonia and Serbia.

Current electricity sector organization of WB6 countries

- **60%** of WB6 generation comes from **lignite plants**
- **Incomplete stage of liberalization of the wholesale market** which is shaped by ongoing reforms (e.g. market coupling) and with **significant involvement of the state** (through ownership, regulation, subsidies, state aid)
- 50 – 90% of electricity generated by incumbent utilities in the WB6 are **reserved for the suppliers of regulated customers**
- Volumes traded on the free market represent mainly the cross-border trade to **sell incumbents' surplus** or **procure volumes** to cover shortages for incumbents or network losses.

Conditions for EU accession: further liberalisation, implementation of emission standards and ETS

- WB6 countries are legally bound to implement the core EU energy legislation, the so-called "***acquis communautaire***"
- Most of WB6 **transposed the Third Energy Package** in their national legislation and must already comply with the Large Combustion Plants Directive **(LCPD)** and Industrial Emissions Directive **(IED) emission standards**
- In 2019 EC adopted an updated **Electricity Regulation 2019/943** which contains further emission standards that would affect WB6 thermal plants (e.g. the 550g CO2/kWh and 350 kg of CO2 thresholds for capacity mechanisms eligibility)
- WB6 have yet to implement carbon pricing and join the **EU ETS**

** This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.*

STUDY SCOPE: WB6 GENERATION ADEQUACY IN CONTEXT OF FURTHER LIBERALISATION AND ETS IMPLEMENTATION

Compass Lexecon and DLA Piper were commissioned by the Energy Community Secretariat to deliver a study focussing on **two main tasks**:

Task 1: Analyses of WB6 generation adequacy by 2030

- Analyse whether the transition to the European Target Model and the implementation of emission standards and ETS carbon pricing may cause adequacy issues in the WB6 region

Task 2: Need and design of capacity mechanisms

- Identify the potential contribution and high level options for design of capacity mechanisms to secure supplies in the WB6 transition to complement other market reforms

CONTENT OF THE PRESENTATION

OUR STUDY COMPARES TWO CONTRASTED SCENARIOS

Base case scenario

Assumptions

- **Exogenous** capacity outlook based on **TSOs' assumptions**
- **No carbon pricing**
- **No refurbishment costs** to comply with environmental norms

Main results

- Investments in new lignite plants and in refurbishment to comply with emissions standards are **profitable**
- WB6 **exports** c.25% of its generation in 2030 but **relies on import** during peak hours
- **No adequacy concerns**

Sensitivity scenario

Assumptions

- **Endogenous** capacity outlook based on **economic modelling**
- **EU ETS implemented** either from 2025 or from 2030
- Obligation to refurbish to comply with environmental norms

Main results

- New lignite plants **unprofitable** ➔ 2.5 GW of new lignite plants are cancelled
- Most of the refurbishment works to comply with LCPD and IED **unprofitable** ➔ 3.1 GW would close in late 2023 and 1.3 GW in late 2027
- WB6 region **imports** c.30% of its consumption
- **Significant security of supply concerns** as soon as 2025, in particular in Albania and Serbia, even with fully efficient market coupling

OUR MODEL REPRESENTS EACH PLANT IN WB6 COUNTRIES AND NEIGHBOURING POWER SYSTEMS

Monte Carlo Dispatch market optimisation based on detailed representation of power market fundamentals at an hourly granularity

Geographic scope

WB6 countries: Detailed modelling on a plant-by-plant basis

Countries interconnected with WB6 countries: Aggregated modelling on a technology level based on ENTSOE forecasts

Other countries: Not modelled (only the import/export volumes with the "blue countries" are considered, based on historical data)

Scenarios for market fundamentals based on latest TSOs' publications, 2030 RES target, and EU emission norms

- Supply outlook
- Demand outlook
- Cross-border capacity outlook
- LCPD
- EU ETS implementation

Modelling framework

- **Fully competitive power market** (e.g. SRMC bids and not indirect subsidies)
- **Perfect market coupling between countries**
- **Plexos based dispatch model**
- **Sample approach based on 3 representative weather samples * 10 outage patterns**

Evaluation of plant profitability, potential decommissioning, and impact on generation adequacy (reserve margin and LOLE)

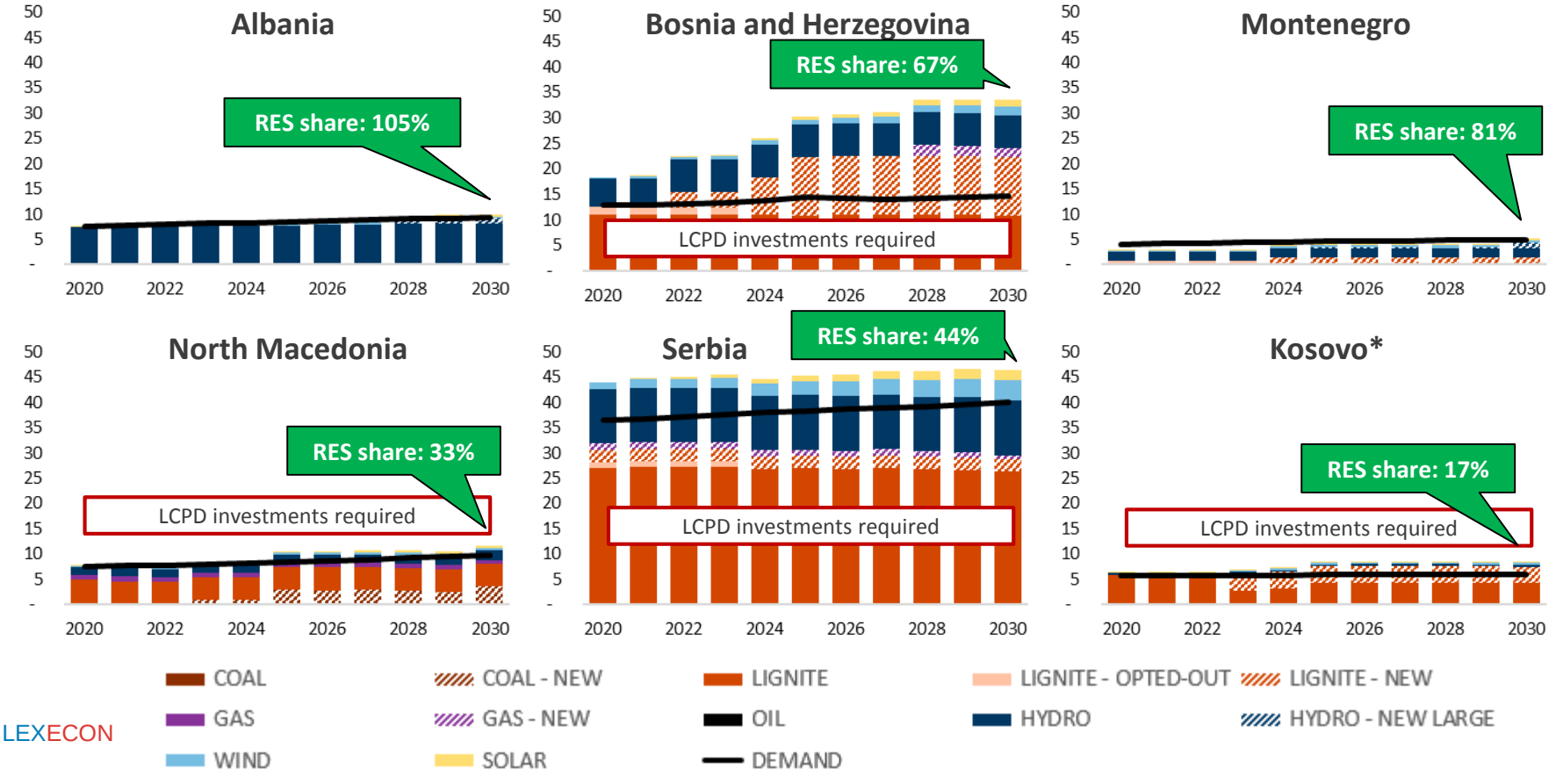
Time horizon

Existing system → 2020 → 2025 → 2030

SIGNIFICANT INVESTMENTS IN MOST THERMAL PLANTS WILL BE NECESSARY TO COMPLY WITH LATEST ENVIRONMENTAL NORMS

- On 1st January 2018, the implementation of the LCPD started in the Energy Community, requiring plants operators to comply, by investing an annualised **15€/kW** for lignite plants, or enter into the Limited Lifetime Derogation (20,000 hrs between 2018 and 2023). Additional annualised investments of **15-30 €/kW** are necessary to comply with IED by 2028.
- In parallel, the Energy Community will transit to higher RES penetration reaching **c55%** of WB6 demand by 2030 (compared to c.45% in 2020)

Annual generation and demand outlook (TWh) and 2030 RES share (% of national demand)

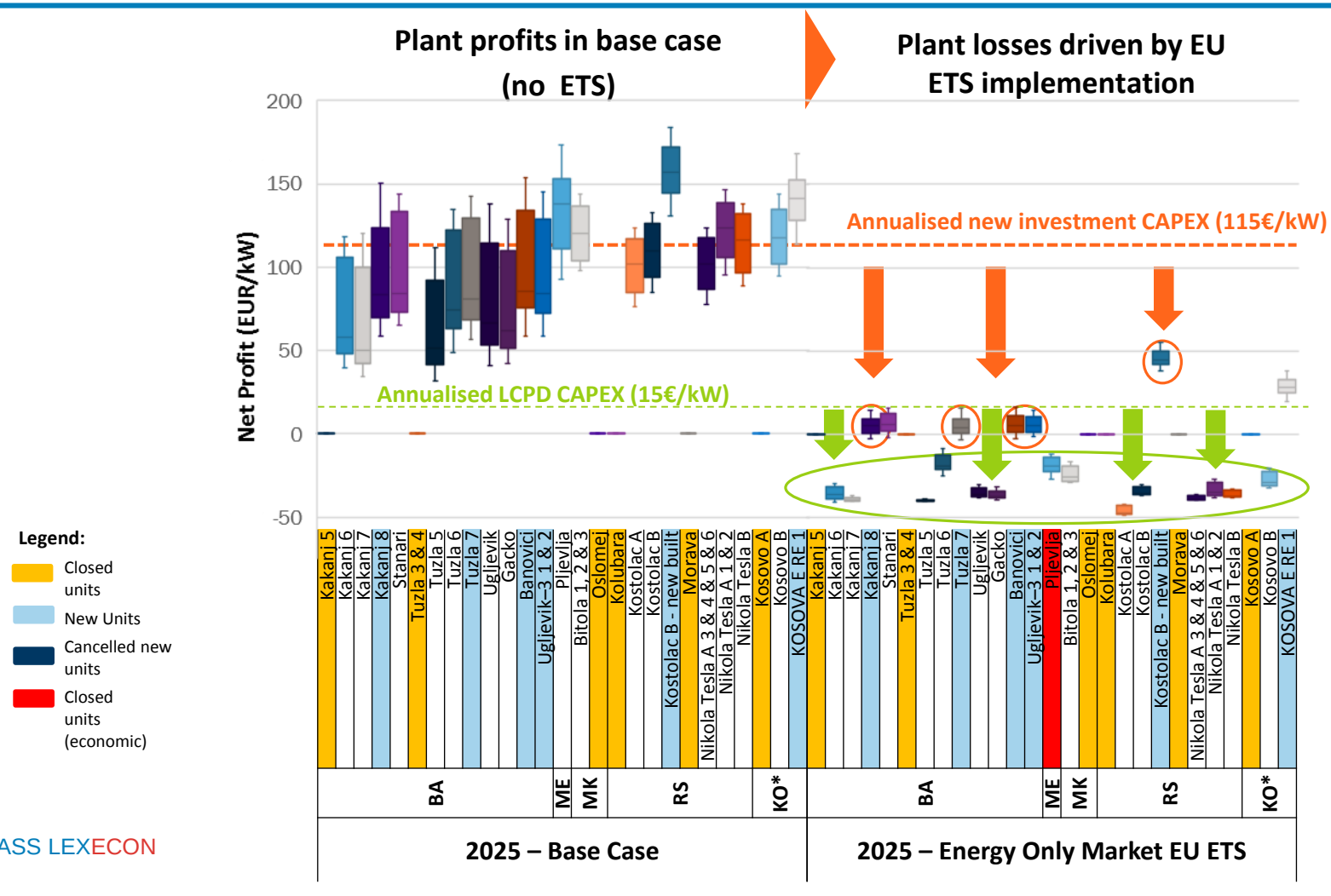


IMPLEMENTATION OF ETS WOULD SIGNIFICANTLY IMPACT THE ECONOMICS OF THE WB6 POWER SYSTEMS

As soon as the EU ETS is introduced, new and existing lignite plants would become **unprofitable.** This would lead to:

- **Closures of existing plants**: 0.9 GW in Bosnia, 0.4GW in North Macedonia and 3GW in Serbia.
- **Projects cancellations**: 1.5GW in Bosnia, 0.2GW in Montenegro, 0.7GW in North Macedonia and 0.3GW in Serbia

Net Profit = Energy Revenue + Reserve Revenue – Variable Cost – Fixed Cost



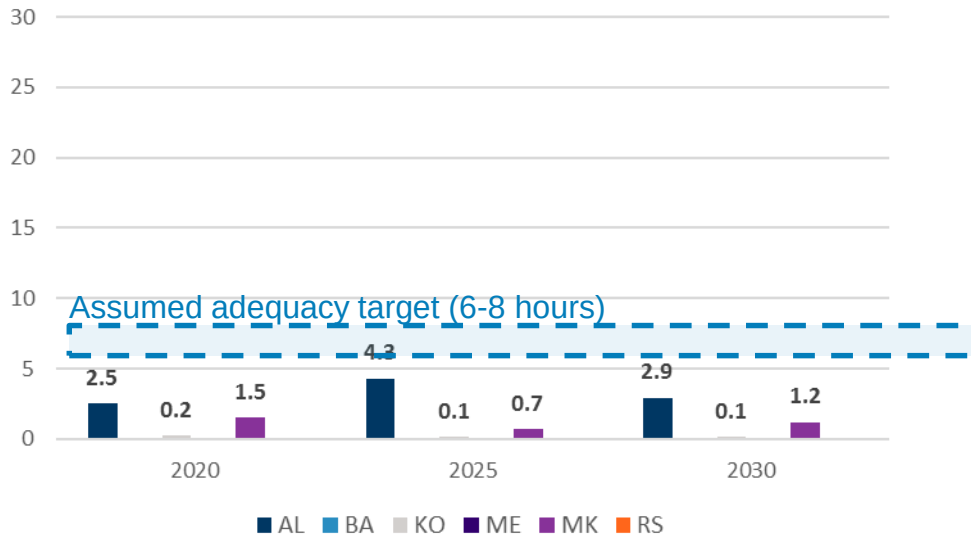
IN THE ETS SCENARIO, SIGNIFICANT CLOSURES OF THERMAL PLANTS WOULD LEAD TO SECURITY OF SUPPLY ISSUES

Assuming a **security of supply target of 6-8 LOLE** hours in all WB6 countries:

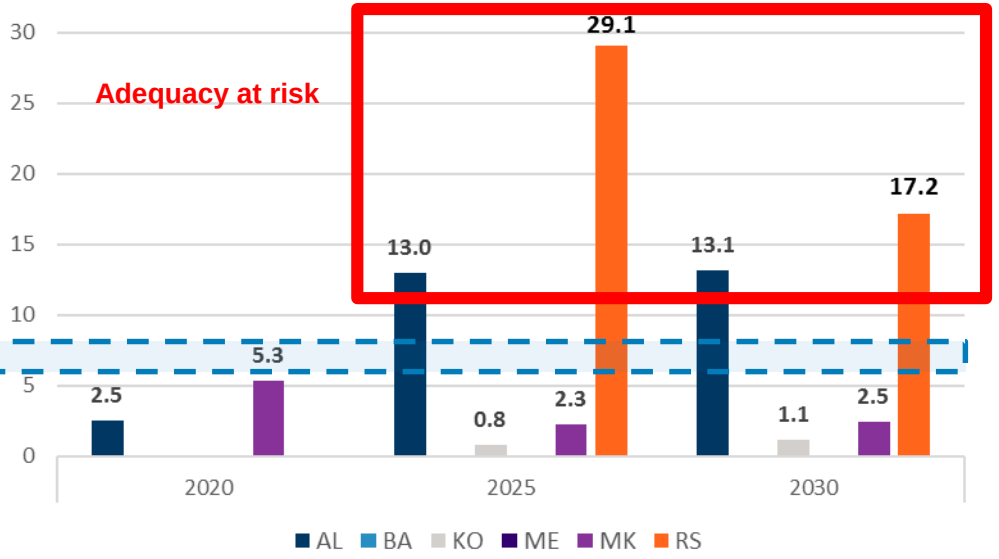
- No adequacy concerns in the Base case scenario if investment new and existing plants is forthcoming and if cross-border capacity is used efficiently;
- The **2025 ETS scenario would result in significant security of supply issues as soon as 2025**, in particular in **Albania and Serbia** due to (i) limited new investments in hydro (for Albania) and lignite (for Serbia) units, and (ii) closure of existing lignite plants (for Serbia).

➔ This raises the question of the **timing and compensation and investment framework** that would allow the **implementation of the ETS in WB6 countries**.

Loss of Load Expectation for WB6 countries, in the Base case scenario (number of hours per year)



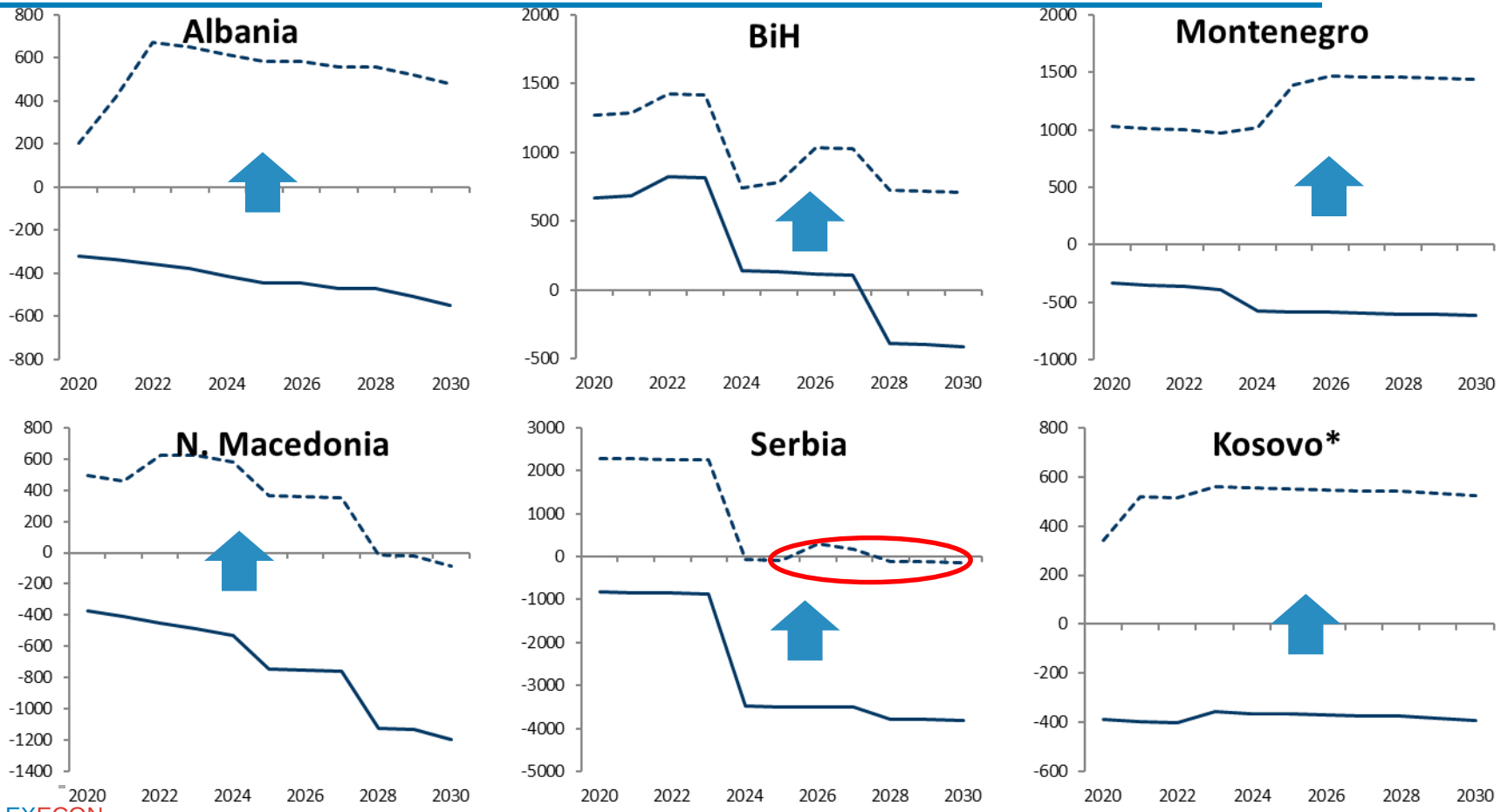
Loss of Load Expectation for WB6 countries, in the EU ETS 2025 scenario (number of hours per year)



INTERCONNECTIONS AND REGIONAL COORDINATION ARE KEY TO MAINTAIN SYSTEM ADEQUACY IN WB6 COUNTRIES

- All WB6 countries except Bosnia are **dependent on interconnections to maintain generation adequacy** today.
- In the ETS 2025 scenario, the **contribution of interconnection to adequacy becomes even more important as the reserve margin deteriorates in most countries**. Serbia would face adequacy issues even when accounting for the contribution of interconnection.

Derated margin = Available capacity – (Peak load + Reserve), MW



CONTENT OF THE PRESENTATION

CONCLUSIONS: IMPLEMENTATION OF EU TARGET MODEL, EMISSION STANDARDS AND ETS COULD RAISE ADEQUACY ISSUES IN WB6 COUNTRIES

Adequacy issues in the scenarios with EU ETS and emission norms compliance

- Thermal plants in WB6 countries will require significant investments to comply with LCPD and IED emission norms.
- Further implementation of EU electricity target model, phasing out of existing state aids, implementation of RES targets, emission standards and EU ETS could reduce significantly profits of existing plants and make investment in new plants uneconomic.
- Adequacy issues as early as 2025 in WB6 induced by lignite plant closures and lack of new investments (closure of up to 4.4GW of lignite plants by 2030 in Serbia, Bosnia and Herzegovina and North Macedonia and 2.8 GW of cancelled investments).

➔ **This raises the question of the timing (gradual phasing in) of the implementation of the ETS in WB6 countries and compensation framework (e.g. via free allowances, investment support, and compensation mechanisms).**

Further coordination and efficient use of interconnection capacity is key for WB6 generation adequacy

- All WB6 countries, except Bosnia and Herzegovina, rely on import capacity during peak hours.
- **In case available interconnection capacity is limited,** Montenegro, North Macedonia, Serbia and Kosovo* will likely face adequacy issues at times of peak demand even without implementation of ETS.
- Because of the high reliance on interconnection, plant closures in one country may “spill over” and have **regional impact** (e.g. closures of lignite plants may have adequacy impact on hydro-dominated Albania).

RECOMMENDATIONS: CONTINUED MARKET REFORMS ARE NEEDED IN THE WB6 COUNTRIES TO ENSURE COMPATIBILITY WITH EU FRAMEWORK

The current market structure in WB6 and existing state aid limits the plants missing money but is not sustainable and will not support the investments required

- **Incomplete liberalization –** Generators mostly sell their energy internally to their supply branches or under PSO obligation with limited reliance on the market, no carbon pricing such as in EU countries limiting profits of thermal plants
- **Various existing state aid –** May make it difficult to justify additional aid through a CRM

Electricity market reforms are necessary to make WB6 compatible with EU Energy Target Model

- **Development of power exchanges and market coupling** to optimize the use of the existing transmission capacity
- **Implementation of carbon pricing** such as in EU, new environmental emission norms leading to investment requirements

Regularization of existing state aid is needed

- A number of **existing state aid measures would need to be reviewed** and modified to be compatible with the EU state aid regulation
- The two main objectives of common interest justifying the legal State Aid in the electricity sector are **decarbonization and adequacy**
- Therefore, the existing state aid programs would need to be **either phased out or converted into either an environmental or an adequacy State Aid (e.g. capacity mechanism)**

RECOMMENDATIONS: AS A COMPLEMENT TO THE REFORMS, A CAPACITY MECHANISM COULD BE USEFUL TO MAINTAIN ADEQUACY IN THE TRANSITION

To maintain generation adequacy in the transition towards EU ETS, WB6 countries could implement a strategic reserve (SR)…

Strategic reserve is an appropriate CM model to manage pace of plant decommissioning

- According to the EC, when adequacy concerns are driven by the risk of retirement of existing plants, a temporary strategic reserve may be appropriate intervention
- SRs have been implemented in Belgium and in Germany to manage pace of thermal capacity decommissioning.
- A similar adequacy issue could emerge in the WB6 as a result of introduction of emission standards and EU ETS
- Given the critical impact of interconnection between countries, cross-border participation of neighboring countries is important.

…However, when new investment becomes needed, a market-wide CM (e.g. a centralized capacity market with long term contracts) could be phased in to support new investment

The need to induce new investment in WB6 may require a market-wide capacity mechanism

- According to the EC, a substantial need to induce new investment, would require a market-wide mechanisms rather than strategic reserve
- European MSs have implemented such market-wide mechanisms in such situations (Poland, France, Italy, Ireland). Belgium is shifting from SR towards a market-wide as a result of the nuclear phase-out.
- The application of the 550gCO2/kWh rule in WB6 excluding coal and lignite from CM would require transition from SR to a market-wide CM **accounting for the specificities of the adequacy issues** across the WB6 region (e.g. Serbian critical role)**.**

[1]Regulation 2019/943 (Art.26)

RECOMMENDATIONS: THE EC HAS DEVELOPED A SET OF GUIDANCE FOR THE DESIGN OF CM TO ENSURE THEIR COMPLIANCE WITH STATE AID

Although these regulations do not yet apply to WB6, they are a useful reference for the design of CM:

Key State Aid criteria		Implications	
1	Contribution to well-defined objective of common interest	Justification	• Must be clear need for state intervention and the objectives must be clearly defined • Objective must be consistent with phasing out environmentally harmful subsidies
2	Need for state aid intervention		
3	Appropriateness of the aid measure	Proportio-nality and design	• Aid should not change the behaviour of market players and be non discriminatory • Aid to the minimum: the amount paid should tend to zero as capacity available approaches the required level • Must have reasonable rates of return a competitive bidding process is encouraged
4	Incentive effect		
5	Proportionality of the aid		
6	Avoidance of major undue negative effects on competition and trade between member states	Impact on competition and internal market	• Operators from other member states should be allowed to participate • Negative effects on the internal market should be avoided • Should not reduce incentives to invest in interconnection
7	Transparency of aid		

According to Regulation 2019/943

- **The need of CM has to be proven via regional adequacy outlook using common ENTSO-E methodology**
- **Reliability Standard shall be introduced which indicates the necessary level of Security of Supply and be expressed as "expected energy not served" and "loss of load expectation".**

Thanks for your attention

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Appendix

Background material on the study

SCENARIOS CONSIDERED FOR THE ADEQUACY ANALYSIS

	Base Case Scenario	Sensitivity scenarios
Wholesale power market reforms to implement "energy only" market (phasing out of existing state aid, in particular on lignite generation)	✓	✓
Increased RES penetration target	✓	✓
Market coupling and cross-border interconnection within and with neighbouring countries	✓ - perfect market coupling	✓ - perfect and imperfect market coupling
Refurbishment costs to comply with environmental norms (LCPD and IED)	✗	✓
Carbon pricing	✗	✓ - through the participation to the EU ETS either from 2025 or from 2030
Capacity outlook	Based on TSOs' assumptions: **no profitability assessment**	Based on **economic modelling** using regional power system model

- **3.2 GW** of new lignite plants by 2030 ➔ it would require total investment costs of **EUR 4,8 billion**
- Only **1.4 GW** of decommissioned lignite plants by 2030 ➔ assuming that all other lignite plants must invest to refurbish and comply with emissions standards, it would imply total refurbishment costs of **EUR 610 million to comply with LCPD** and at least the same amount to comply with IED

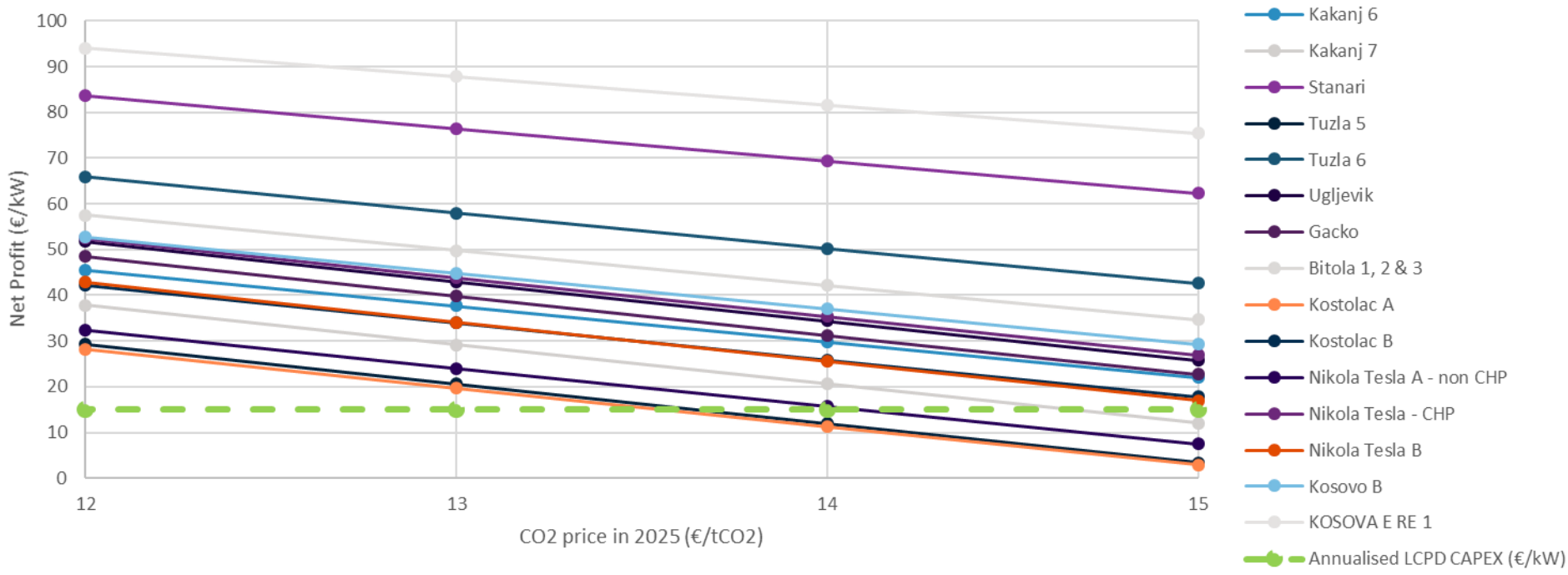
What happens to these investments:
- **If we implement carbon pricing in WB6 countries?**
- **If we apply LCPD and IED standards?**
- **If we reduce the efficiency of market coupling?**

SENSITIVITY ANALYSIS: FOR LIGNITE PLANTS TO REMAIN PROFITABLE, CO_2 PRICE SHOULD BE < 13-14€/TCO_2 IN 2025

Assuming that the WB6 region will (i) implement a CO_2 price as soon as 2025, but different from the EU ETS price and (ii) enter the EU ETS market in 2030 at the latest, we assess the maximum CO2 price that should be applied in WB6 countries and that would limit the decommissioning of lignite plants.

- The transitional CO_2 price in WB6 countries should not be higher than **13-14€/tCO_2** in 2025
- By contrast, the CO_2 price assumed in 2025 in the WB6 region in the EU ETS 2025 EOM scenario is equal to 22.5€/tCO_2.

Net profit of existing lignite plants in 2025 for different CO2 prices in the WB6 region



ADEQUACY ASSESSMENT BACKGROUND ASSUMPTIONS (1/2)

On commodity prices

Element	Source	Value
Gas price	Based on forward prices for the coming years and on the New Policies scenario of the WEO 2018 for 2025 and 2030 + a premium on top to reflect historical regional spread in WB6 region compared to CWE hub prices	c.26€/MWh in 2020 and c.27€/MWh in 2030
EU ETS CO2 price	Based on forward prices for the coming years and on the New Policies scenario of the WEO 2018 for 2025 and 2030	c.22€/tCO_2 in 2020 increasing to c.30€/tCO_2 in 2030
Lignite price	A common and constant regional coal price, based on DG Energy. This value is higher than the current observed prices in WB6 countries due to the importance of lignite subsidies in WB6 countries, which we remove in this study	8.3€/MWh (2.3€/GJ)

On costs

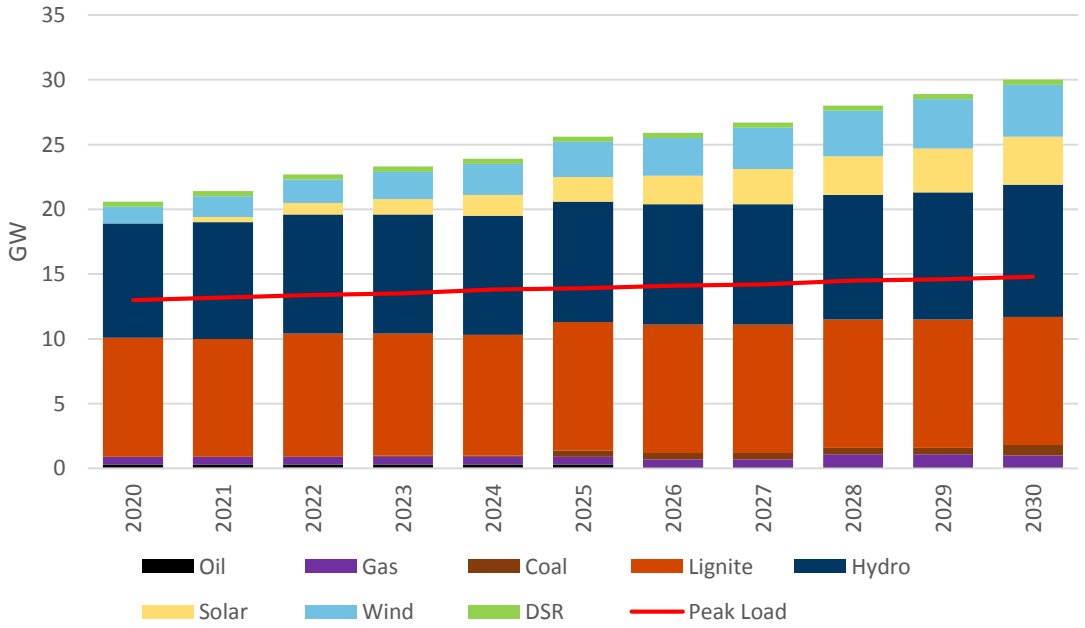
Element	Source	Value
Variable O&M	Provided by WB6 TSOs. When unavailable, generic values assumed by ENTSO-E are used	For lignite plants, from 3.3 €/MWh to 4.6 €/MWh depending on the plant
Efficiency	Provided by WB6 TSOs. When unavailable, generic values assumed by ENTSO-E are used	For lignite plants, from 23% to 44% depending on the plant
Fixed O&M	DECC	40€/kW-year for lignite plants
Investment costs	ETRI, e3a Modelling, Eurelectric and Energy Community	115€/kW-year for coal plants during 35 years, 65€/kW-year for CCGT during 30 years
Refurbishment costs to comply with LCPD	ETRI, e3a Modelling, Eurelectric and Energy Community	15€/kW-year for lignite plants during 10 years
Refurbishment costs to comply with IED	ETRI, e3a Modelling, Eurelectric and Energy Community	15-30€/kW-year for lignite plants during 10 years

ADEQUACY ASSESSMENT BACKGROUND ASSUMPTIONS (2/2)

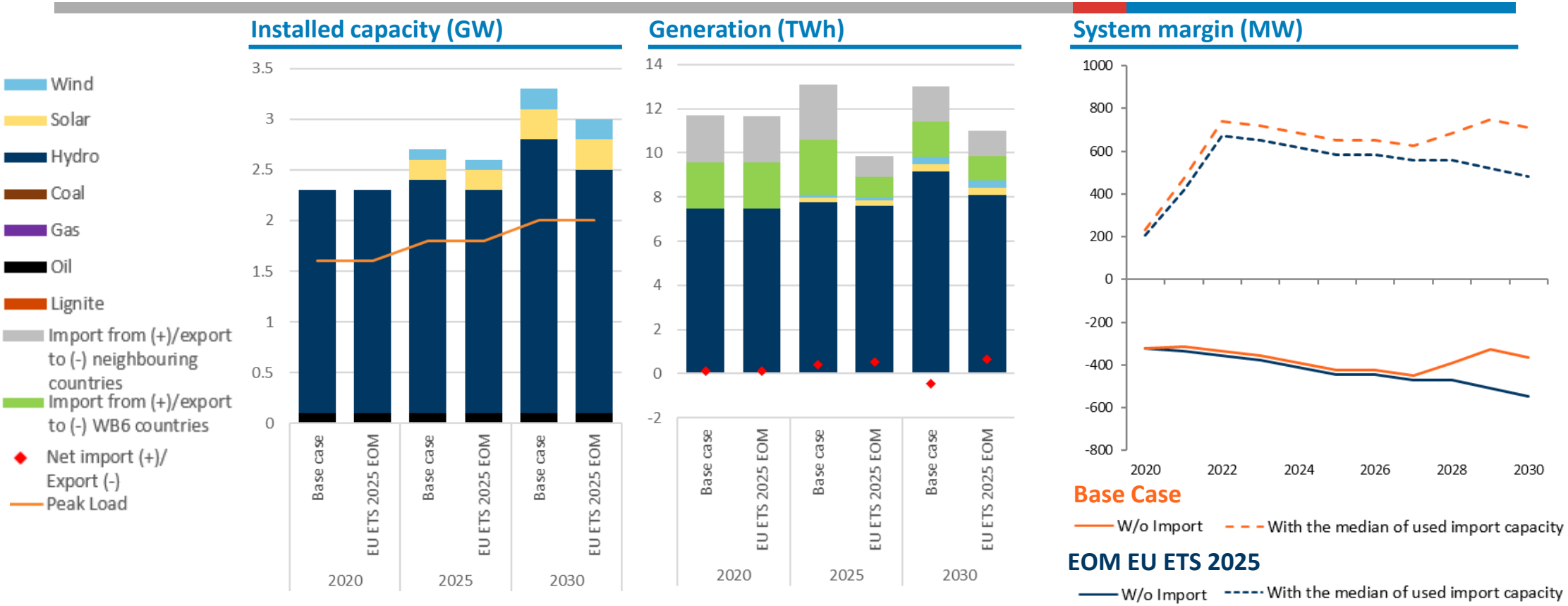
On power market supply, demand and interconnection

Element	Source
2030 RES Target	Energy Community Secretariat
Generation capacity	WB6 TSOs and, when unavailable, ENTSO-E
Demand and reserves	WB6 TSOs and, when unavailable, ENTSO-E
Cross-border capacity outlook	WB6 TSOs and, when unavailable, ENTSO-E

Installed capacity in the Base Case scenario, based on WB6 TSOs' assumptions



ALBANIA – DETAILED RESULTS



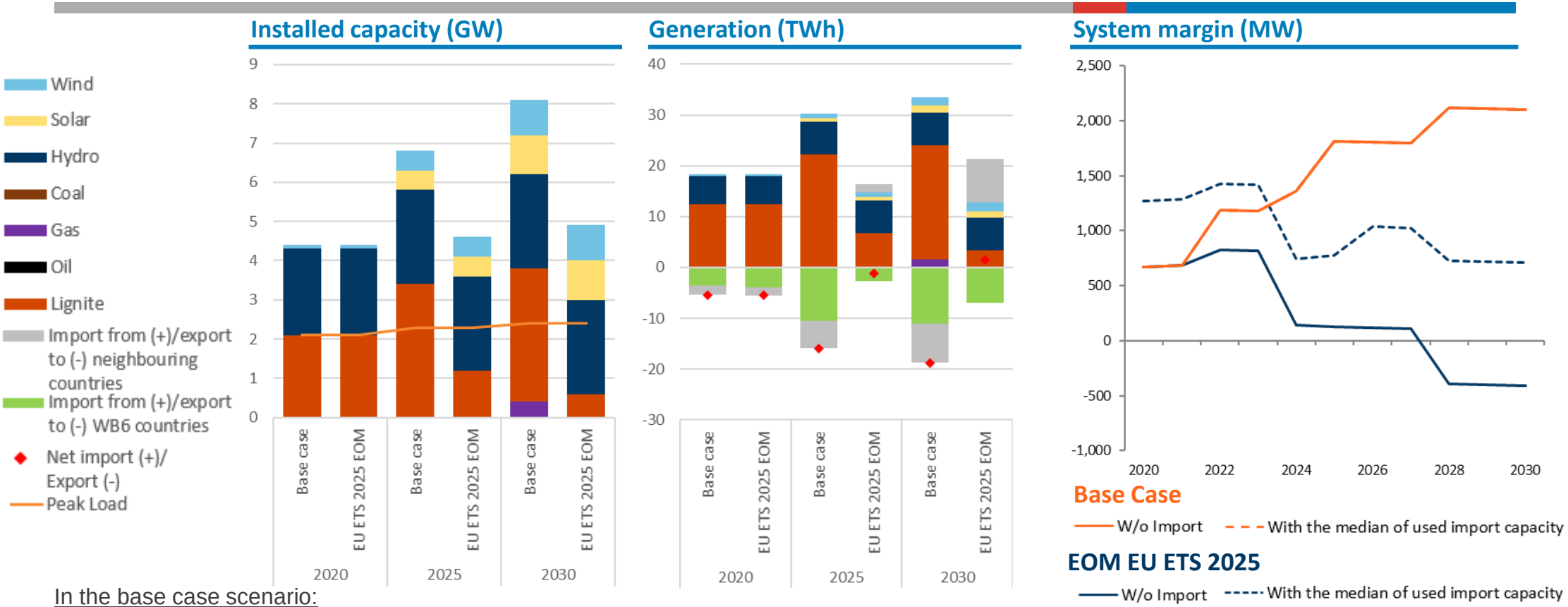
In the base case scenario:

- Without the import contribution, Albania would not be able to meet its demand during peak hours: this is explained by the relatively low statistical availability of hydro plants during peak hours while hydro accounts for the quasi-totality of installed capacity in Albania
- When accounting for import capacity, the Albanian power market features a positive margin

In the EU ETS scenarios:

- Difference compared to base case is slight given that there are no lignite plants in this country: the margin decreases by c.200 MW between 2020 and 2030 (due to cancelled new projects in large hydro plants which are assumed not economic in an energy-only market design)

BOSNIA AND HERZEGOVINA - DETAILED RESULTS



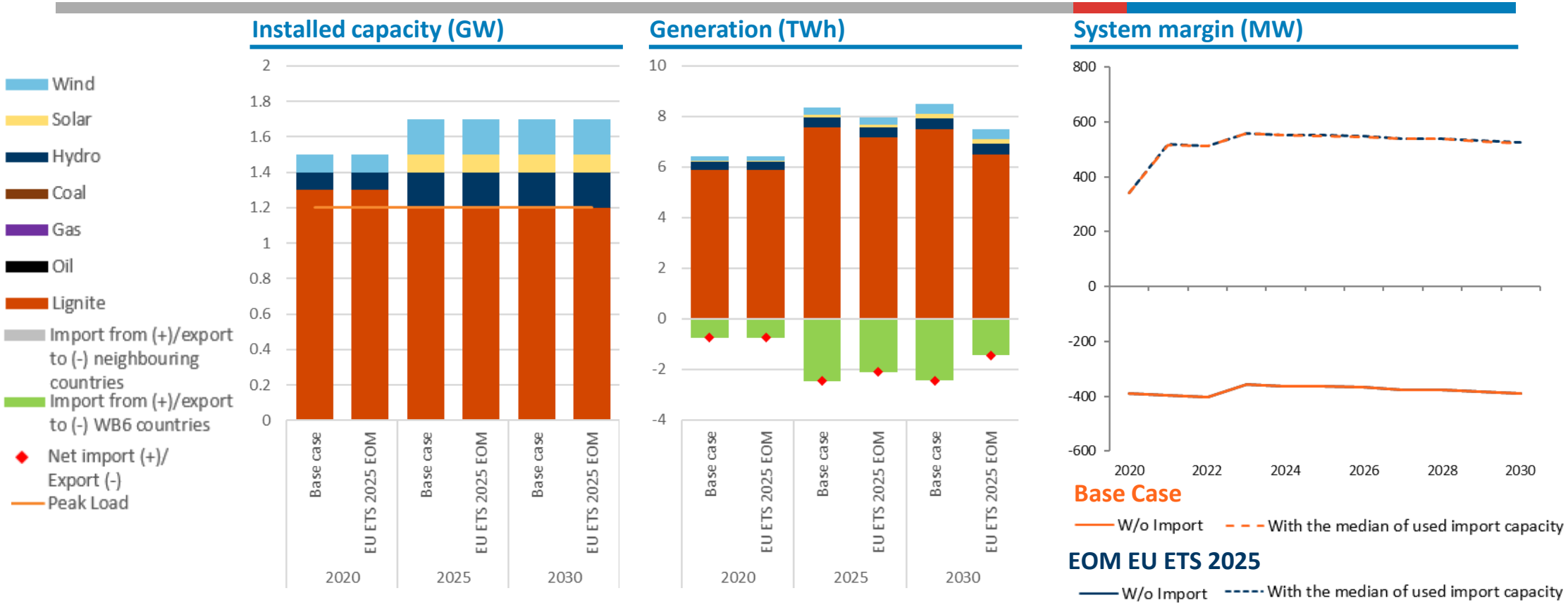
In the base case scenario:

- Positive margin given the current overcapacity in thermal plants and a high availability of hydro (margin is even increasing thanks to expected new thermal projects, despite the decommissioning in 2023 of several plants which are in the LCPD opt-out list)
- Results with and without imports are the same: Bosnia and Herzegovina does not rely on imports during peak hours

In the EU ETS scenarios:

- Introducing a CO2 price would deeply impact the economic situation of lignite plants: new projects are cancelled and several existing plants are decommissioned since their refurbishment to comply with environmental norms (LCPD or IED) is not profitable
- System margin starts decreasing as soon as 2022. From 2028 onwards, Bosnia and Herzegovina needs to rely on imports during peak hours to cover demand

KOSOVO* - DETAILED RESULTS



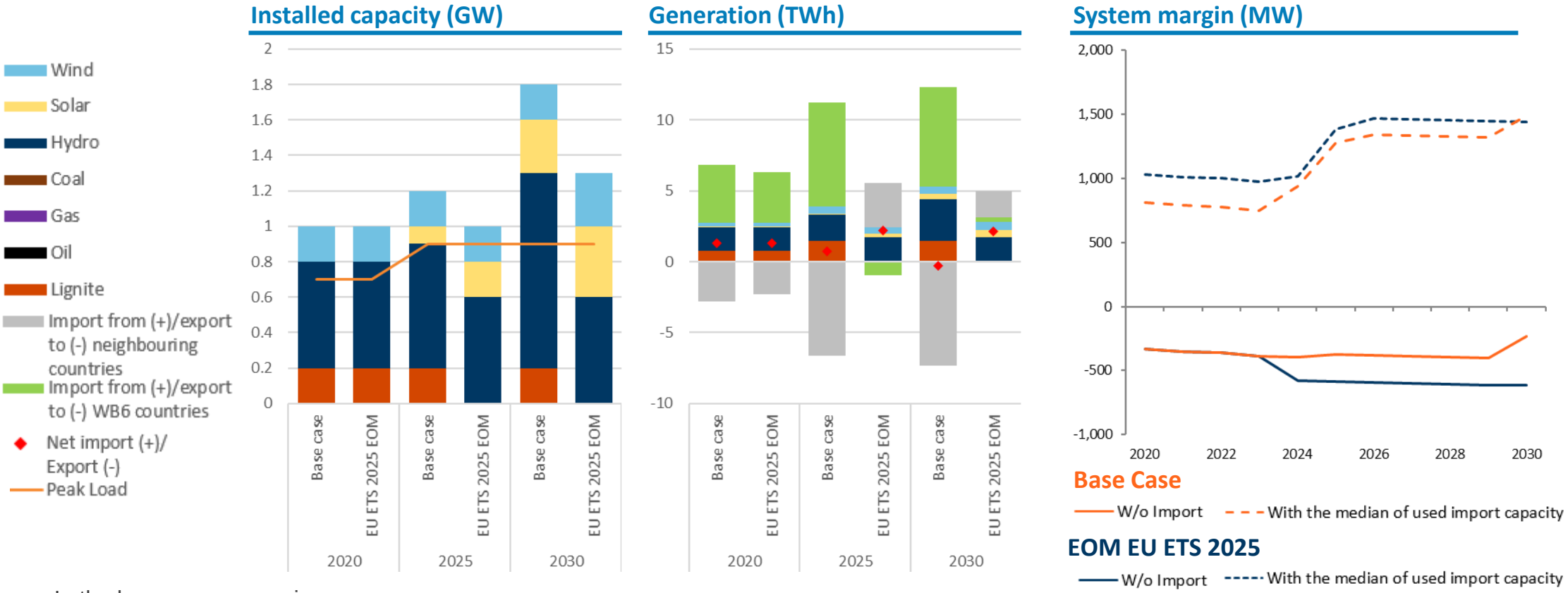
In the base case scenario:

- Negative margin throughout the horizon, explained by the low level of installed thermal capacity (c. 900 MW) compared to the peak demand (1,200 MW). However, when accounting for import capacities, the system margin becomes positive.

In the EU ETS scenarios:

- Implementation of the EU ETS market does not have any consequences on the Kosovar power system (the orange and blue lines overlap).
- The new plant Kosovo e RE is assumed to be built regardless of the market conditions, given the advanced status of the tender ; the Kosovo A plant is expected to close in all cases (i.e. with or without CO_2 pricing) in 2023 since it is in the LCPD opt-out list and the Kosovo B plant is assumed to be profitable enough, even with a CO_2 pricing, to stay operational during the whole studied horizon.

MONTENEGRO - DETAILED RESULTS



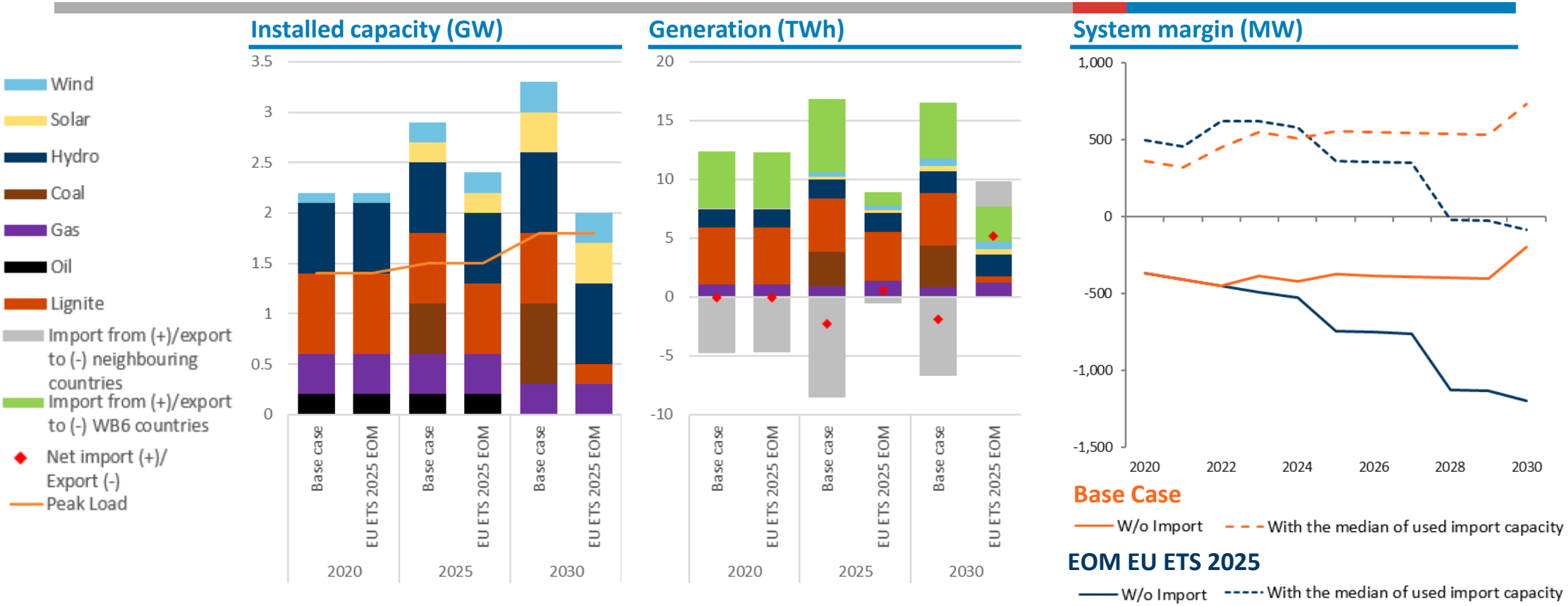
In the base case scenario:

- A negative margin throughout the horizon explained by the importance of hydro capacity, whose availability during peak hours is low (42%).
- When imports are considered, the system margin becomes positive. It even increases throughout the horizon following commissioning of new lines with Italy, Serbia and Bosnia and Herzegovina in 2024, 2025 and 2026.

In the EU ETS scenarios:

- The CO_2 price has slight impacts on the system margin (compared to other countries). Its introduction makes the refurbishment of the existing Pljevlja plant unprofitable, which then closes in 2023. Similarly, several new projects of large hydro are cancelled in the EU ETS 2025 scenario given they are assumed not economic in an energy-only market design.

NORTH MACEDONIA - DETAILED RESULTS



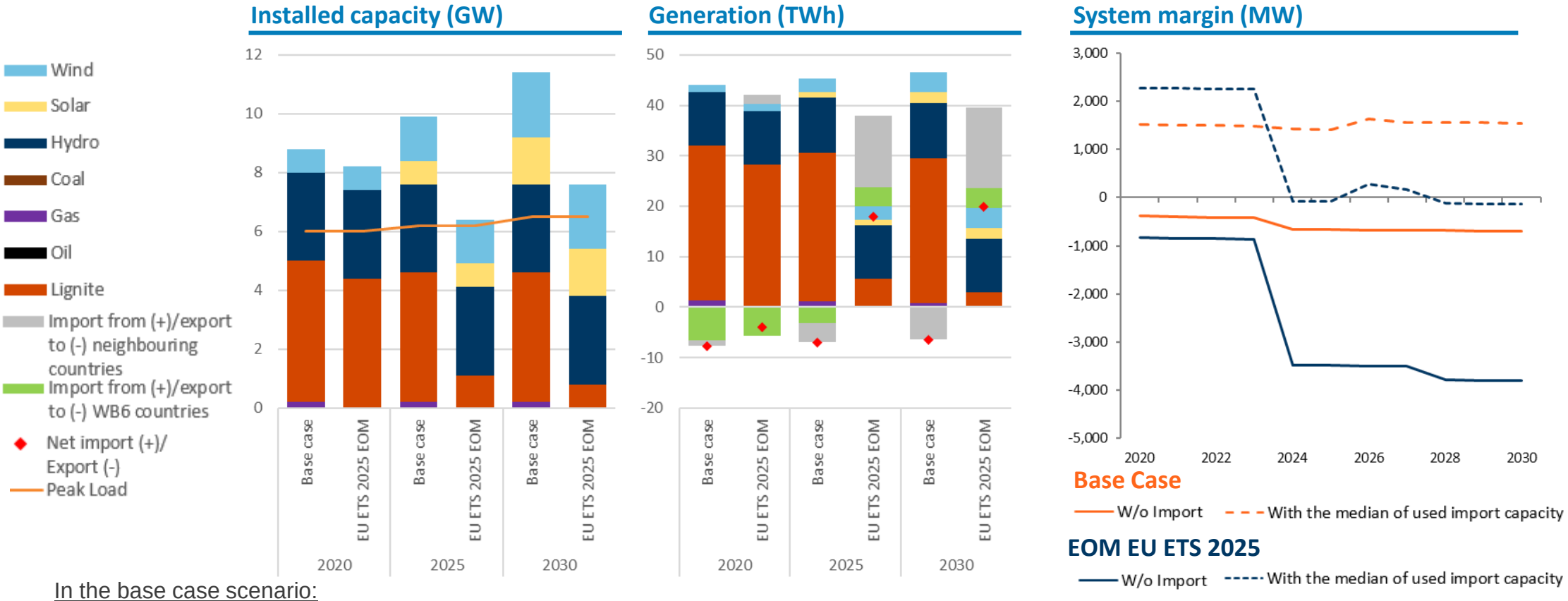
In the base case scenario:

- North Macedonia relies on imports to cover demand during peak hours. Despite several new coal projects (c. 700MW), the margin remains constant up to 2029 given the increasing peak demand (+300 MW between 2020 and 2030) and the decommissioning of Negotino and Oslomej plants

In the EU ETS scenarios:

- Implementation of the EU ETS market has significant impacts as it leads to several cancelled projects (e.g. Oslomej in 2023) and closures (e.g. Bitola 1 and Bitola 2 in late 2027 in both scenarios). As a result, system margin decreases significantly but, thanks to imports, remains positive or slightly negative until 2030.

SERBIA - DETAILED RESULTS



In the base case scenario:

- Negative system margin when imports are not considered. Even if total installed capacity is sufficient to cover peak demand, about half consists in hydro or wind capacity: their availability during peak hours is lower than that of lignite plants, which explains the negative margin.
- This margin even decreases throughout the studied horizon given closures of plants on the LCPD opt-out list and the increasing peak demand.
- When accounting for imports, the system margin becomes positive and even increases in 2026 thanks to the new cross-border line with BiH.

In the EU ETS scenarios:

- Introducing a CO2 price would deeply impact the economic situation of lignite plants: new projects are cancelled and several existing plants are decommissioned since their refurbishment to comply with environmental norms (LCPD or IED) is not profitable: it causes a major drop in the system margin and a negative margin equal to -4,000MW when imports are not considered.
- Even with imports, Serbia is expected to experience a negative margin from 2024 onwards, which may ultimately translate into shortages

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