Energy Community

15th Regional Exchange of Modelling Experts involved in the Development of Integrated National Energy and Climate Plans (NECP) in the WB6

Study on the flexibility options to support decarbonisation for the Energy Community

Draft study results

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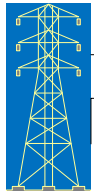
Energy Community Secretariat

What is flexibility in the power system?

Ability of all power system resources/facilities to adjust the electricity output and consumption to maintain nominal frequency at all times

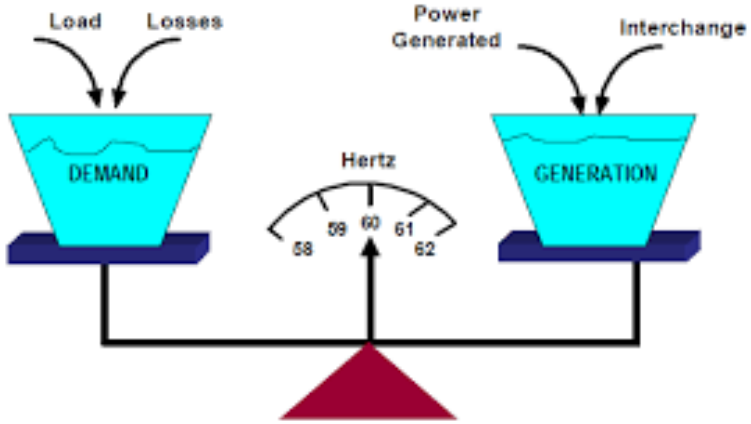
Generation

Storage



Interconnectors

Demand-response



Source: Internet (http://www.ee.unlv.edu/~eebag/4.pdf)

Scope of work

Task 1 Analysis of technical and non-technical sources of flexibility

Task 2 Evaluation of current flexibility sources utilized in the Contracting Parties (utilisation, needs, gaps, costs)

Task 3 Evaluation of existing flexibility potential and future needs for additional flexibility in 2030 and in 2040, in each Contracting Party's power system

Task 4 Recommendation of optimal set of solutions (technologies, policy instruments, regulatory measures)

Task 5 Recommendations for improvement of the legal, regulatory and institutional frameworks in particular related to the market design, necessary for the implementation of the optimal flexibility scenario, for each CP

SPECIFIC QUESTIONS:

What is existing flexibility potential in the CPs?

What additional flexibility is needed in 2030 and 2040 for three RES integration scenarios (baseline, moderate and high RES integration)?

What may be a role of integrated systems and markets in providing flexibility?

Drivers of flexibility needs in the EnC

EU goals

- Decarbonisation
- Sustainability
- Market development
- Climate neutrality …

Power systems transformation is expected to support decarbonisation goals. More electricity will be consumed due to transport and heating sector electrification. Additional consumption may happen because of green hydrogen production. At the same time, a majority of new production will be based on RES.

Increased penetration of intermittent renewable energy sources

Phase-out of coal-based power (and heat) generation Including lignite

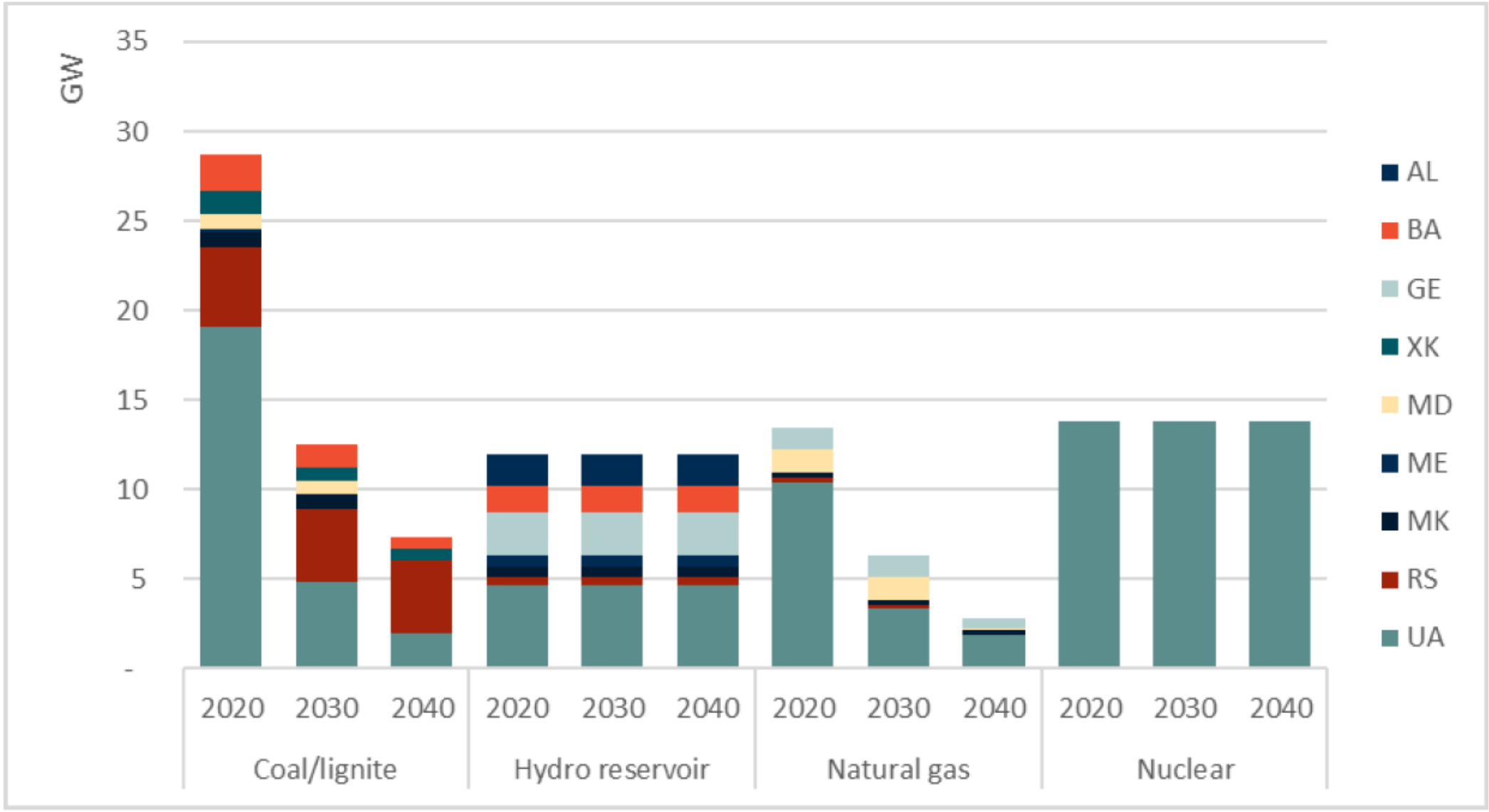
Need for increased resilience of the energy system

Carbon pricing and decarbonisation targets

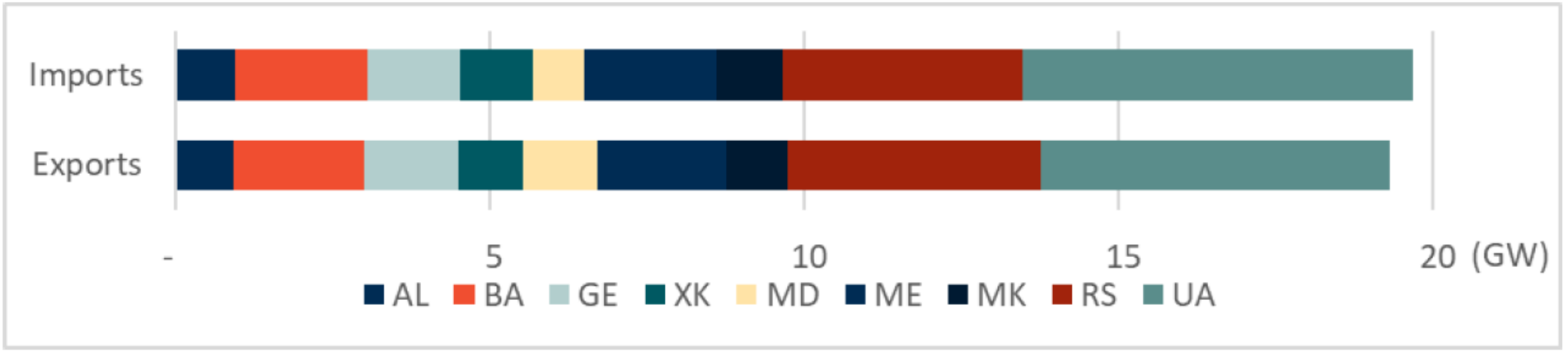
Implementation of LCPD (Large Combustion Plant Directive) and IED directives

Carbon border adjustment mechanism (CBAM)

Existing flexibility resources

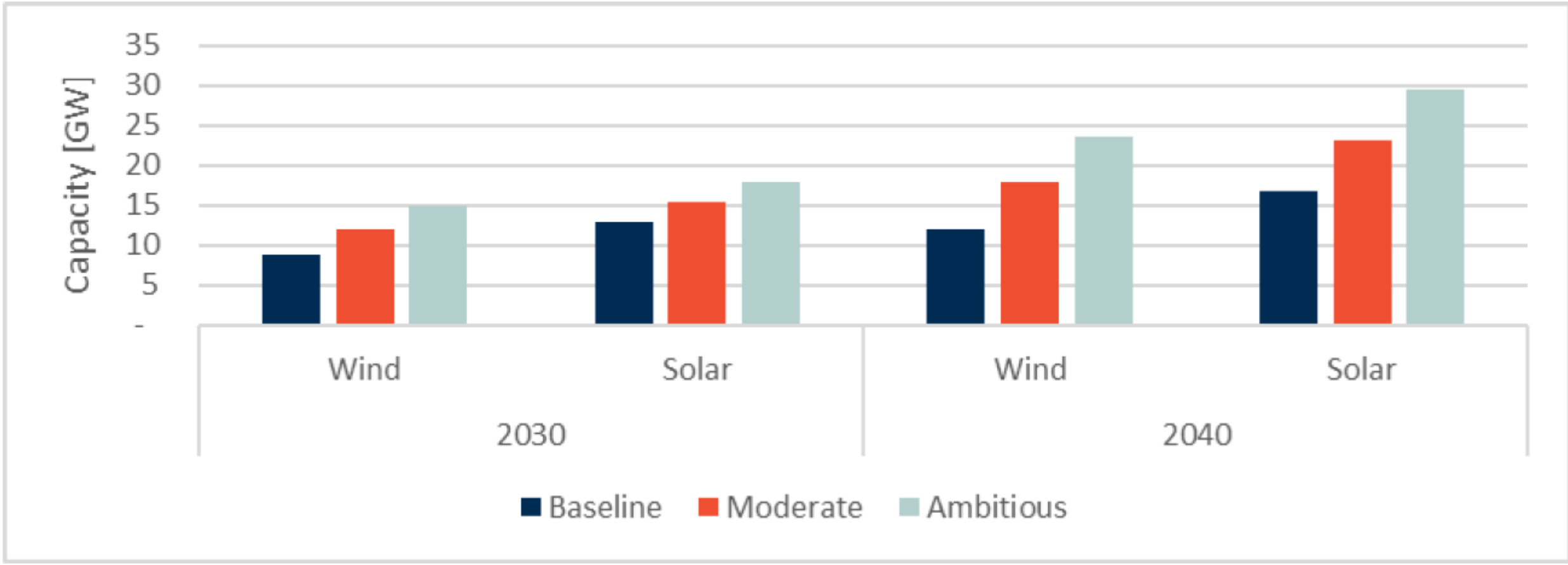


Existing flexibility resources

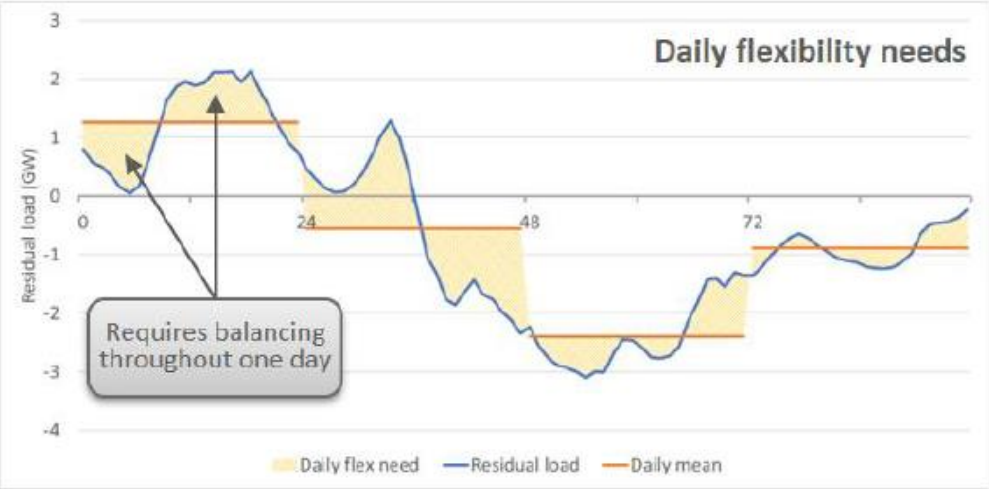


Significant interconnection capacities between the CPs and with the EU MSs !!!

vRES integration scenarios

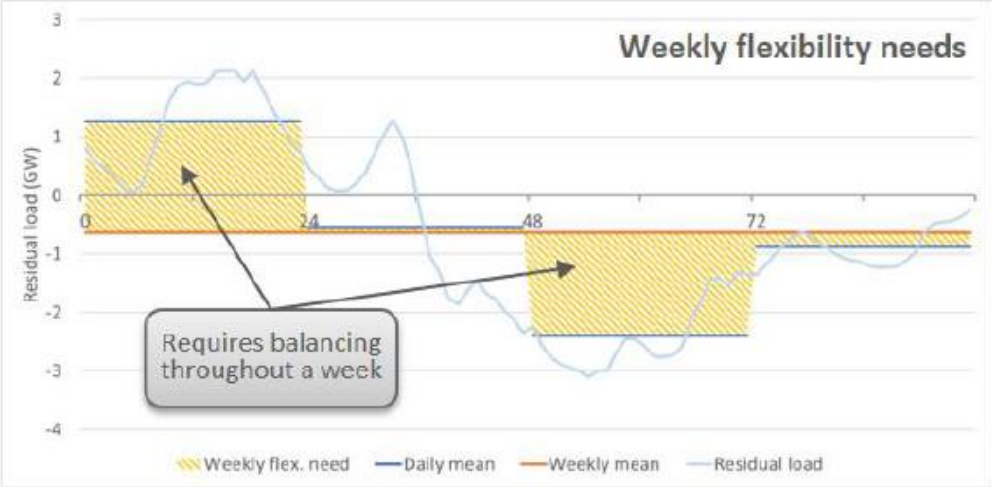


Flexibility needs - methodology



Residual load:
total hourly system load – vRES hourly production

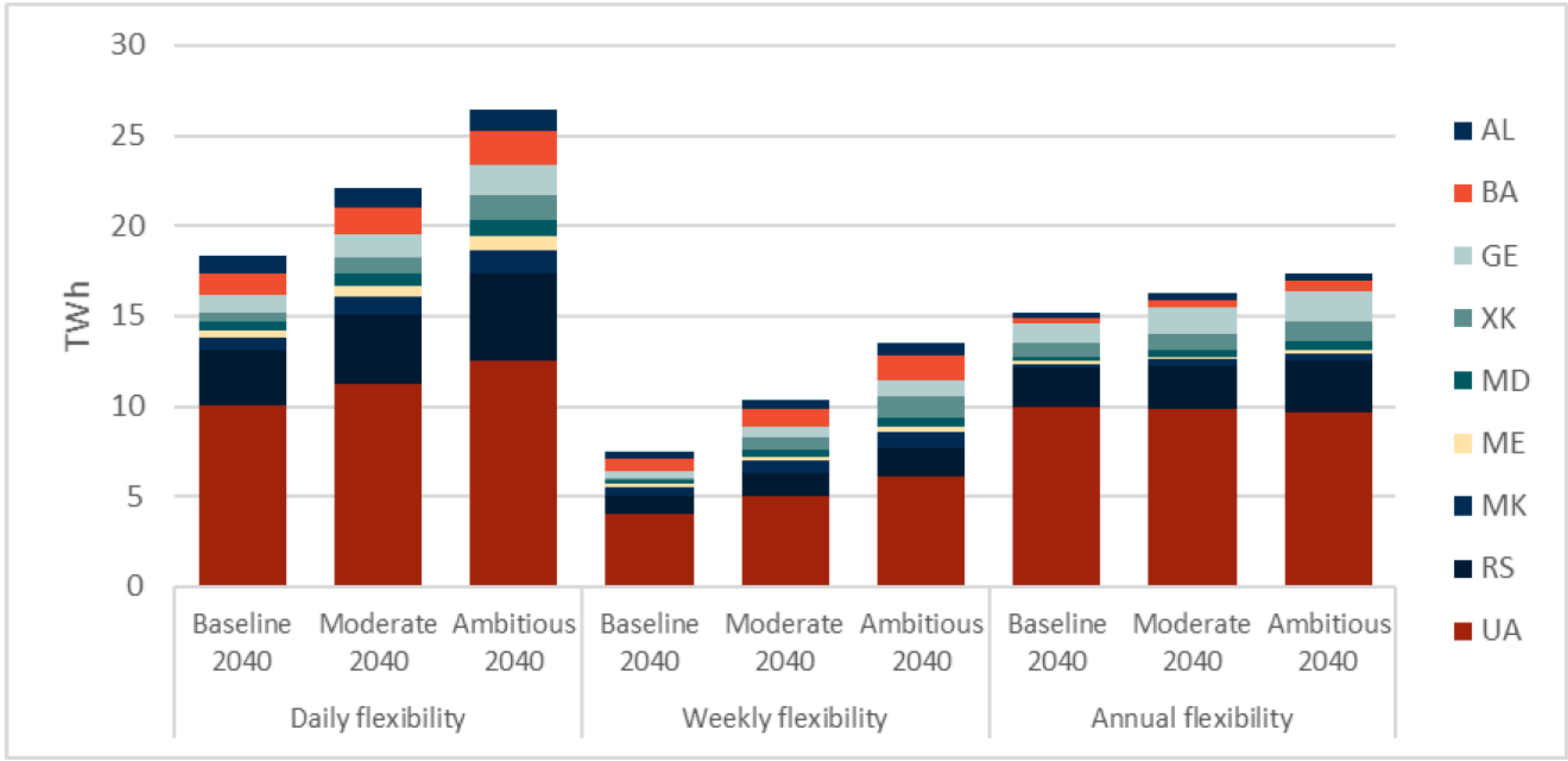
Daily flexibility needs:
hourly residual load in a day – daily average residual load



Weekly flexibility needs:
daily average residual load – mean residual weekly load

Annual flexibility needs:
cumulated difference between the weekly averages and the mean residual load across the entire year

Aggregated flexibility needs (2040)



Modelling a cost-optimal flexibility portfolio

Energy Community

Input parameters

- Installed capacities for RES, nuclear, hydropower, etc.
- Projections of end-use demands
- Catalogue of investments options with associated characteristics and costs:
  - Flexible generation assets (OCGT/CCGT)
  - Storage assets (e.g. batteries, pumped-hydro storage)
- Technical and economical characteristics of power plants, heating technologies, etc.
- CO_2 price and commodity cost assumptions

Computation

Objective

Optimise investments and operations (cost-minimising criterion) for a given scenario using an hourly time resolution in order to meet all energy demands

Results

- Investments in optimal portfolio of flexibility solutions
  - Per Contracting Party
  - In 2030 and 2040
  - For 3 RES levels
  - For 2 integration approaches
- Operational management of the power system (hourly dispatch)

- GHG emissions
- Extensive set of key performance indicators (social welfare, producer revenue and cost, GHG emissions, etc.)

Artelys Crystal Super Grid

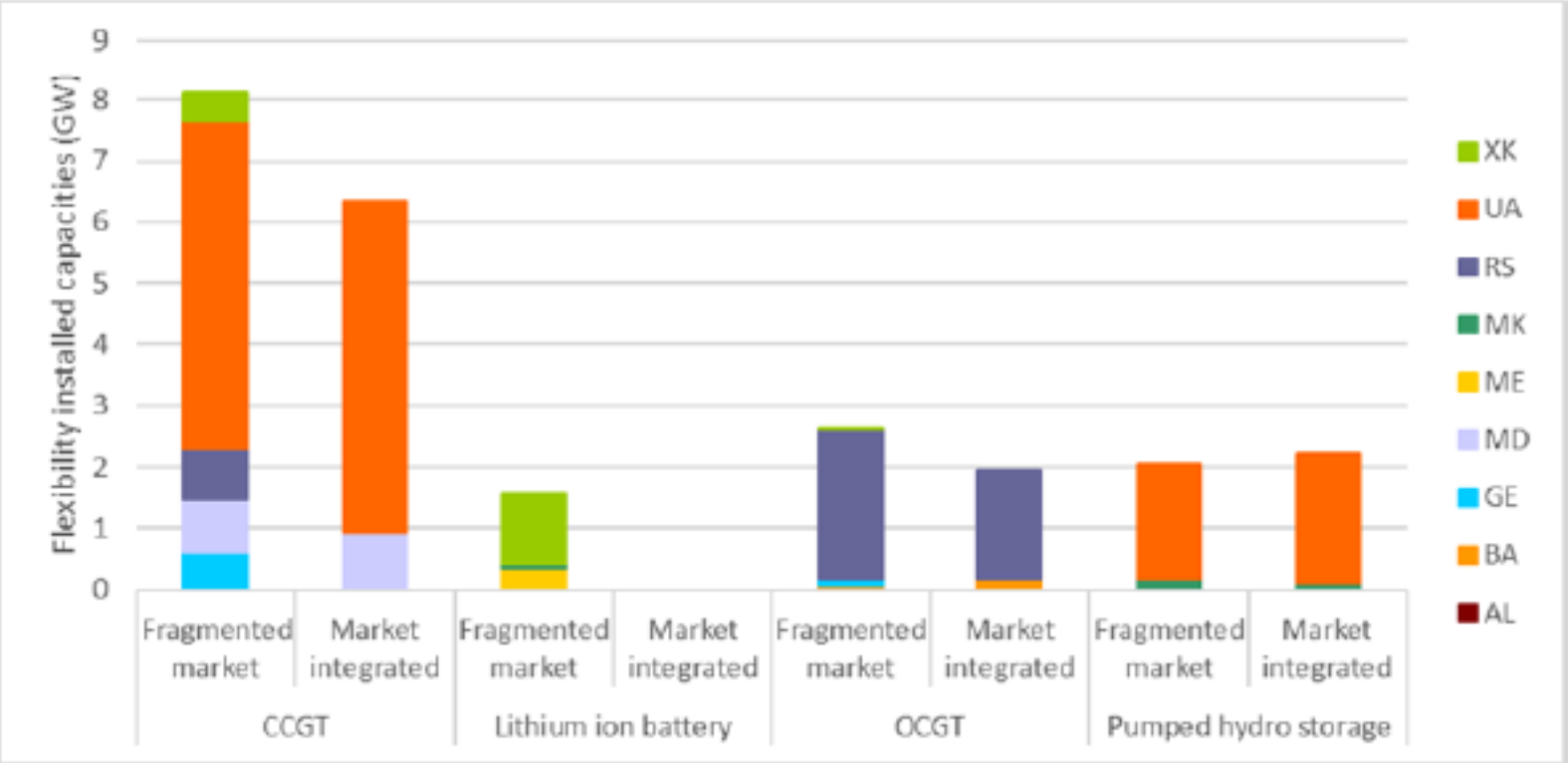
Findings

- ✓ **There is no need for investments in additional flexibility capacities by 2030.** The existing capacities that provide system flexibilities, namely cross-border interconnections (enabling increasing imports), gas-fuelled power plants and storage assets (including reservoir hydro), but also other thermal plants can cope with the rising flexibility needs related to an increasing degree of RES deployment, even in the Ambitious scenario. In CPs with coal and lignite capacities, they continue to represent a relevant share in total power generation and hydropower or interconnections provide additional flexibility (even in the Fragmented market scenario, which considers limited cross-border interconnection).

- ✓ **Necessary investments in new flexible solutions are low in 2040, despite the coal and lignite phase-out** envisioned in almost all CPs. Interconnection capacities are the main provider of flexibility at the CP level, allowing to mutualise flexibility resources among CPs and with EU countries. Storage capacities are relevant in CPs where the RES shares are highest (Montenegro, Kosovo* and North Macedonia) while gas power generation assets are particularly necessary in CPs who lack cost-competitive generation capacities to meet the national demand (Ukraine, Moldova, Serbia by 2040).

Market integration

- ✓ **Market integration of regional power systems decreases the need for flexibility from storage and thermal generation, and drives down CO2 emissions.** Such regional cooperation facilitates RES integration at lower costs and reduces congestions between Contracting Parties



Impact of market integration
High RES scenario 2040

THANK YOU
FOR YOUR ATTENTION

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