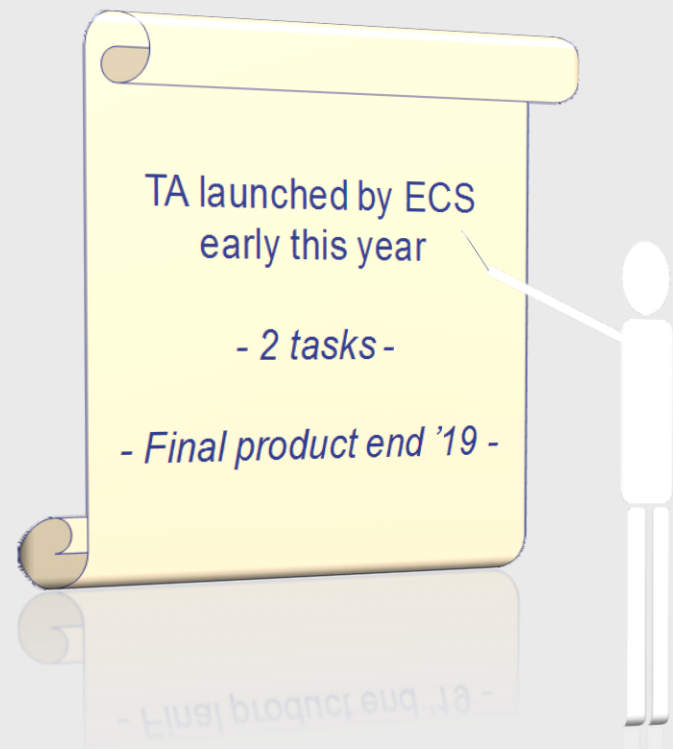




- Challenges: market liberalization and de-carbonization
  - Regional market integration is lagging behind
  - Aging power plant fleet
  - Reliance on lignite (also imported gas)
  - Surge of RES
  - Compliance with LCPD and IED
  - Prospect:
    - CO2 price
    - CEP
    - ...

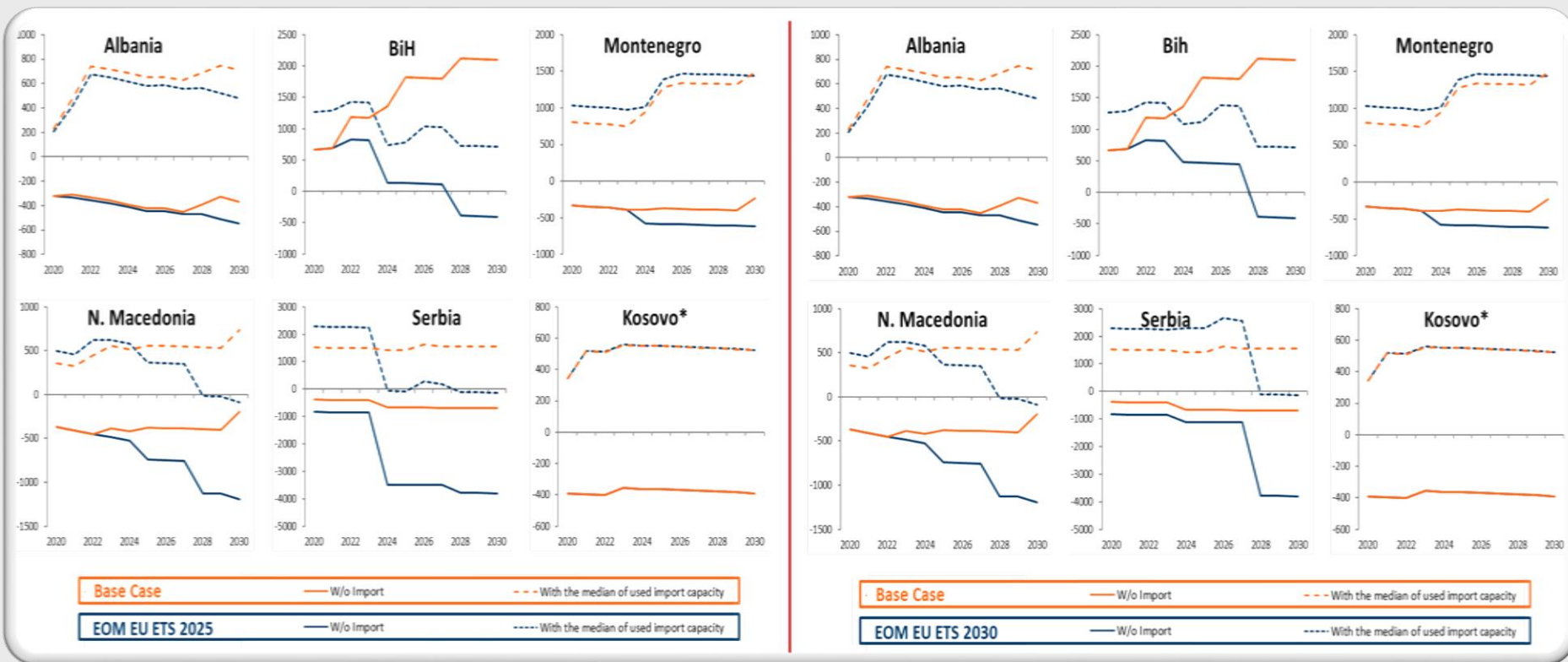


- Forward adequacy assessment (2020-2030)
  - demand and supply forecast, RES, hydro, thermal capacity, the cross-border capacity (all de-rated), as well as projections for commodity prices and costs. A highlight of scenarios and findings is outlined below:
- Base-case scenario - TSO's base case scenario of capacity forecasts + an assumption on RES development 2030 and no CO2 price considered.
- EOM scenario - market-driven investment and operational decisions, compliance with LCPD and IED and sensitivity regarding the start of implementation of carbon pricing regime:
  - EU ETS price in WB6 as of 2030
  - EU ETS price in WB6 as of 2025
  - Transitional CO2 price between 2025 and 2039 in order to assess to assess the extent to which lignite plants economics would be impacted by a different carbon price
  - Market coupling efficiency through limitation of cross-border capacity

- Integrated market, efficient use of cross-zonal capacity crucial to ensure adequate margin
- In the market-based scenario + EU ETS:
  - lack in future investments (in new and existing plants) might affect the future security of supply, due to an economic closure of a number of lignite power plants in the WB6
  - In couple of countries the number of hours of Loss of Load Expectation (LOLE) compared to base-case, would increase above a typical level of LOLE, once the EU ETS price is implemented
- Implementation of a transitional carbon price not linked with EU ETS would mitigate some of the anticipated closures
  - Such price level assumed as of 2025 is 13-14 €/tCO<sub>2</sub>, while it can be increased as of 2028 to reach the EU ETS level in 2030.
- Assumption on the cross-border capacity with neighbouring countries has impact on the anticipated closures in the market-based scenario.
  - Limiting the import volume from the neighbouring countries, which mimics inefficient use of cross-border capacity (absence of the market coupling, etc.), means that market-based exit of some of the existing lignite power plants would be partly mitigated, requiring therefore more expensive WB6 plants (extra 500MW compared to efficient cross-border mechanism) to produce.

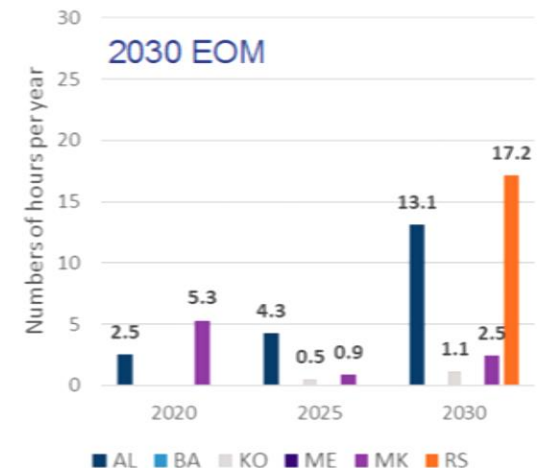
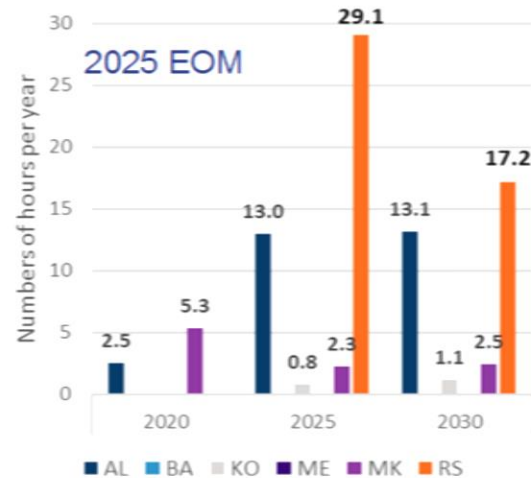
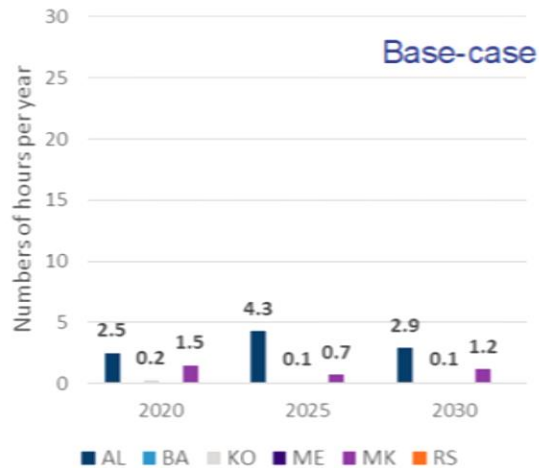
# Findings: Adequacy – reserve margin

- De-rated capacity assumed vs. Peak + upward reserves | Peak load 1-in-10 year risk
- Cross-border capacity crucial to ensure adequate margin | MK and RS face negative margin as of 2028



# Findings: Adequacy – LOLE

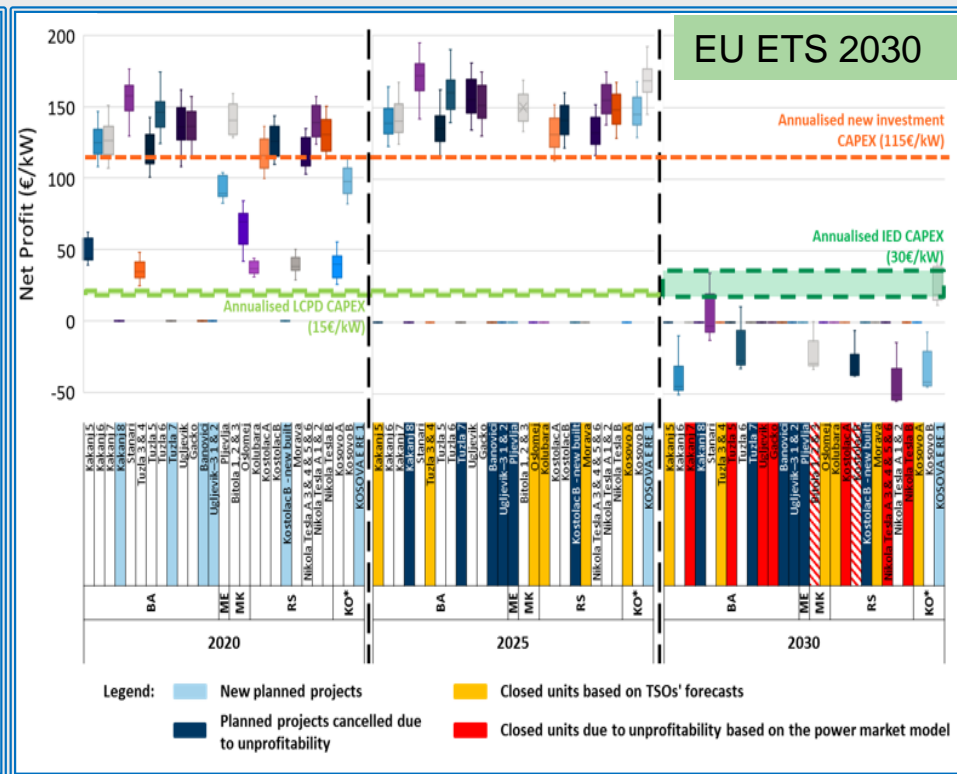
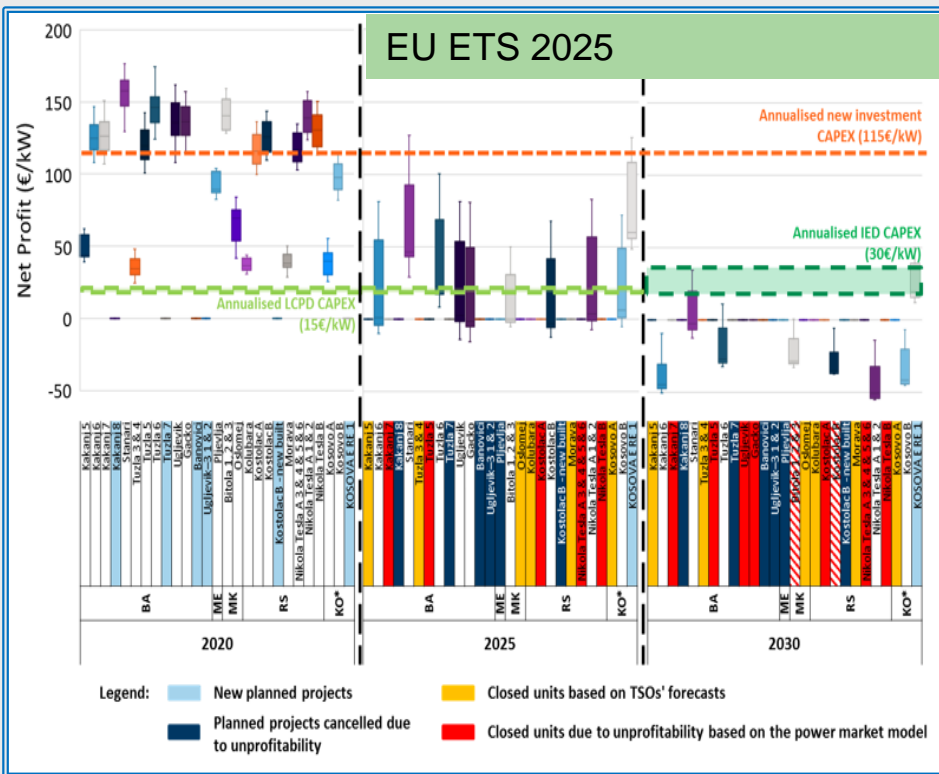
- Adequacy assessment based on the margin ‘disregards’:
  - Co-existence of the tight situations in all countries, random outages beyond ‘de-rated’, few climatic -example dry- years, adequacy can occur also on non-peak
- Loss of Load Expectations (LOLE) assessment, based on Loss of Load Probability (LOLP), takes into account these extra contingencies throughout a year. No LOLE target set, but assumed SoS target is 6-8h for WB6
  - Increase on LOLE under market regime, in particular RE (lignite economic closure) and AL (hydro sensitivity)



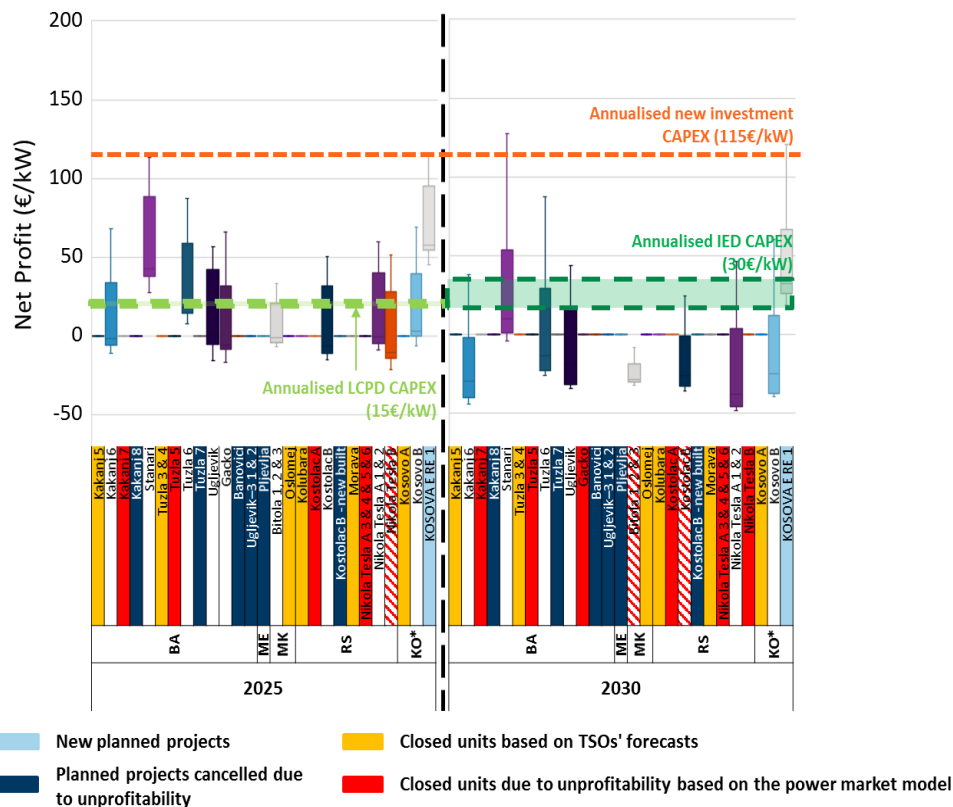


# Market impact on lignite power plants in WB6 (1)

~ 3 GW lignite plants expected to close in late 2023 due high refurbishment costs to comply with LCPD + another ~ 1.3 GW due to CO2 costs (in EU ETS 2025) - 4,4 GW total (in EU ETS 2030) – same effect but later!



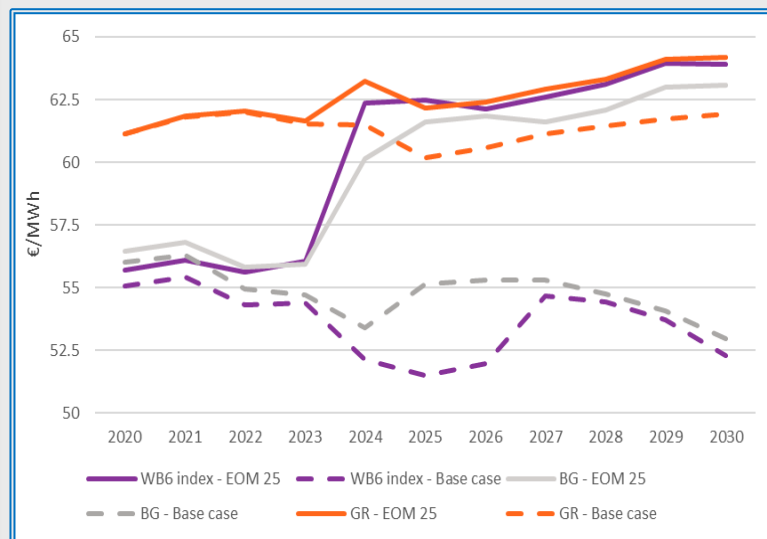
# Market impact on lignite power plants in WB6 (2)



Cross-border sensitivity scenario (mimics curtailment or inefficient use of cross zonal capacity with EU MS)

~500MW is remains to cover for lack of import possibility, but little impact on the price

Prices tend increase in the EOM in WB6 do to cancellation of planned and later economic retirement





## *Policy measures to address adequacy*

- Speeding up the necessary reforms to enable regional market, ensuring at the same time compliance with the environmental norms,
- Coordinated and efficient use of cross-zonal capacity
- Potential implementation of transitional CO<sub>2</sub> price, in the long run, to facilitate coal phase out and to avoid price shocks once the EU ETS
- Incorporate the Clean Energy Package in the Energy Community to avoid different standards within one single energy market
- Removing the non-compliant direct and indirect subsidies to the PPs and **-as the case may be- address adequacy issues through **compliant form of capacity mechanism (with cross-border participation)****
  - Strategic reserve – to address short to medium term potential adequacy issues – smoothening phase out of lignite and impact from implementation of the environmental norms and CO<sub>2</sub> price
  - Market wide mechanism – after the CEP is part of the EnC acquis to incentivise new build, in case adequacy issues persist



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