THE ELECTRICITY SECTOR IN SE EUROPE

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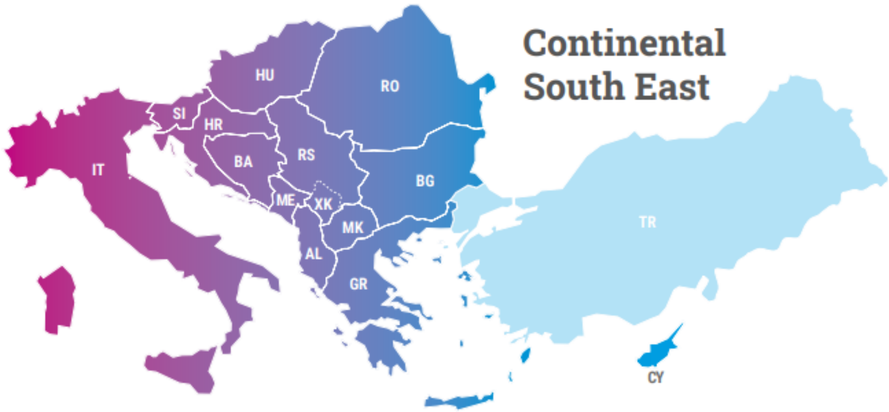
Building an “Outlook” for SE E



An attempt to comprehensively:

- Present and analyse the current picture and status of the secto
- Detect and formulate the prospects and future trends

The electricity sector in Southeast Europe faces the challenges associated with green transition, markets’ development and global geopolitical events (e.g. uncertainties caused by the recent war in Ukraine).

Transformation towards liberalization and competitive markets development started two last decades ago (deregulation, unbundling and privatization).

Increasing share of RES and ambitious plans for RES

Local specificities and peculiarities

Various sources of information: entso-e “transparency platform”, IEA, National Energy and Climate Plans, (NECP), entso-e TYNDP etc. Public data should be processed and aggregated, missing data to be filled

Many countries of different size and characteristics: Albania (AL), Bosnia and Herzegovina (BA), Bulgaria (BG), Croatia (HR), Hungary (HU), Montenegro (ME), North Macedonia (MK), Greece (GR), Romania (RO), Serbia (RS) and Kosovo (XK) – IT and TR are also presented

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The Region (characteristics and specificities)

Six non-EU members (Albania, Bosnia and Herzegovina, Kosovo, Montenegro, North Macedonia and Serbia - referred as WB6 countries) not obliged to follow European legislation and policies but committed to align national legislation; the process is rather slow and targets usually not met timely. Process is led by the Energy Community organization (EnC)

A variety of sector landscapes as far as the structure, the existing legislation, the targets for green transition, the market structure and status, the generation mix, etc. The WB6 de-carbonization targets significantly lower compared to EU member states; energy transition proceeds much faster in EU member states

The electricity mix across the region is quite diverse: a mix of conventional thermal power plants (primarily coal and lignite), hydropower, nuclear and a significant share of intermittent renewables (mainly wind and solar). Lack of generation capacity reflected in wholesale market prices.

Wholesale electricity prices notably higher compared to central Europe. Retail prices follow wholesale prices in EU countries but have remained relatively stable for household consumers in the WB6 countries due to strong regulation. Electricity prices for industrial consumers have been rising steadily.

The region was highly impacted by the energy crisis that followed the Russian invasion in Ukraine. The crisis resulted in (sometimes extremely) high prices with lots of spikes and large volatility in the wholesale markets

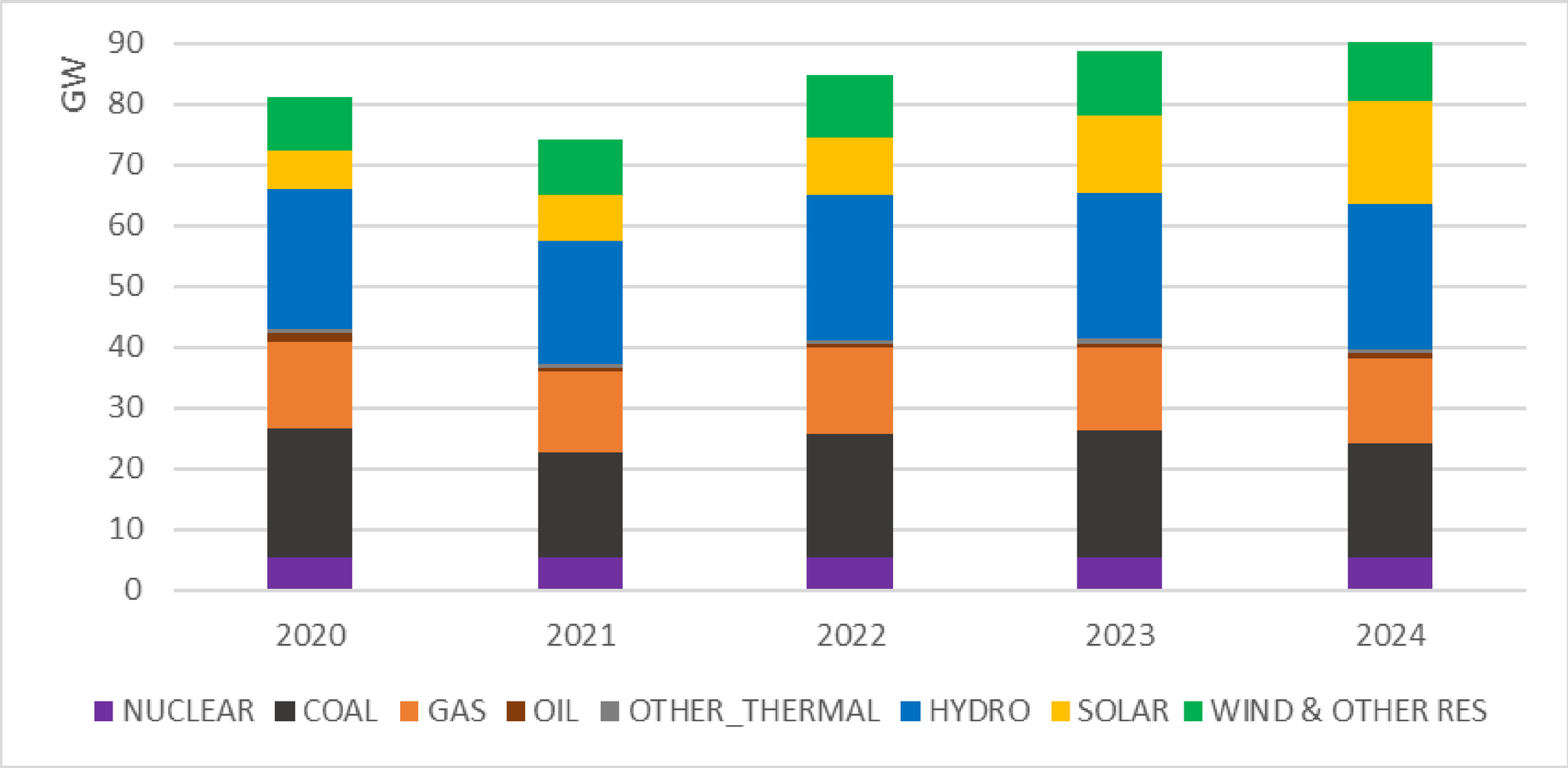
The transmission infrastructure in SEE is sparse and the interconnectivity among the countries of the region and with the rest of Europe is limited with low Net Transfer Capacities (NTCs). Limited interconnectors contribute to increased electricity prices and endanger system security. The strengthening of the transmission network and especially the interconnections among countries is necessary.

The processes towards integration of the internal market continued during the last years; the market coupling process, although decelerated, helped to increase trade and market liquidity.

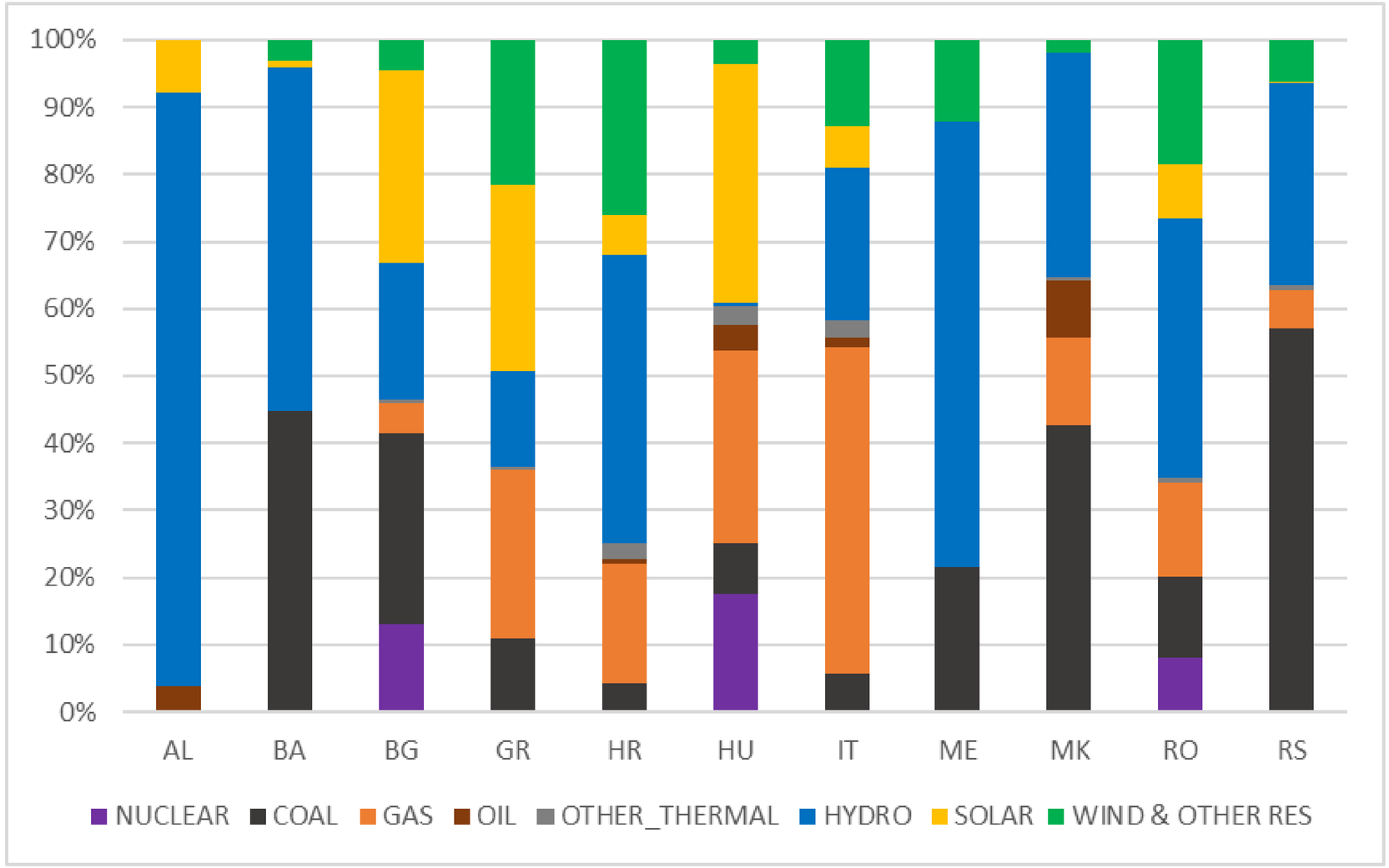
Generation capacity and green transition

- Traditional coal-fueled generation continuously declining in favor of RES, especially in EU countries.
- Total installed capacity in the Balkan region increased from 81,09 GW (2020) to 97,30 GW (~13,5 % growth) by the end of 2024. Capacity growth comes almost entirely from the RES (wind and PV).
- Wind and PV represent most of the RES capacity in the region which has almost been doubled, between 2020 and 2024
- Solar PV technology was the leader in RES development: 10,68 GW of solar PV and 2,7 GW of wind farms were added within 2020-2024. Italy increasing its total intermittent RES installed capacity from 37GW in 2020 to 50 GW by the end of 2024 (more than 55% growth). The wind capacity reached 13 GW by the end of 2024 compared to 11,9 GW in 2022; PV's installed capacity jumped from 25,05 GW in 2022 to 37,1GW by 2024.
- The EU countries (except HR) have reached a much higher RES capacity compared to the non-EU countries.

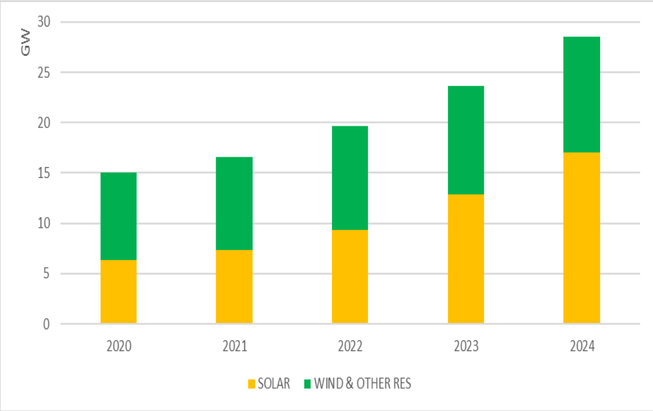
Installed capacities (IT not incl'd) during 2020-2024 by primary source (GW)

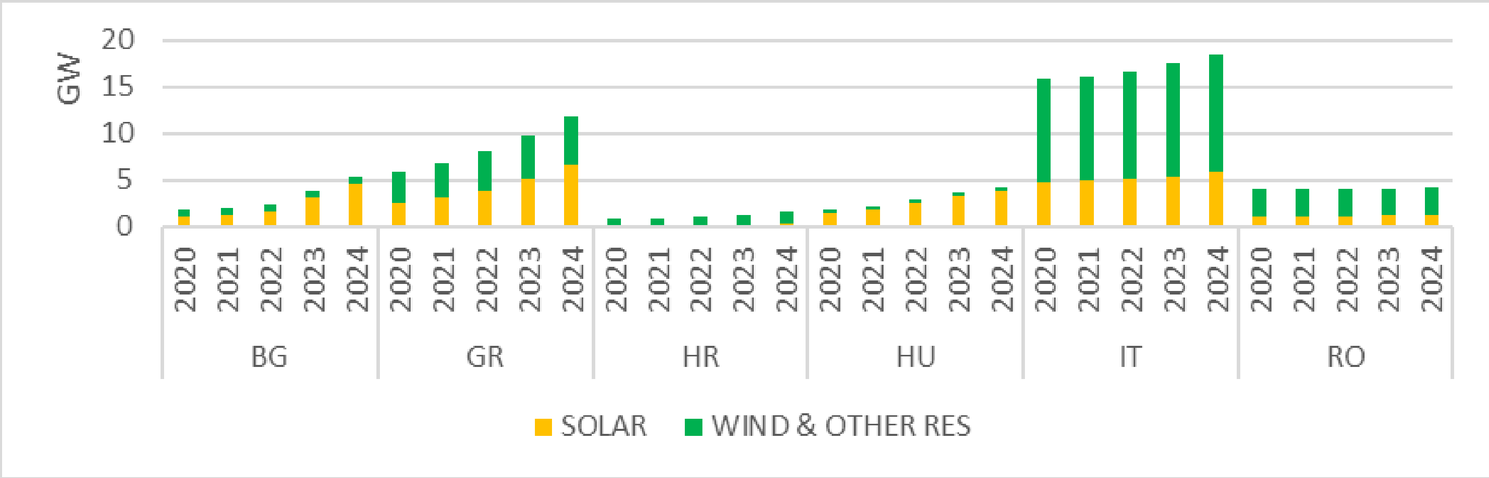


Installed Capacity per Country and primary source (end of 2024)

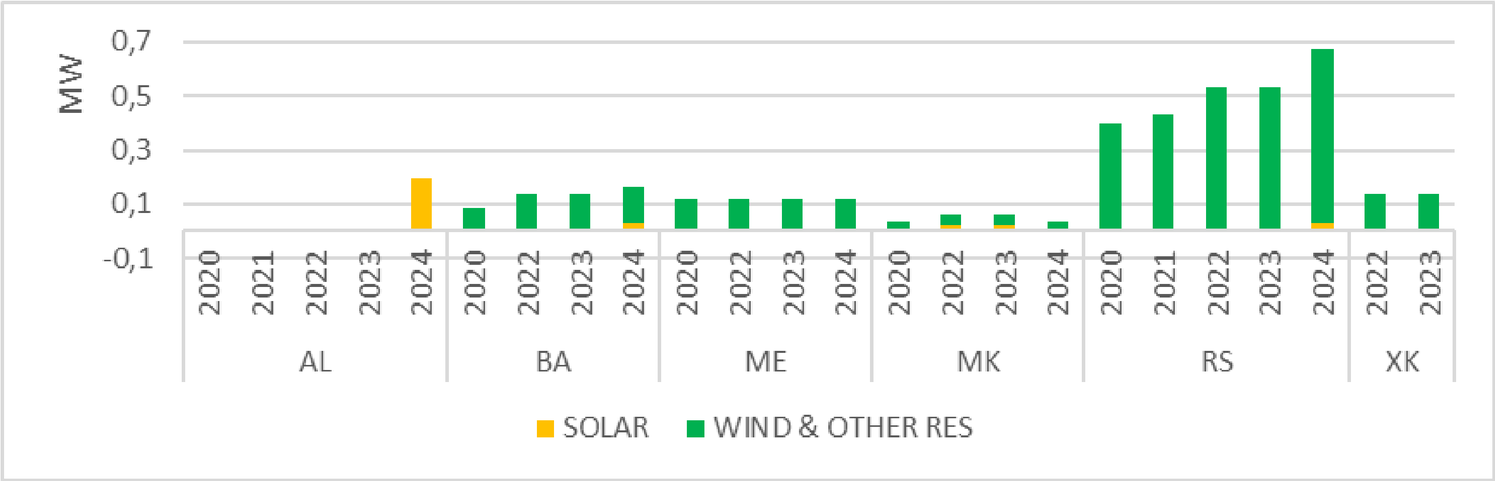


Renewables



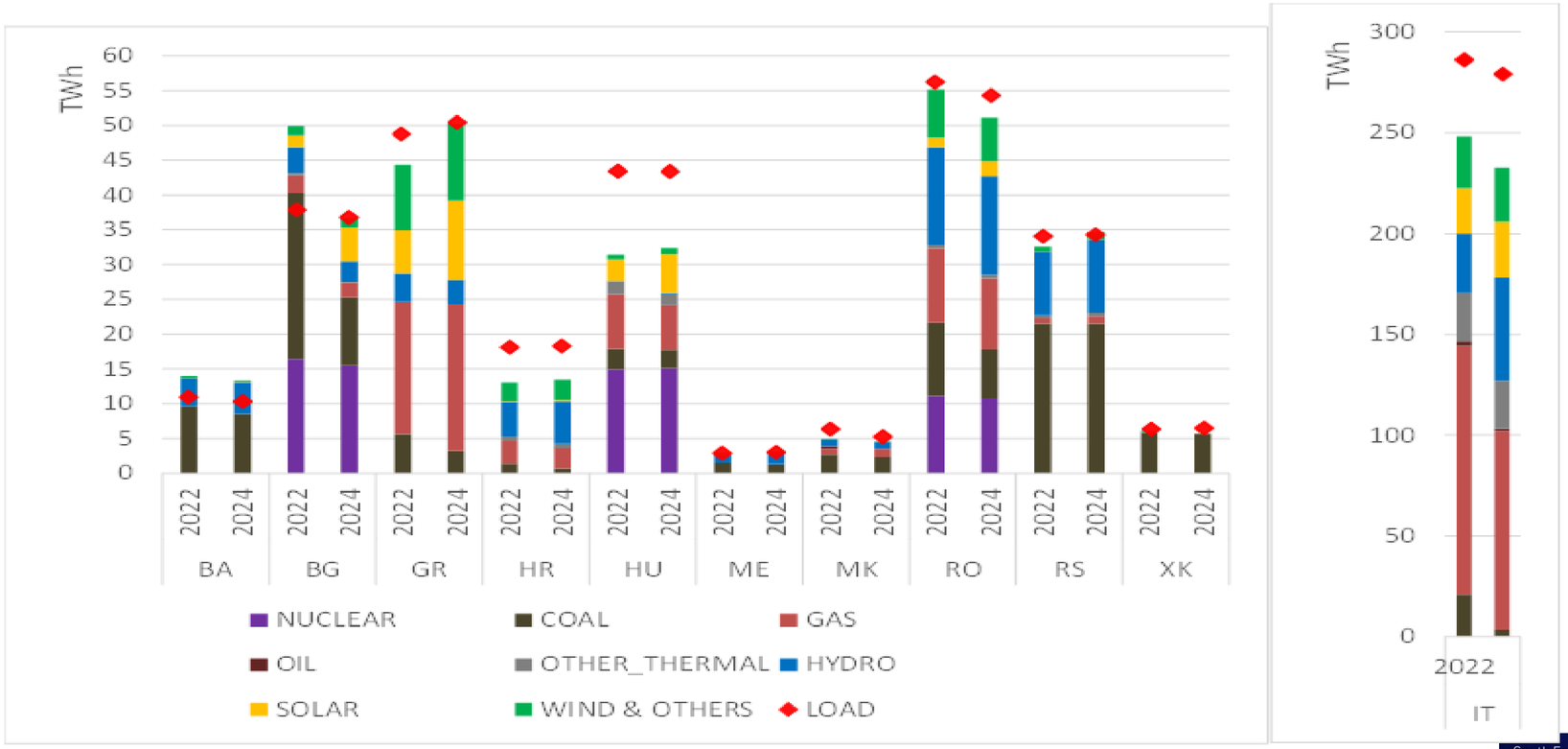


GR is the leader achieved ~ 50% RES penetration in 2025
BG, RO show a rapid growth in PVs
Curtailments due to the “sun-set” effect



Electricity Demand …

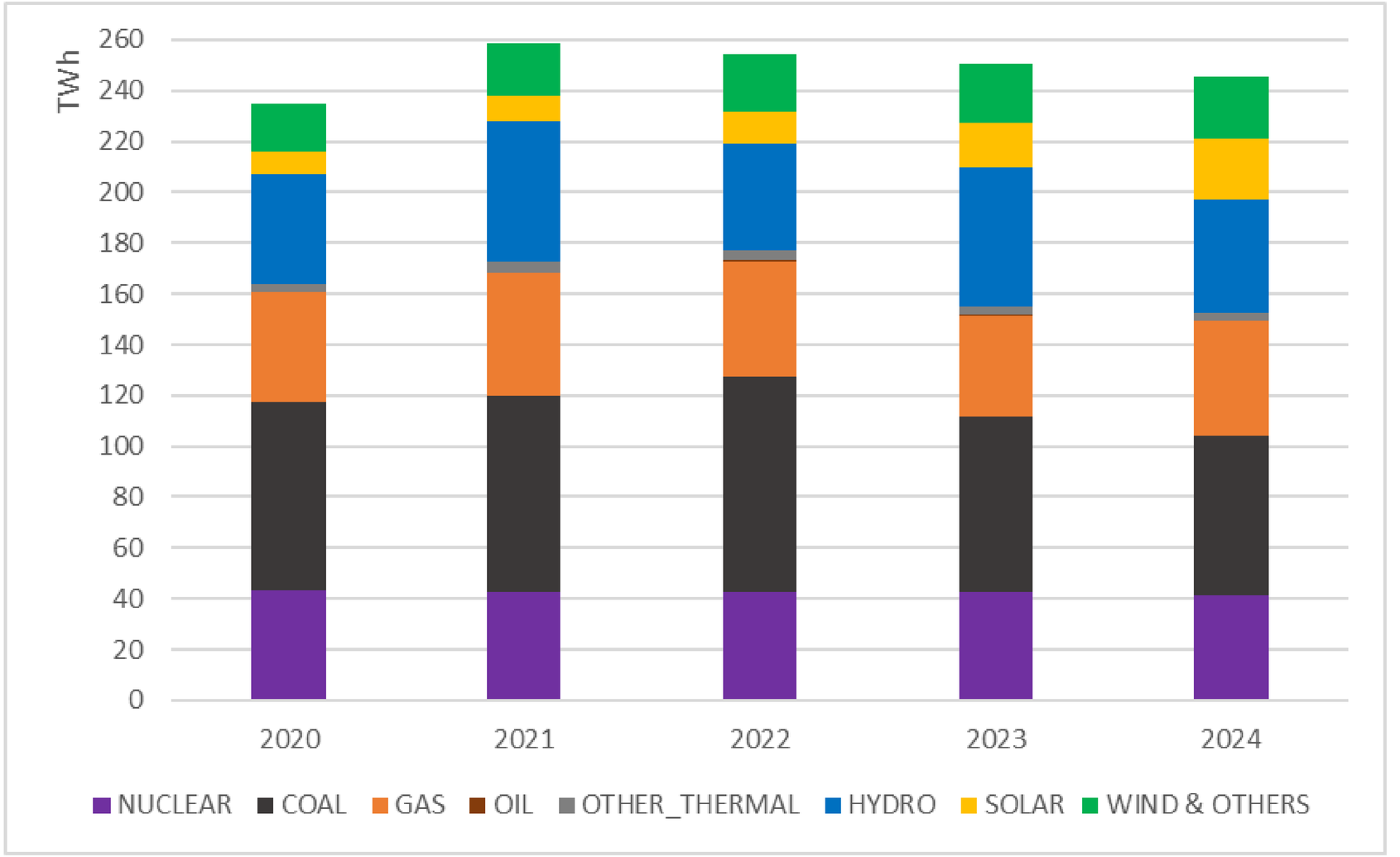
Electricity demand and reflects population characteristics, GDP structure as well as commercial and industrial activities. Since the region is comprised of economies of various sizes and diverse activity with respect to electricity intensity, electricity demand is extremely diversified. There are large markets (TR gross electricity consumption is appr. half of the total regional demand), while there are very small systems like Montenegro which corresponds to approx. 0,5% of the region’s demand



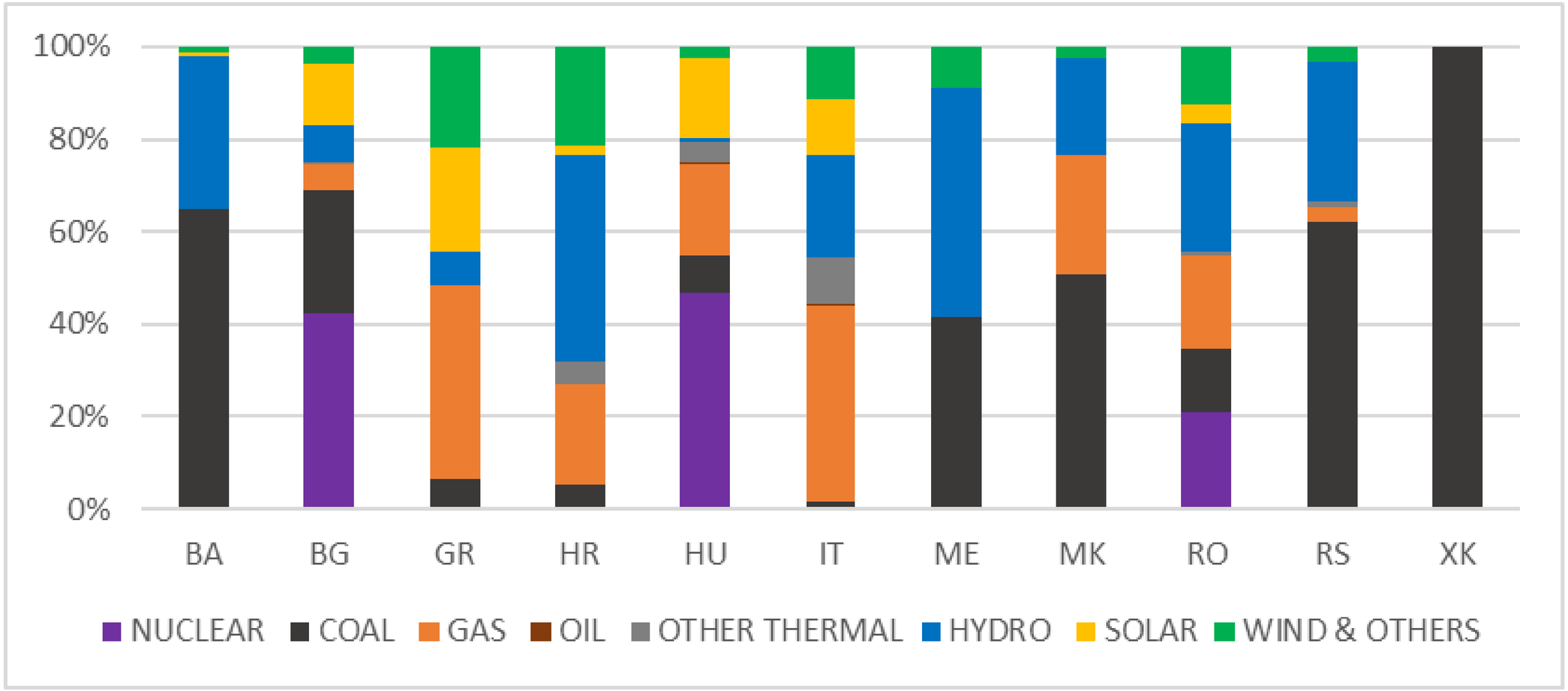
Generation and Supply

- Trend: phase-out of coal and the ongoing development of renewables.
- The large systems (IT, TR) followed different evolution paths: the domestic production in IT reduced by 6,2% in 2020-2024, while TR increased its domestic production by 7%. In the Balkan region (AL, BA, BG, HR, HU, ME, MK, RO, RS and XK) the total generation reached a peak of around 258,58 TWh in 2021 and started declining until 2024 (245,25 TWh).
- The total demand was slightly declined from 271TWh in 2022 to 270TWh in 2024. Coal is still the largest contributor to the electricity balance; coal's contribution reduced by 15% . Moderate increase in natural gas (by around 6%). Nuclear energy has a stable contribution in the order of 18% of total generation. Intermittent renewables (wind and solar) are continuously increasing their contribution (especially PVs) having reached 48,3 TWh in 2024 compared to 27,7 TWh in 2020 (almost a 75% increase).
- The contribution of large hydros is very important for the region: hydropower contribution varies from 42TWh to 55TWh depending on hydraulic conditions.
- The region is constantly a net importer due to seasonal lack of generation capacity and market prices. Imports although gradually reduced, have a significant share and varied from 3,25% (in 2023) to 10,8% (in 2020) depending strongly on the available hydro generation.

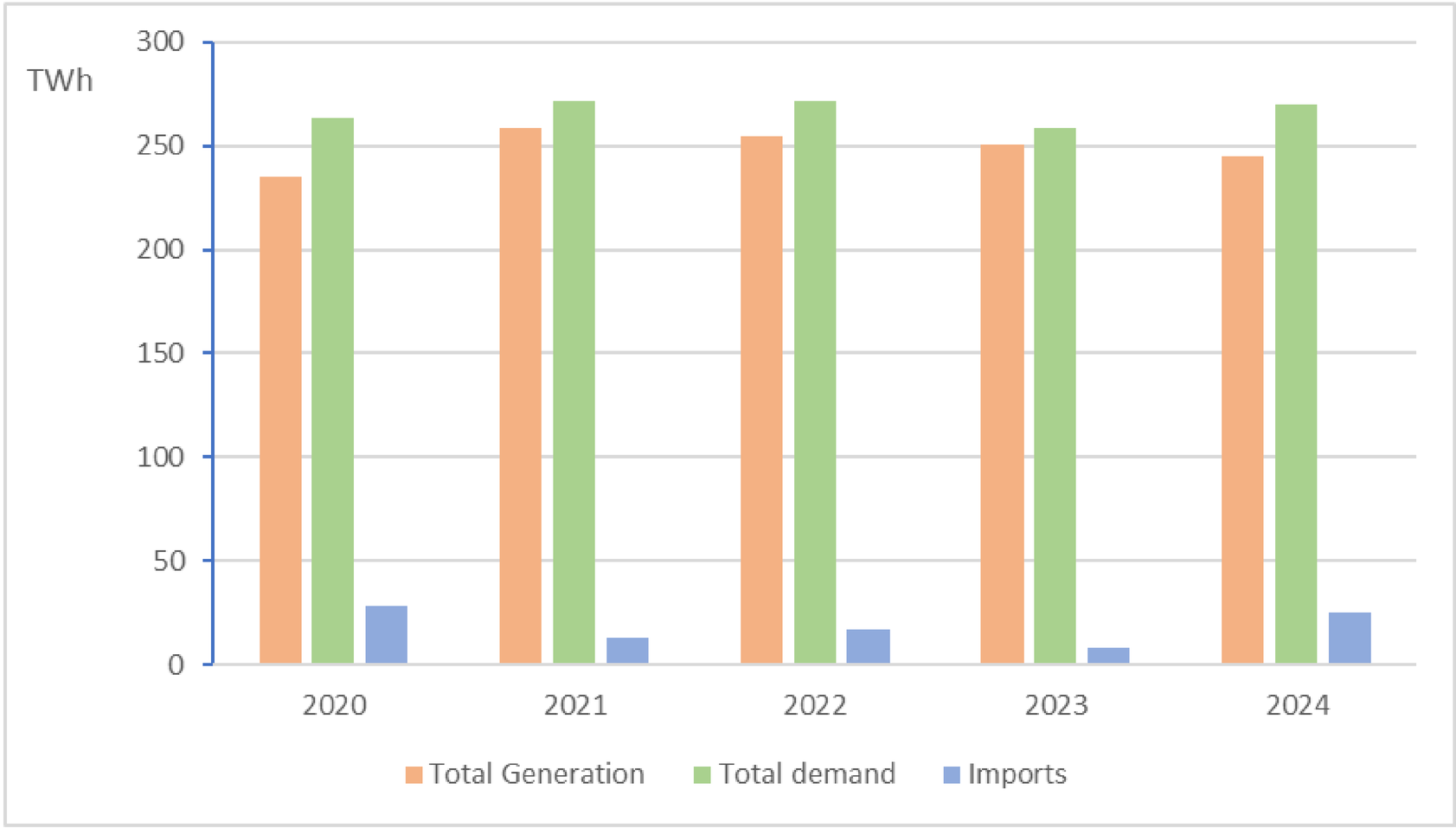
Annual electricity production by primary source in Balkan area (2020-2024) (TWh)



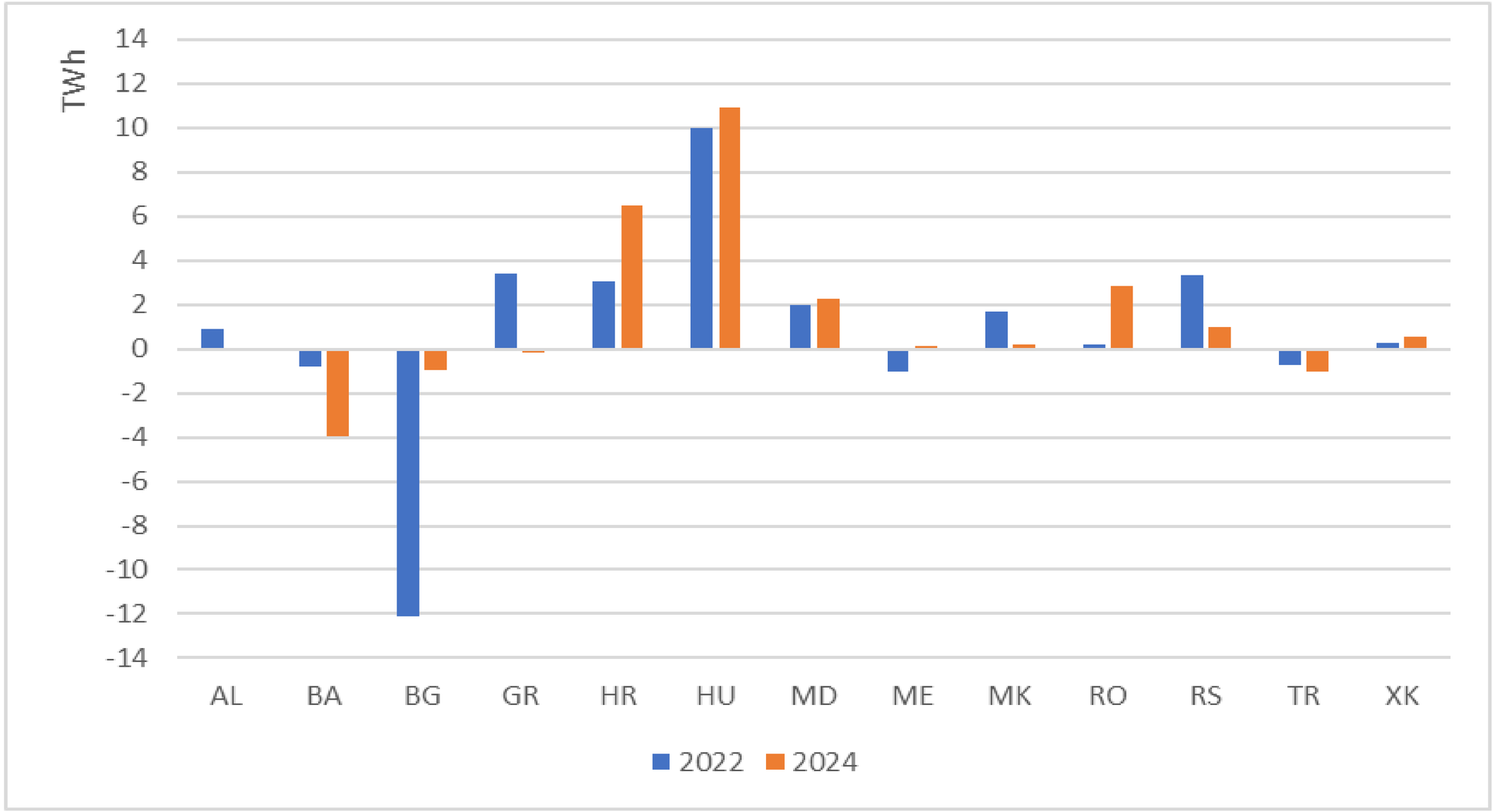
Share of primary sources in generation by country (%)



SE Europe is a net-importer



Annual Im/Ex balance for 2022 & 2024 (IT, TR not included)

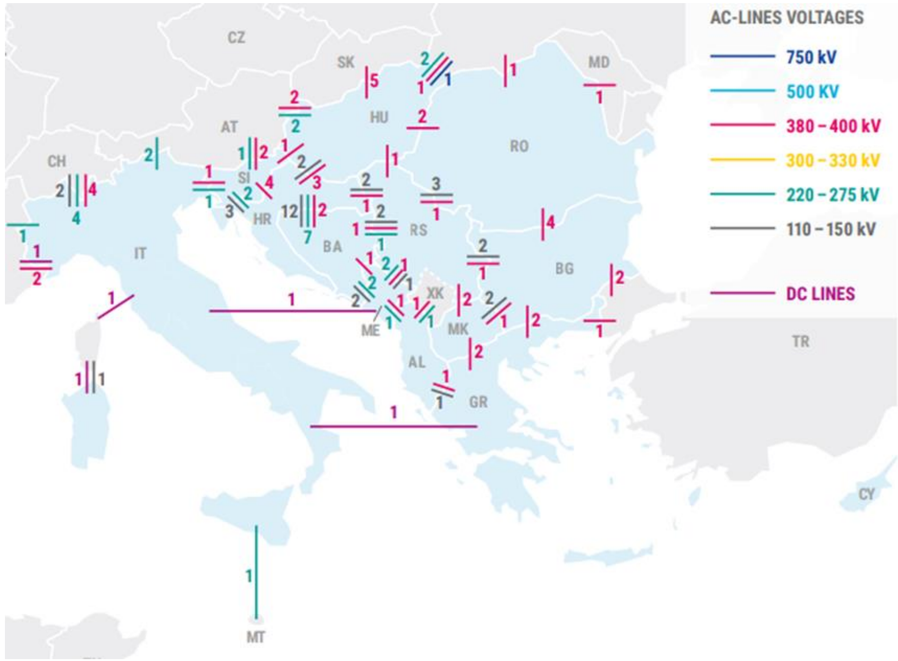


Transmission

- Sparse transmission grid with limited interconnectors. 400 kV, 220 kV, 150 kV and 110 kV voltage levels are in use.
- Transmission and distribution infrastructure is overaged; this brings an increased number of incidents and power supply problems. Reinforcements and modernization is needed.
- Due to the sparsity, unwanted loop flows appear within the last decades. These flows endanger the safety of the systems and increase network losses. Common effort by the TSOs in the area to control and reduce such flows.
- The integration of intermittent RES raised voltage regulation problems, mainly overvoltages, especially in the south Balkan area (Bulgaria, North Macedonia, Kosovo and Northern Greece)
- There is a growing need for grid reinforcement in the region in order to facilitate energy transition, further use of nuclear power and the integration of the internal European electricity market. New technical challenges for the power systems in SE Europe emerge, such as grid stability, transmission efficiency, system balancing, voltage and reactive power control and storage.
- Currently, the CSE region is connected by 100 AC tie-lines and two DC links between Italy and the Balkan Peninsula (to Greece and Montenegro). These interconnectors are affecting 16 borders.
- Numerous incidents during last years, some of them severe as of January 2021 and June 2024 (analysed in the Outlook)

46 new transmission projects and 12 new storage projects are expected in the period 2030–2039. Total investment ~ €60 billion. Furthermore, some ambitious projects are under consideration, i.e. the Great Sea Interconnector between Greece (Crete island), Cyprus and Israel, the Central-Balkan Corridor, an undersea cable between Romania and Georgia, the GREGY project between Greece and Egypt, the Green Aegean Interconnector between Greece and Germany, the Saudi Arabia-Greece Interconnector, etc.

Transmission system and interconnectors

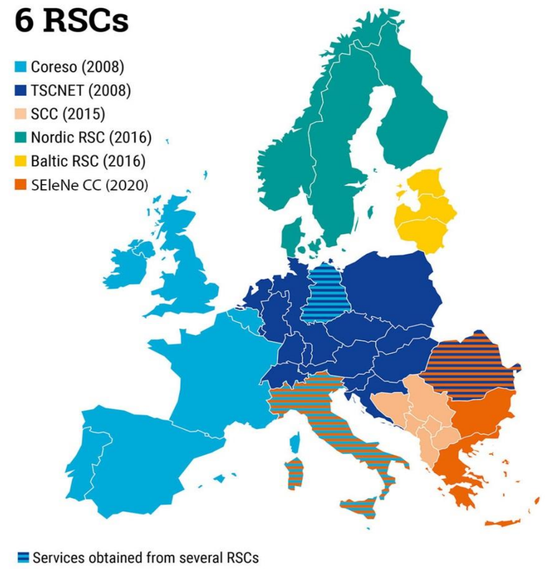


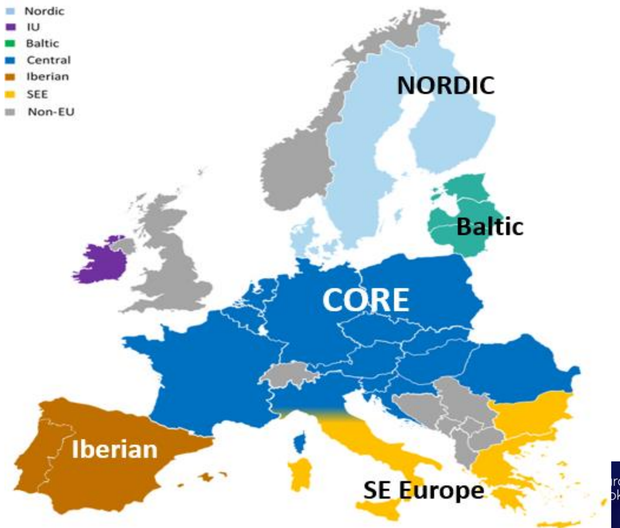
Transmission -SELENE

- Since 2008, 6 Regional Security Coordinators (RSCs) have been developed in Europe, upgraded to Regional Security Coordination Centers (RCCs) in 2021.

- SE Europe TSOs are served by 4 RCCs: TSCNET, SELENE, SCC and partially CORESO.

- According to the provisions of the clean energy package (CEP) the “System Operation Regions” (SORs) were introduced. SE Europe comprises one SOR including the SELENE and the SCC region.





Market development

SE Europe is a complex market landscape; the regulatory differences raise severe obstacles to the integration of the market within the region. EU countries fully follow the “target model” in their electricity markets and relevant legislation. Nevertheless, significant progress has been made by the non-EU countries under the stewardship of the Energy Community for gradual full harmonization. The market development in SEE is an on-going project.

Despite the delays in harmonization;

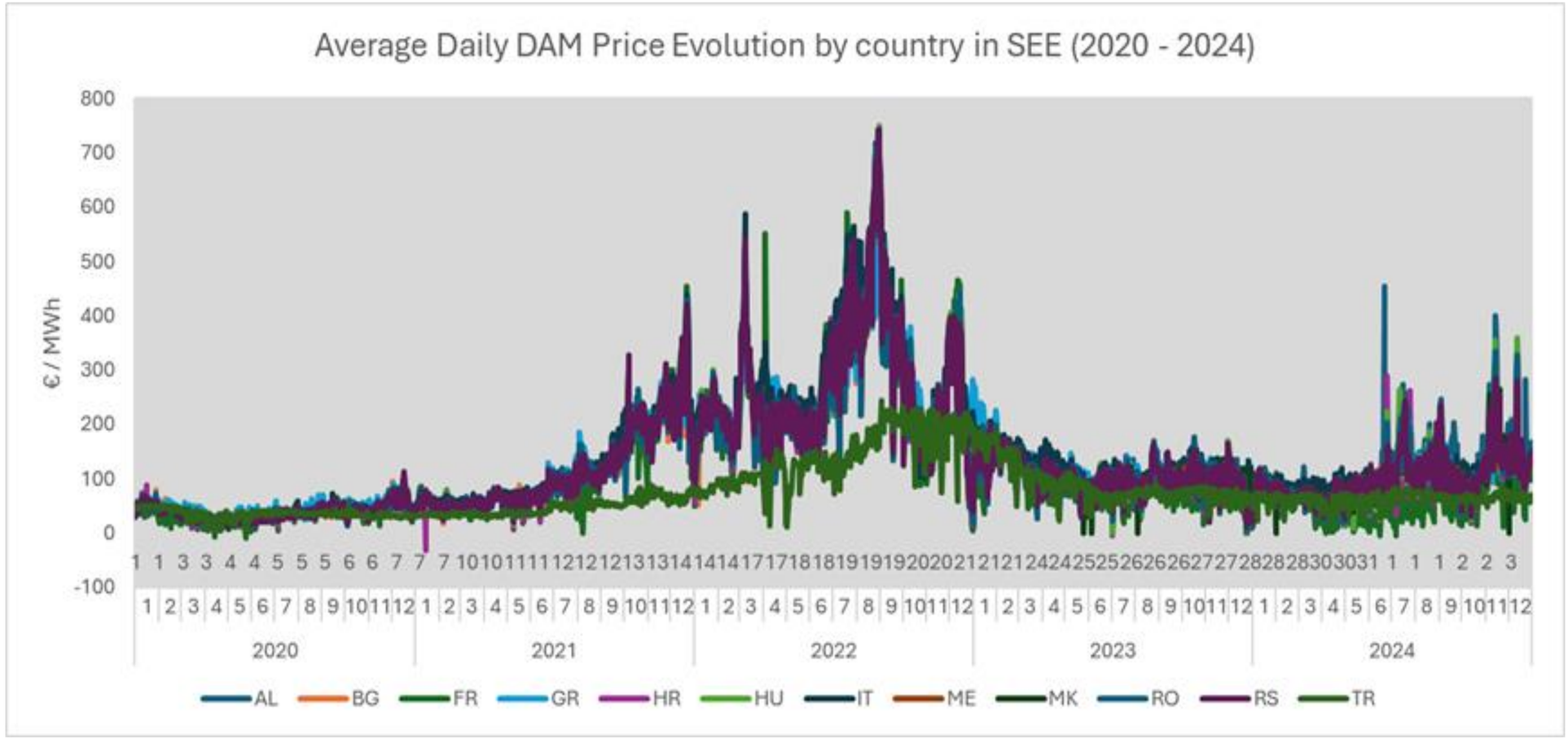
- DAM markets and Power Exchanges are present in all countries
- DAMs are fully coupled while IDMs are partially coupled. The coupling is on-going
- Cross-Zonal capacity allocation is efficiently performed (through CAO and JAO)
- Balancing markets are in place in the majority of the countries

Recent developments:

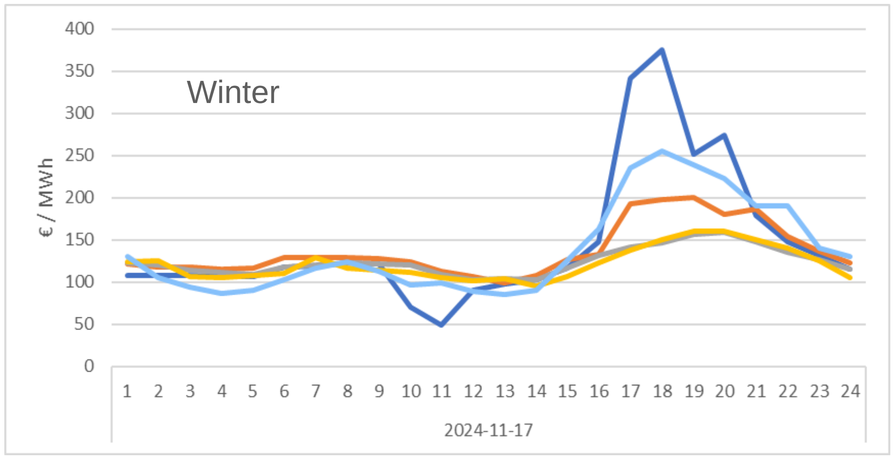
- application of the “70% rule” in the majority of the borders
- 15 min products started to be traded and have increased market liquidity

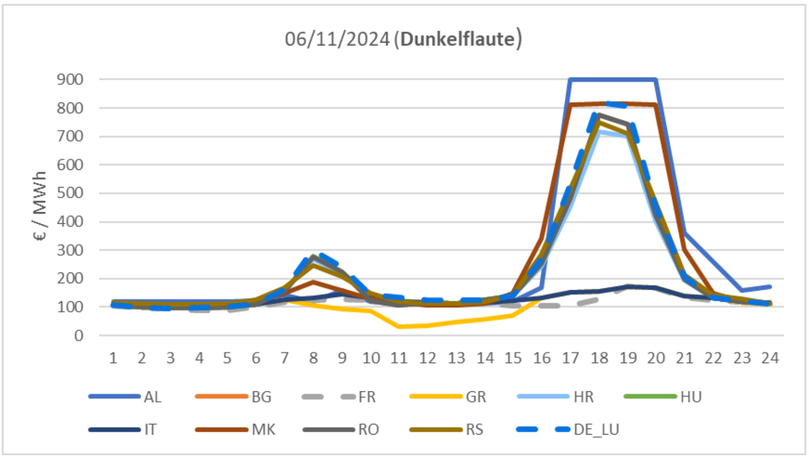
The degree of liberalization and deregulation of the retail electricity markets in SE Europe varies considerably among the countries:EU countries having fully liberalized markets and the WB6 countries which are highly regulated

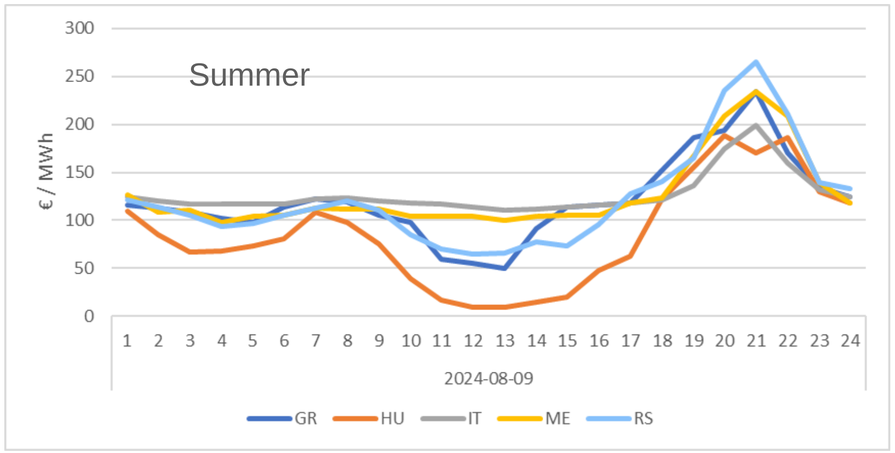
Daily Average DAM price by country (2020-2024)

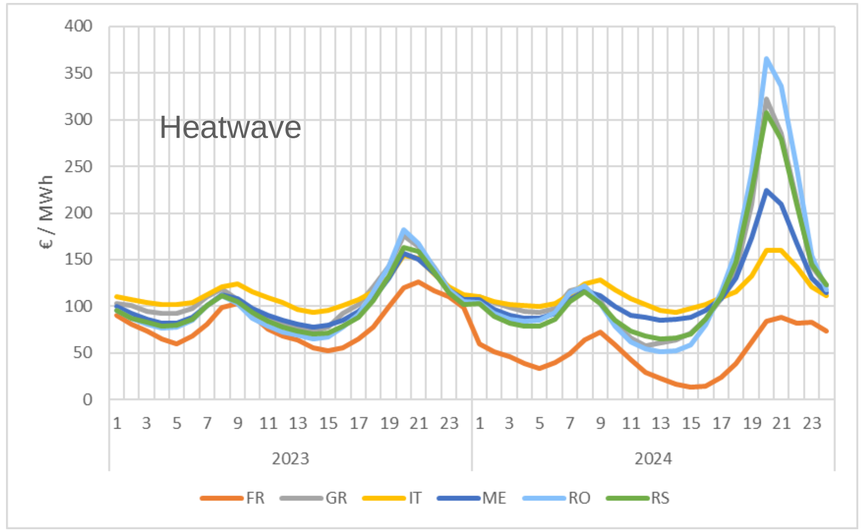


Impact of PVs in Daily DAM price

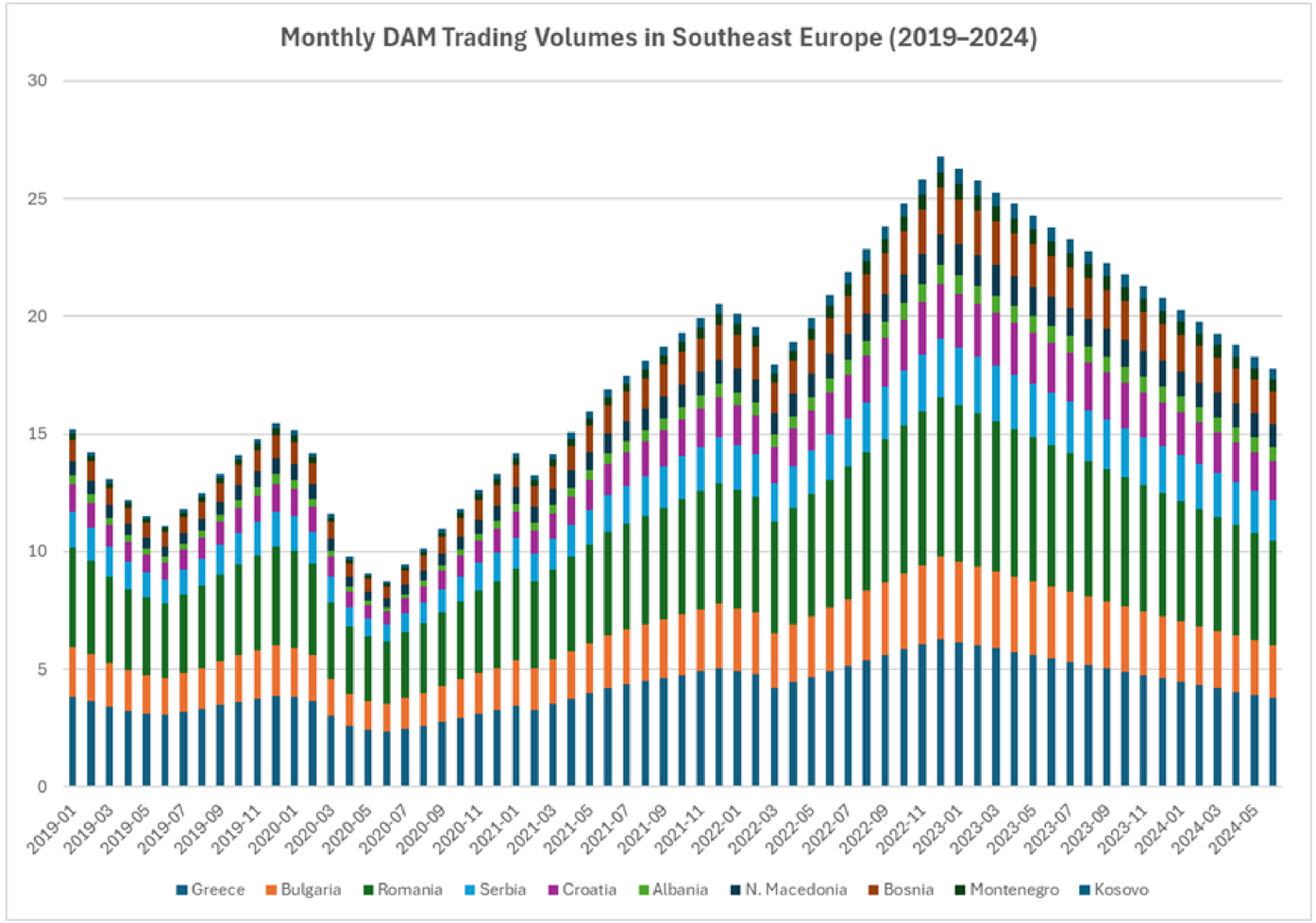








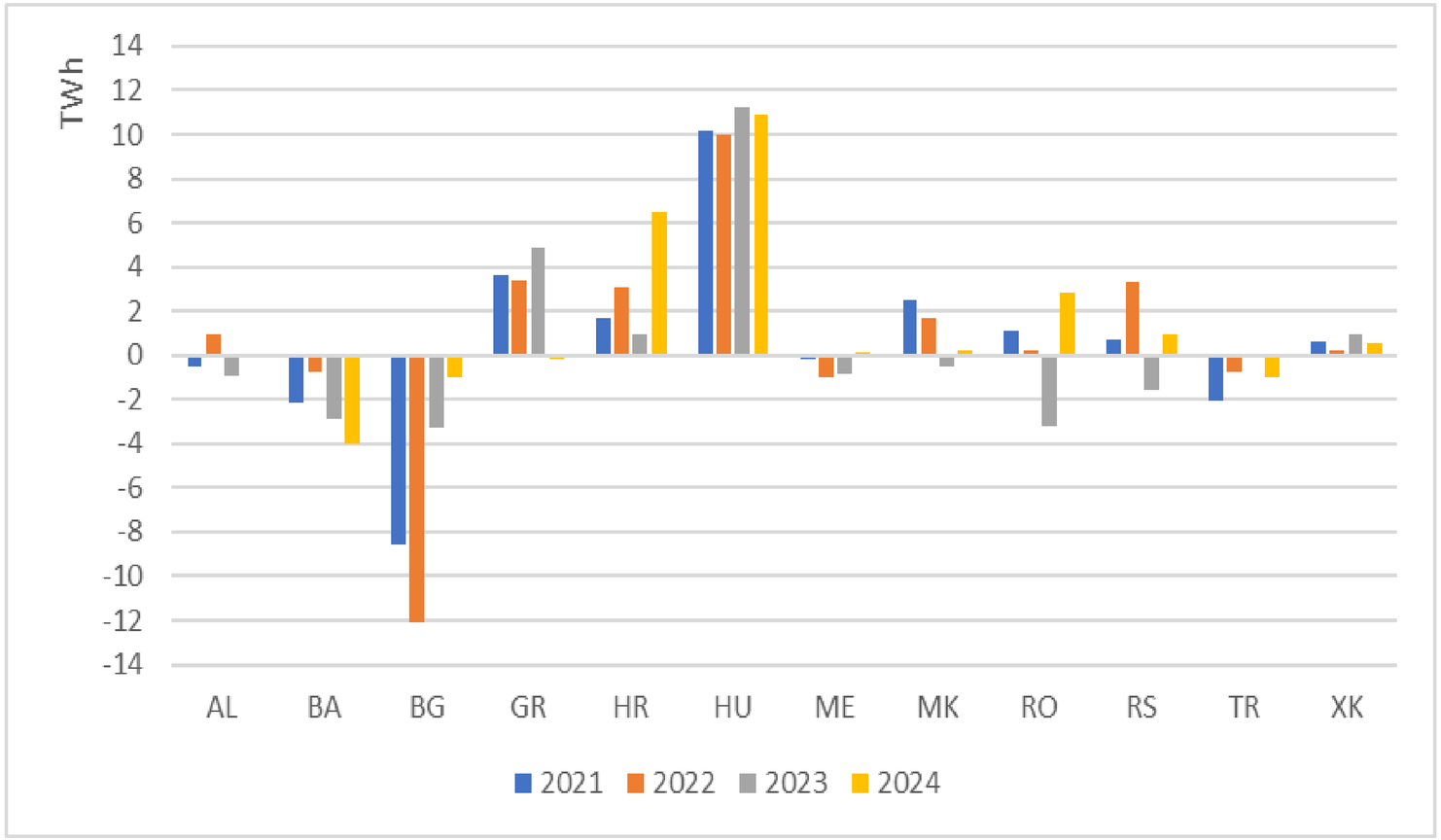
Cross-border electricity trade volumes (TWh)



Electricity exchanges

The Balkan region is an importing area with some potential for seasonal occasional exports. This was the case in the last decades, making the region vulnerable to variations of energy commodities prices. RES development will mitigate this problem.

Certain countries (Croatia, Italy and Hungary), are elctricity importers. Hungary is highly relying on imports (by around 25%). Greece, being a net importer, transformed to a net exporter in 2024 due to the increasing RES penetration.. Romania and Serbia are also net importers but in years of high hydraulicity as of 2023, they export.. Bulgaria is continuously a net exporter during last decade and a transit country. The coal and hydro based system of BA is constantly a net exporter. Albania as a 90% hydro-based system, is a net exporter during wet years and net importer in the dry ones



SE Europe at a glance

- The less developed region in Europe
- Specificities in terms of sector structure and regulation; need to harmonize legislation and rules
- Moderate RES development and different paces in energy transition
- Coal still in dominant position in non-EU countries
- Lack of generation capacity –The region is a net importer
- Sparse and overaged transmission network – severe reinforcements are needed
- Different stages of markets' development. Significant progress in coupling during last 5 years. Harmonization is on-going
- Moderate developments in storage and electric mobility

Enjoy Reading

Thank you!