



Flexible Capacity and Regional Integration

2023 CAREC Energy Investment Forum

29 November 2023

ADB

Agenda

I. Flexible capacity

II. Regional integration and new interconnections

Relative economics of RES integration options



Source: Flexibility in 21st Century Power Systems. NREL/TP-6A20-61721.

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Operating reserves

Intermittency of Wind/PV characterized in terms of:

Variability → Regulating Reserves

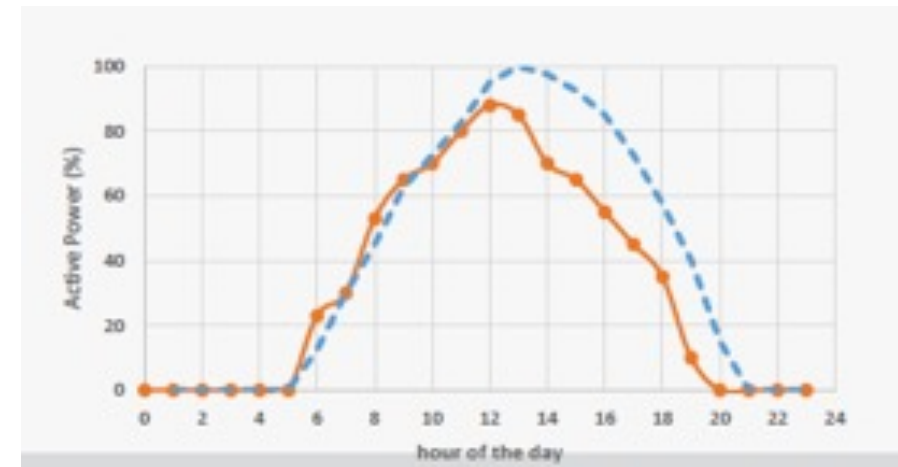
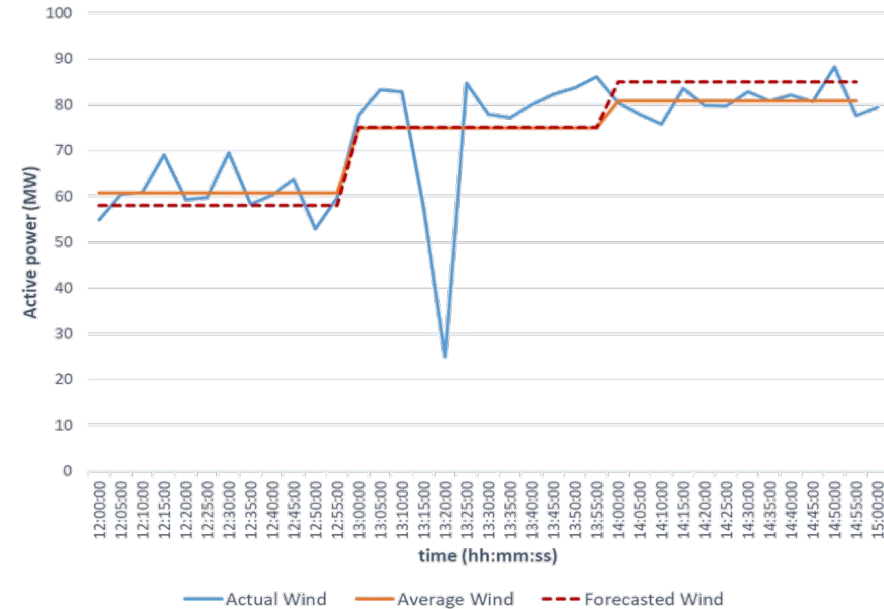
-Expected changes in power generation occurring at time resolutions lower than unit scheduling resolution (e.g. 10-minute variability of VRE generation in a system with hourly unit schedule)

-Reduction can be achieved by geographical dispersion

Uncertainty → Balancing Reserves

-Change in power generation that is not expected, i.e. due to forecast errors

-Reduction can be achieved by the use of state-of-the-art forecast tools



Case study on estimating operating reserves for RE integration

Input data

	2025 (MW)	2030 (MW)	2025 (TWh and % of the demand)	2030 (TWh and % of the demand)
Wind	1718	2568		
Solar	1433	2053	8,9 / 7,3%	12.2 / 9.5%

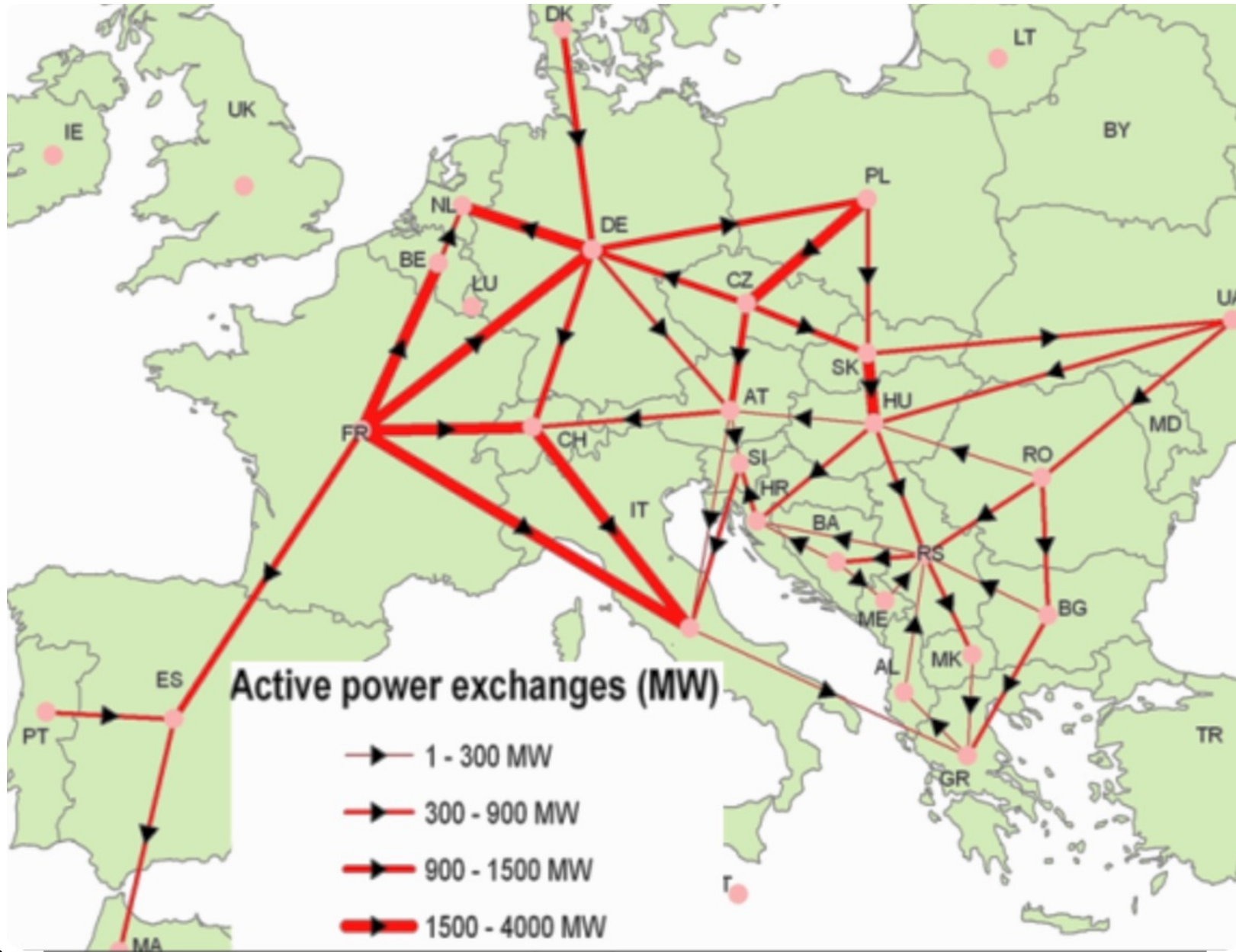
Simulation results

	2025 (MW)	2030 (MW)
Regulating Reserves (10 min step changes)	283	413
Regulating Reserves (60 min step changes)	569	828

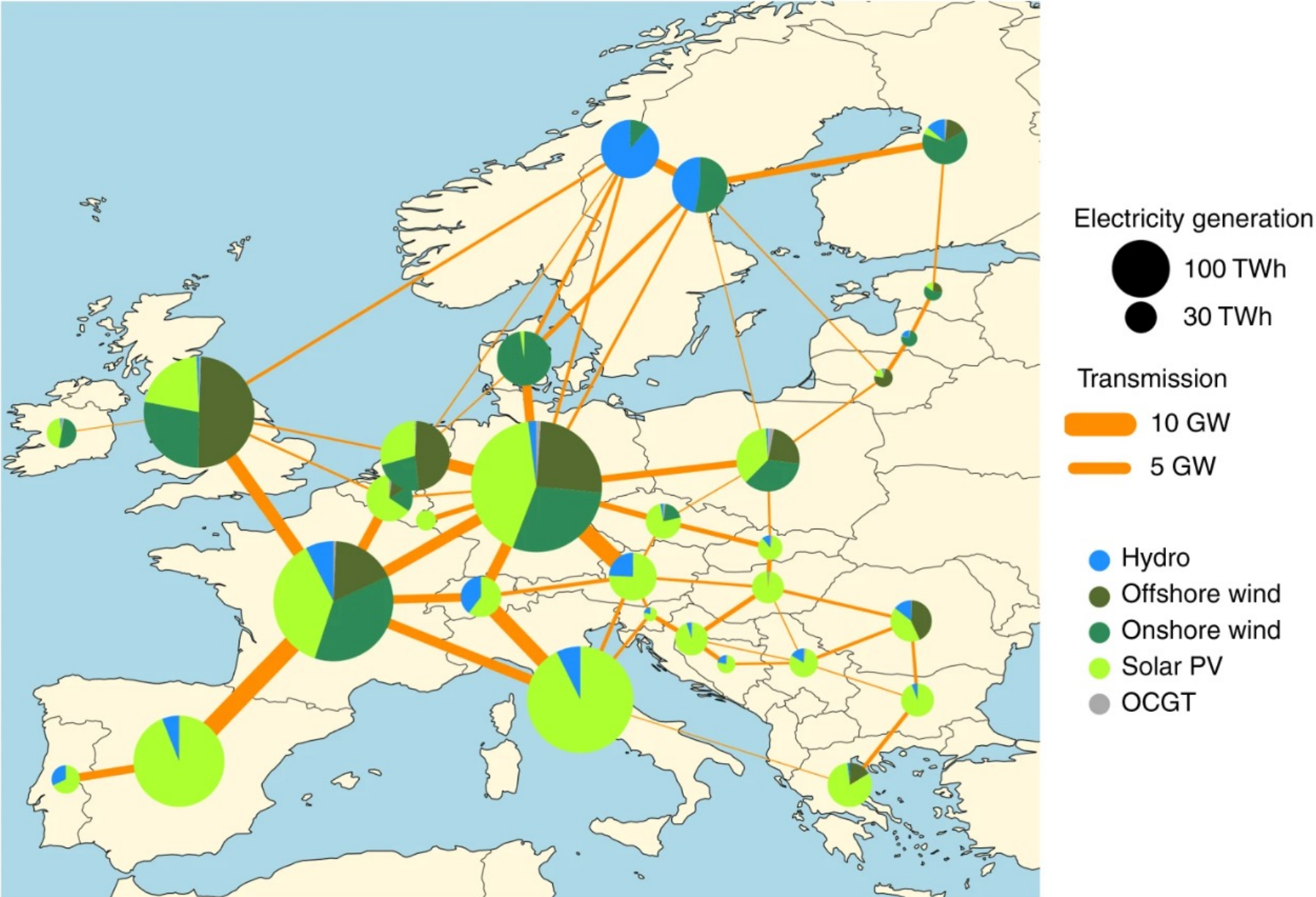
Balancing reserves:

- With the current unit scheduling practice (fixed commitment for 24 hours ahead of real time, inflexible dispatch due to power purchase agreements), balancing reserves will be unusually high
- This lack of flexibility will result in considerably high levels of Wind/PV curtailment that will jeopardize integration of RE

Active power exchange in EU



Decarbonization scenario for EU electricity production in 2050.



Key Messages about Power System Flexibility

- Renewable energy will change the shape of dispatch requirements
- In many power systems, sufficient flexibility exists to integrate additional variability, but this flexibility may not be fully accessible without changes to power system operations or other institutional factors.
- A wide range of power system elements impact system flexibility, ranging from transmission assets to generation characteristics and operational practices.
- Policy incentives can be designed to anticipate flexibility needs and support system flexibility
- Flexibility considerations can be integrated into the design of procurement policies for new RE (e.g., time zones related feed-in tariffs, subsidies)
- Uncertainty regarding the level, timing, and type of renewable energy deployment will complicate the problem of finding the optimal levels of investments.
- There are several approaches to improving grid flexibility, including improving ramping capabilities of the dispatchable generation fleet, increasing demand-side and distribution level participation, **and increasing coordination across multiple markets or balancing areas.**

Agenda

I. Flexible capacity

II. Regional integration and new interconnections

Regional interconnection initiatives

Green energy projects provide opportunity to export electricity from Central Asia to Europe through Azerbaijan <https://www.azernews.az/business/217438.html>

Georgian-Initiated Black Sea Submarine Cable to Boost European Energy Security and Connectivity <https://georgiaembassyusa.org/2023/03/13/georgian-initiated-black-sea-submarine-cable-to-boost-european-energy-security-and-connectivity/>

Northeast Asia Power System Interconnection (NAPSI)
<https://sdgs.un.org/partnerships/northeast-asia-power-system-interconnection-napsi>

CAREC 2030



Regional Electricity Cooperation Organizations

