The role of improved thermal flexibility in Vietnam's energy system planning, operation, and future power sector

Hanoi, January 26 of December
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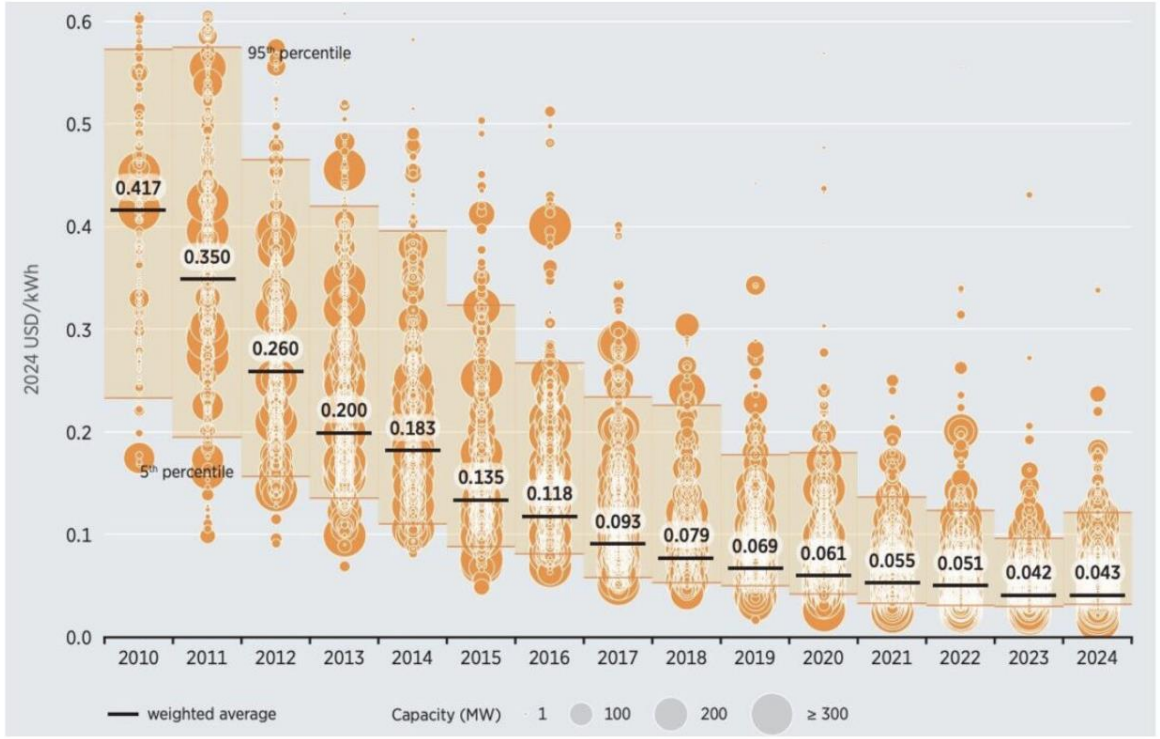
Danish Energy Agency

Introduction

Introduction: The future of electricity systems

Over the last decades, energy markets have fundamentally changed. Key renewable technologies are the cheapest souces of <u>new</u> power and will play an increasing role.

- Renewables key to strengthening affordability and **energy security** (fuel import and geopolitical dependence)
- **Higher renewable** shares require a more **flexible power system**
- **Coal supports the future energy system** when it can respond **flexibly**



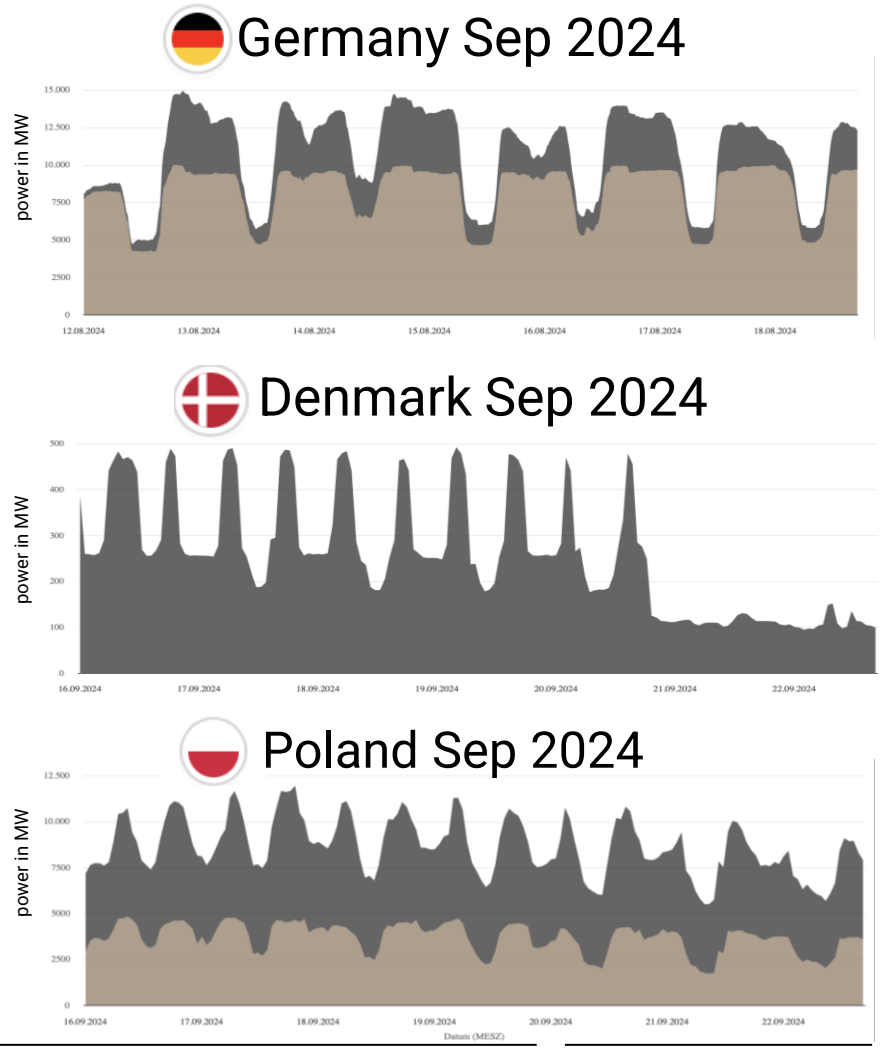
The European experience

Danish and European experience show high RE shares possible with thermal flexibility

In Denmark, as well as other EU countries, thermal flexibility has been crucial to integrate RE shares of well over 40 % (capacity) and 70-80% (generation)

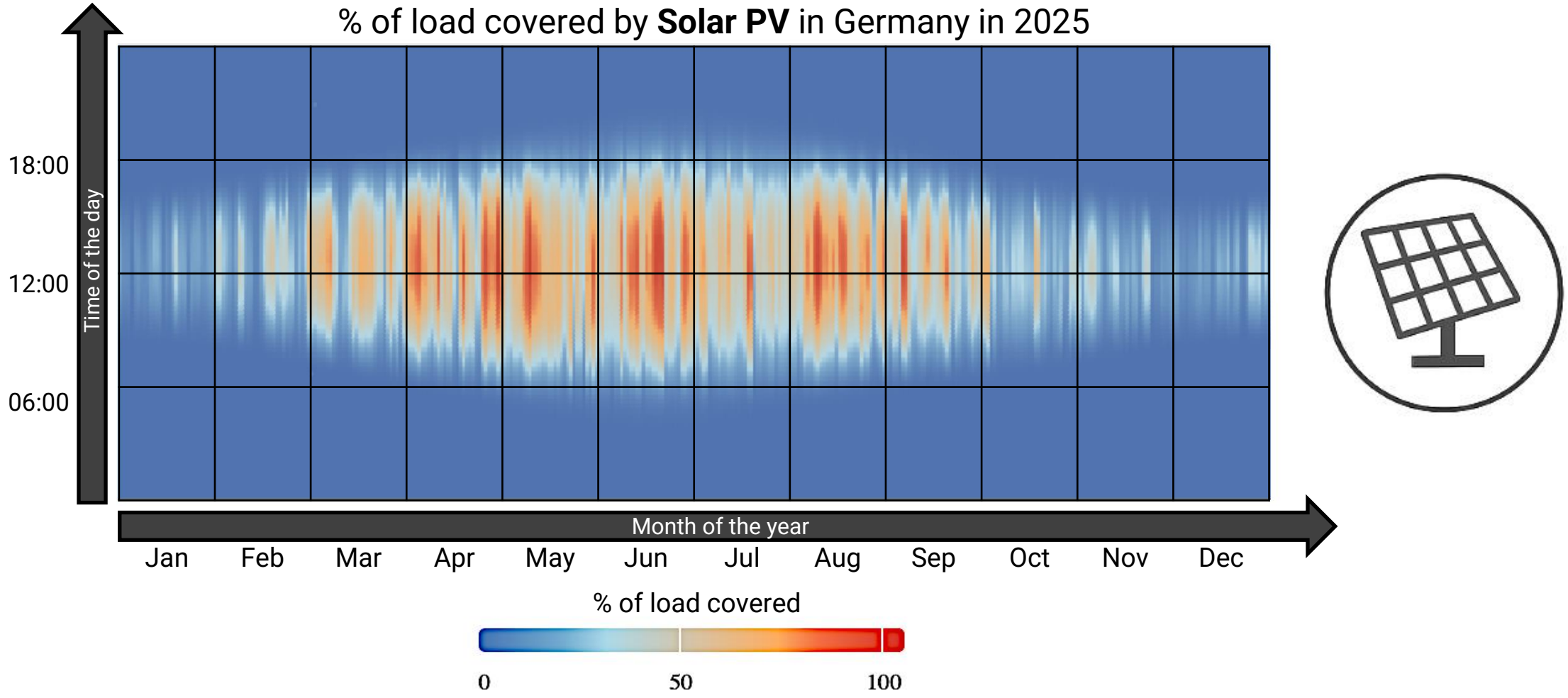
Share of installed capacity in % (source: ENTSO-E)

Country	Solar	Total Wind	Solar + Wind
Denmark	20%	39%	**59%**
Germany	37%	29%	**66%**
Poland	28%	16%	**44%**



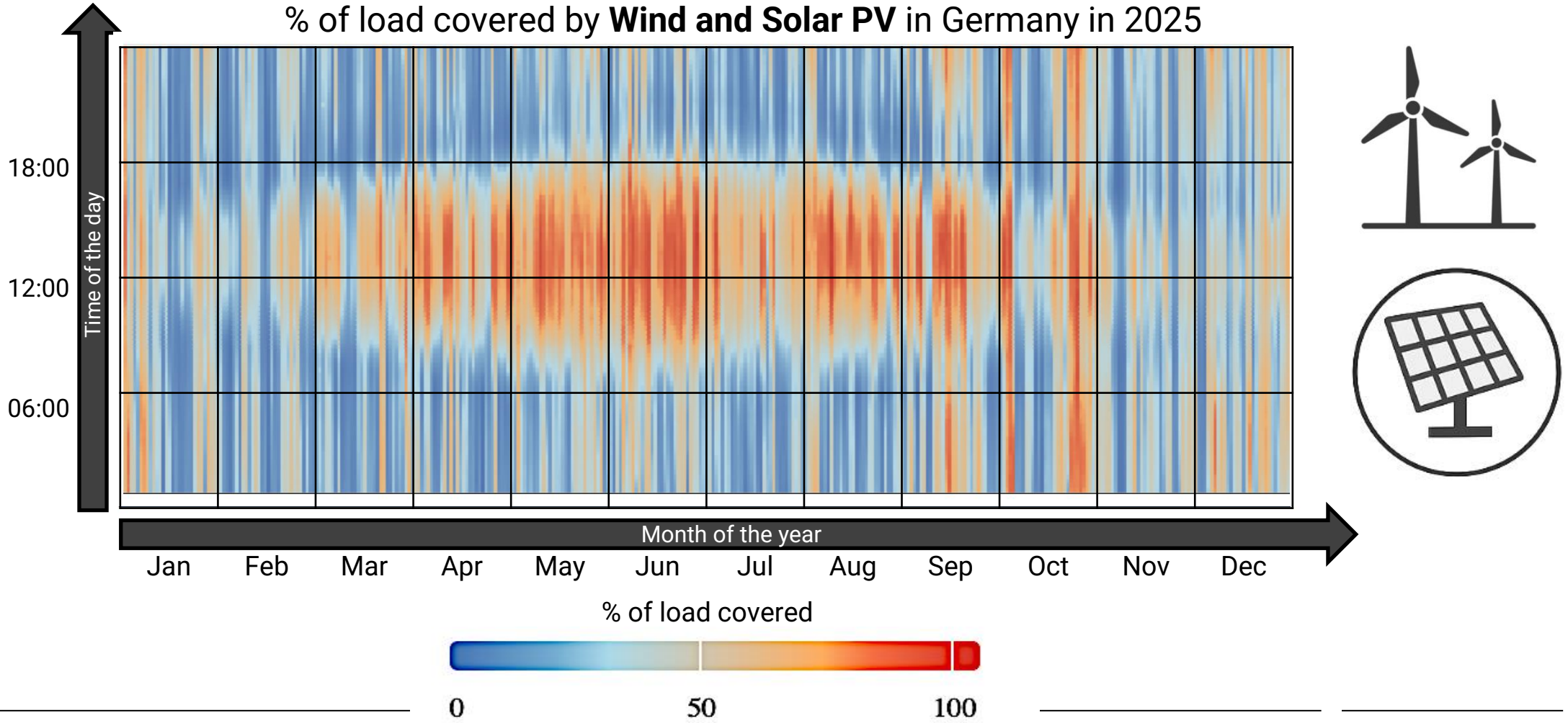
(source: ENTSO-E)

European experience: operational patterns of solar PV, wind and coal in the year 2025 (1/4)



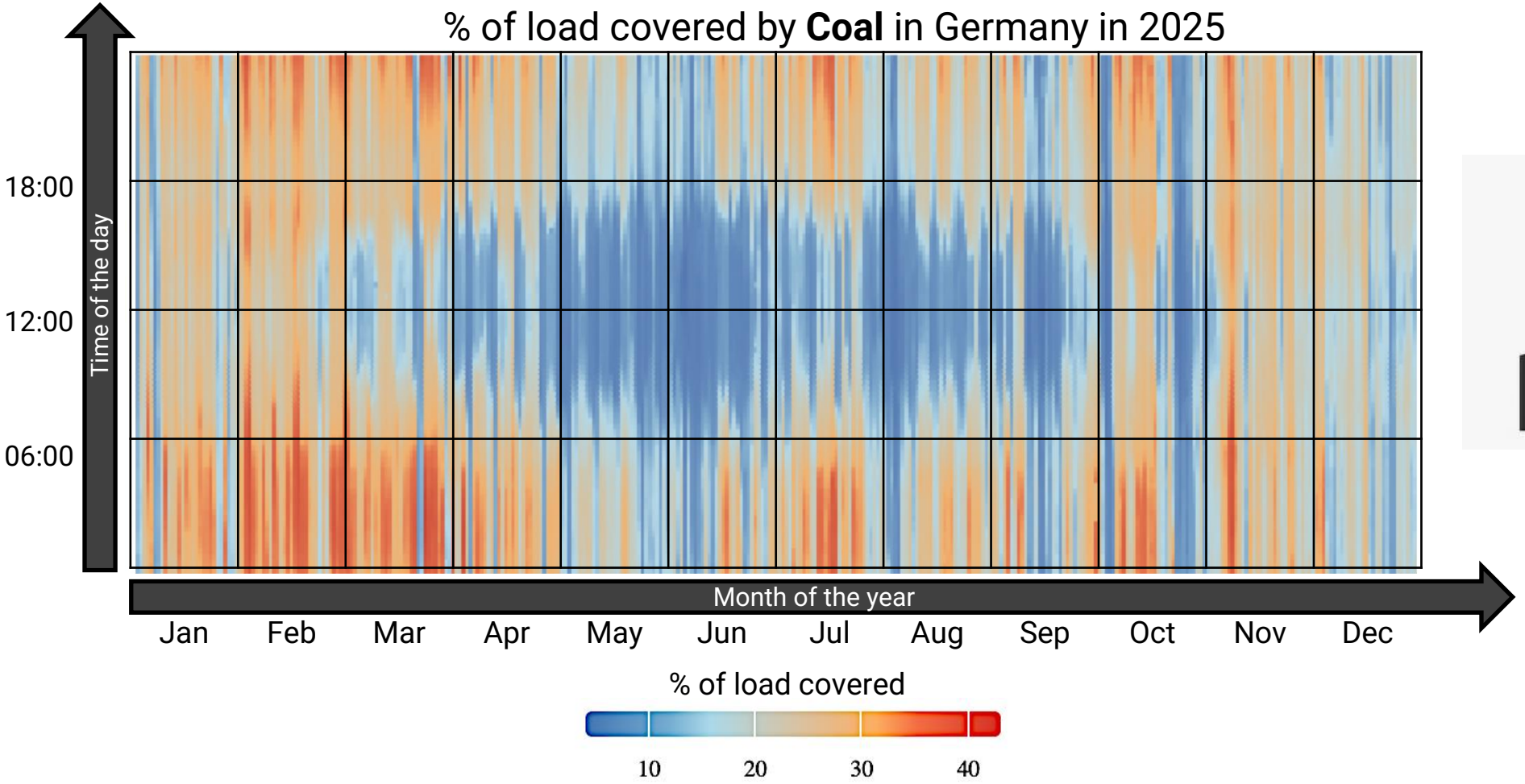
(source: ENTSO-E)

European experience: operational patterns of solar PV, wind and coal in the year 2025 (2/4)



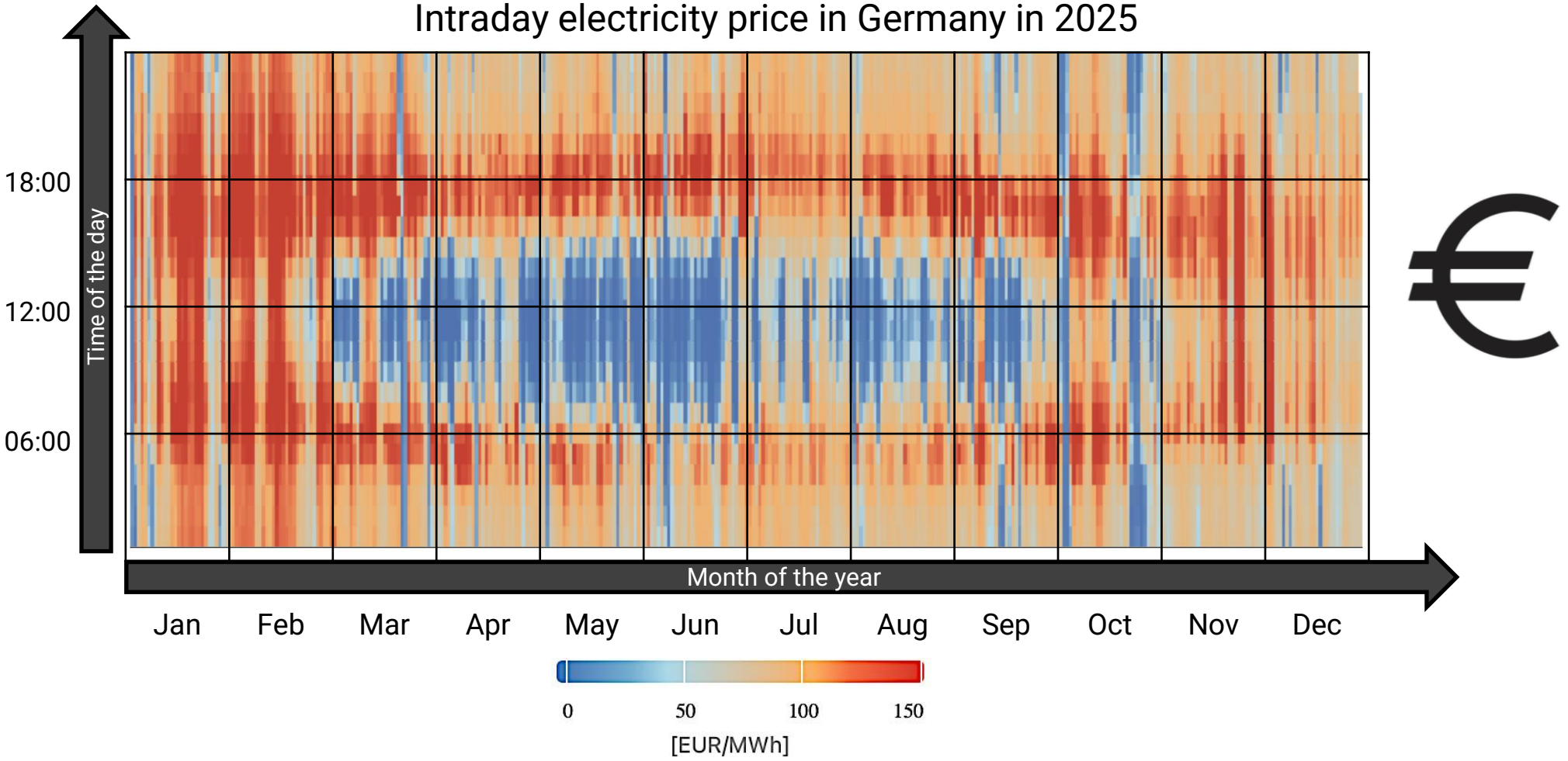
(source: ENTSO-E)

European experience: operational patterns of solar PV, wind and coal in the year 2025 (3/4)



(source: ENTSO-E)

European experience: operational patterns of solar PV, wind and coal in the year 2025 (4/4)



(source: ENTSO-E)

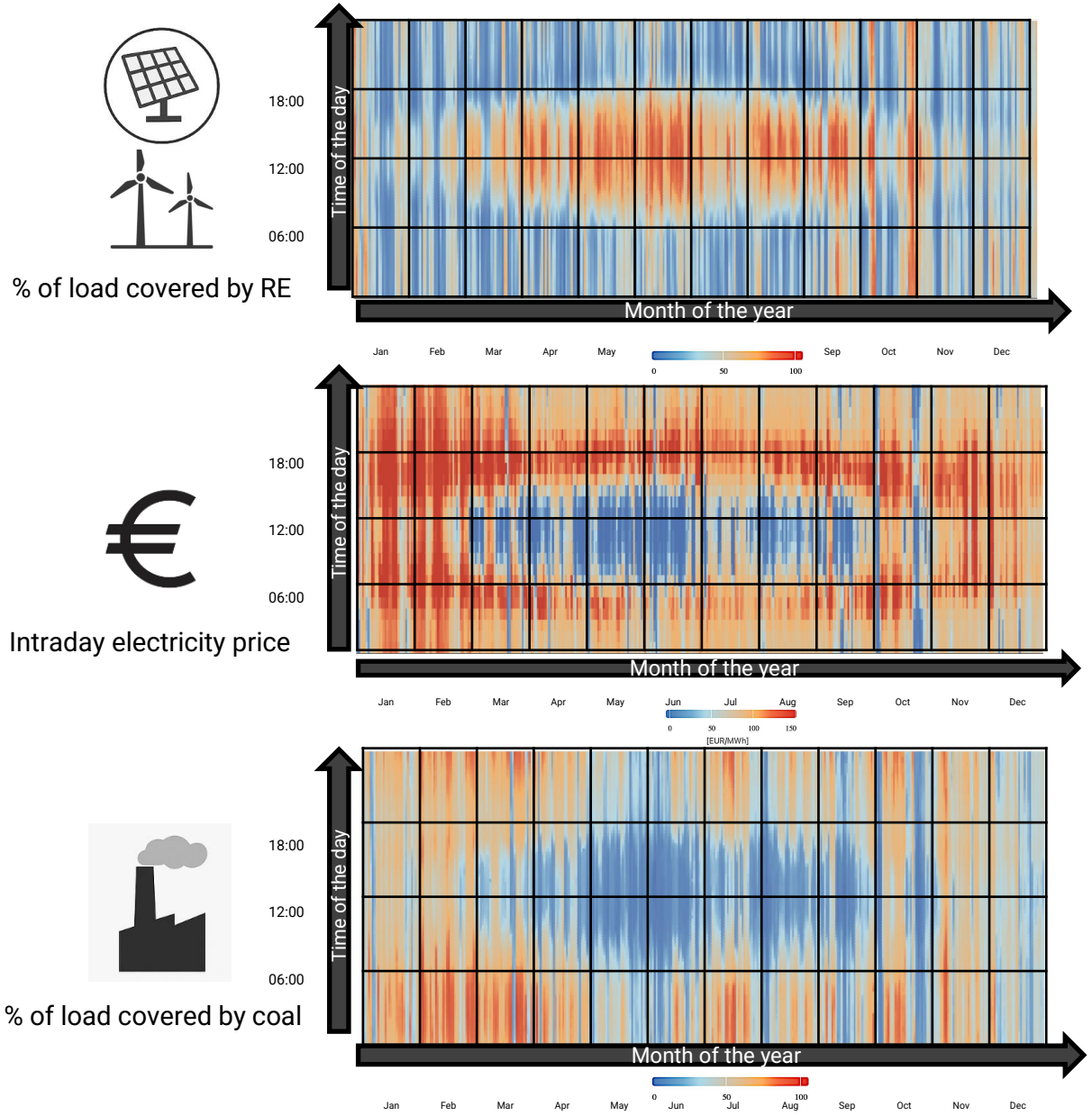
The European experience today: prices determine dispatch

In competitive EU wholesale markets prices are first - dispatch follows

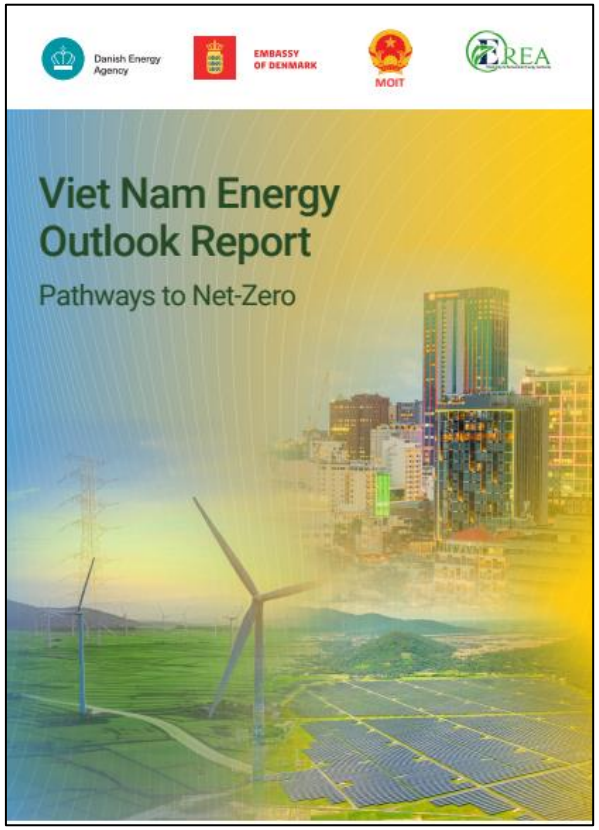
Market prices reflect marignal generation costs and system conditions

Coal generation: is only viable when market prices are higher than variable costs

SOE approach	Central dispatch decisions, PPAs, partial particitpation in markets
Competitive market	System operation is coordinated by prices, not by administrative dispatch decisions.



Vietnam’s electricity system with higher RE shares



Future electricity systems require greater system flexibility

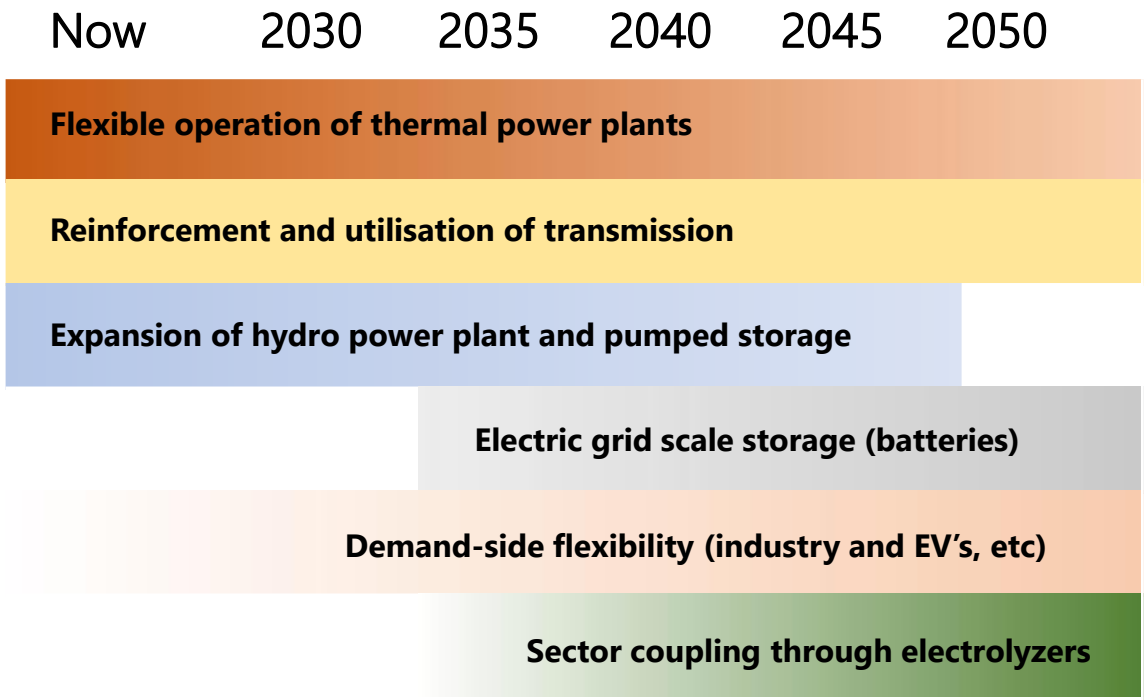
Key message: In-depth EOR modelling of Vietnam shows <u>which measures are required over time</u> to provide flexibility and reliability at the lowest possible costs

Higher <u>RE integration requires greater system flexibility</u>:

Time-variant generation: solar PV and wind daily and seasonal generation patterns.

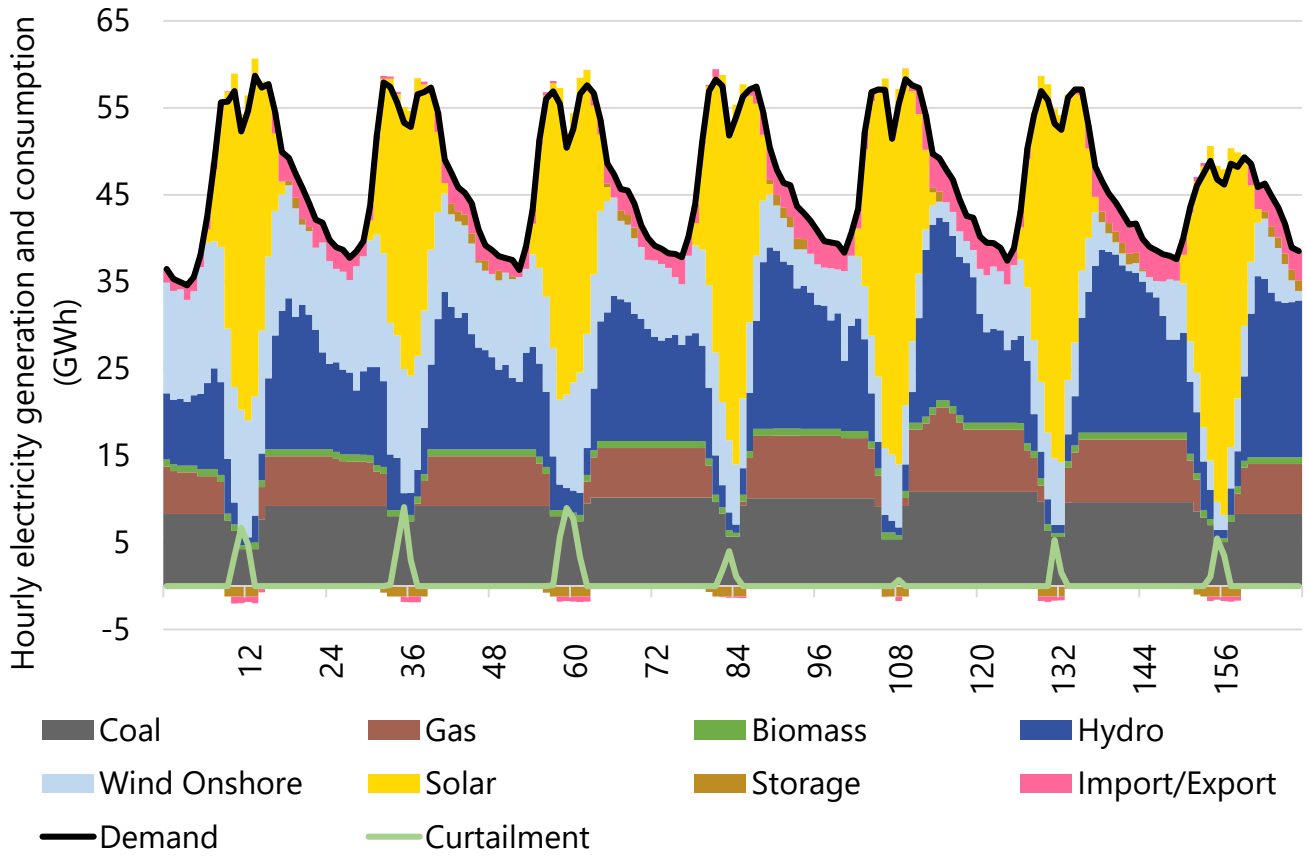
Different options exist: thermal flexibility, grids, batteries, pumped hydro storage, demand side management, and other measures can provide flexibility.

Lowest cost options first: Thermal flexibility ranks as a low cost option.



(source: DEA and EREA 2024)

In-depth EOR modelling of Vietnam shows that with higher RE integration, power plants should be more flexible to avoid RE curtailment



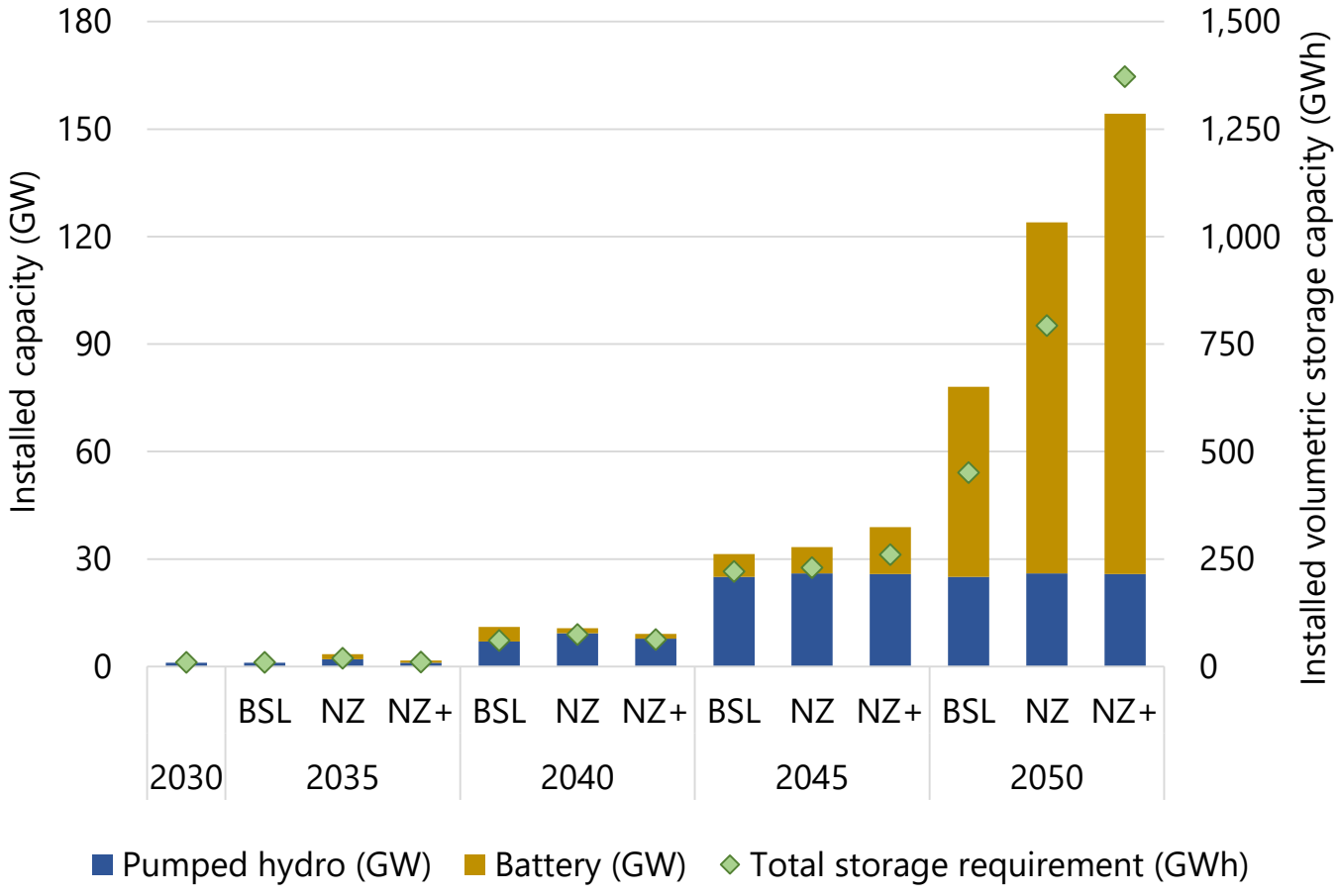
Example of modelled hourly dispatch of full power system, assuming low flexibility of coal power plants. (NZ scenario, a week in March, 2030)

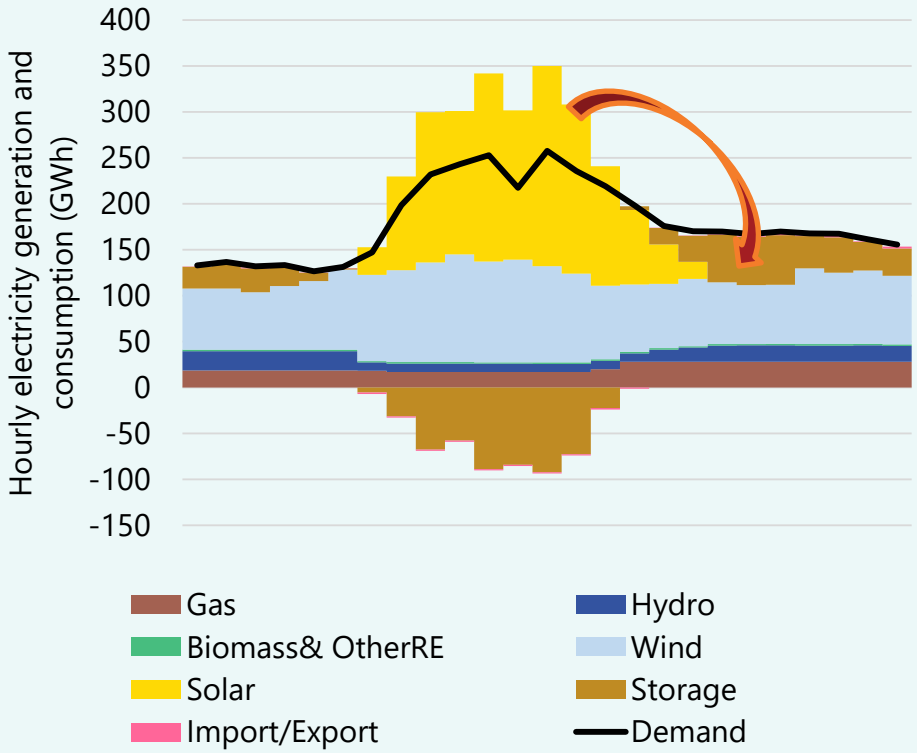
Under higher VRE shares, the power system is almost fully renewable during daytime

Gas and hydro might not be enough – coal must also adapt

Curtailment means higher costs by wasting RE generation, and adding a risk to RE project developers.

Electricity storage will be crucial after 2030.



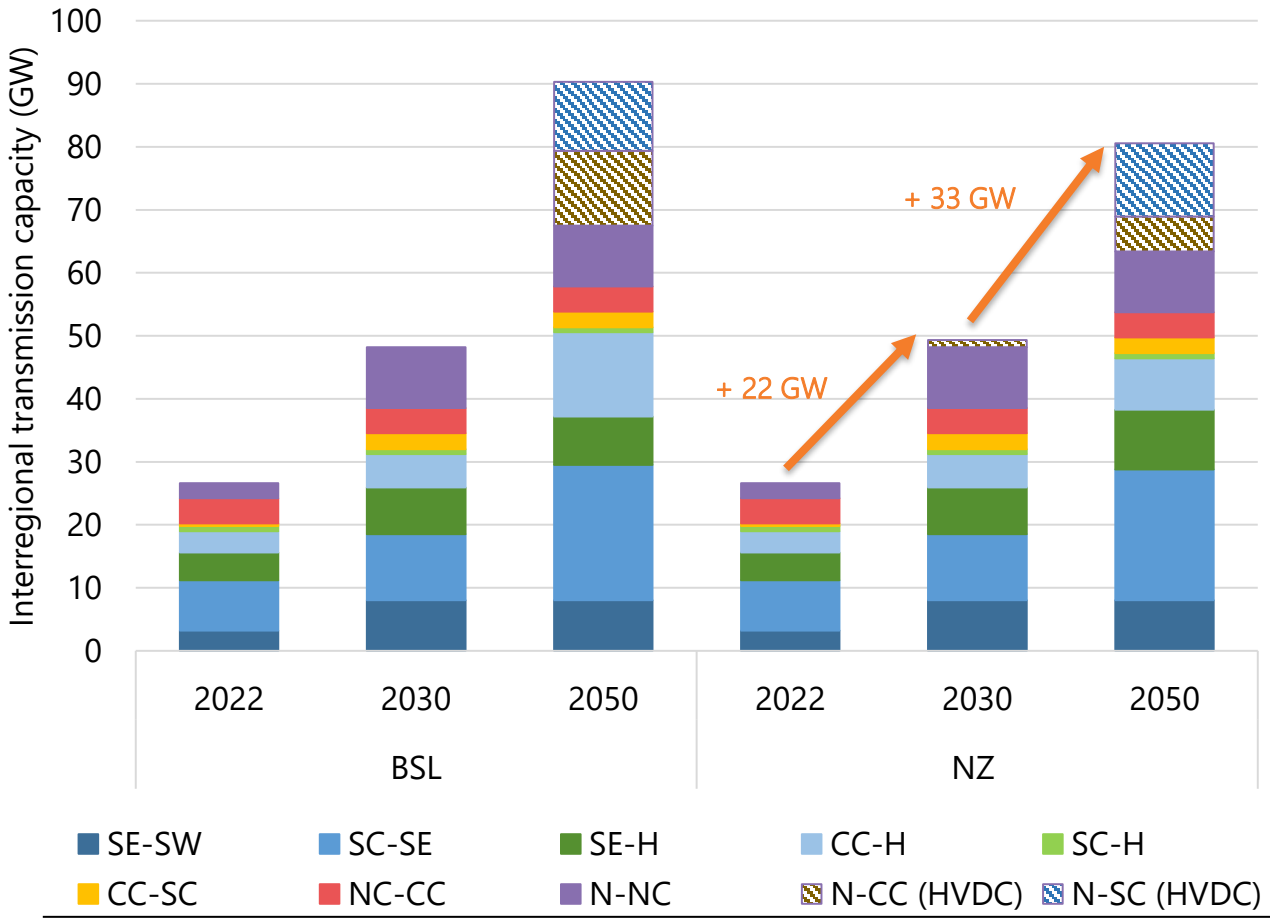


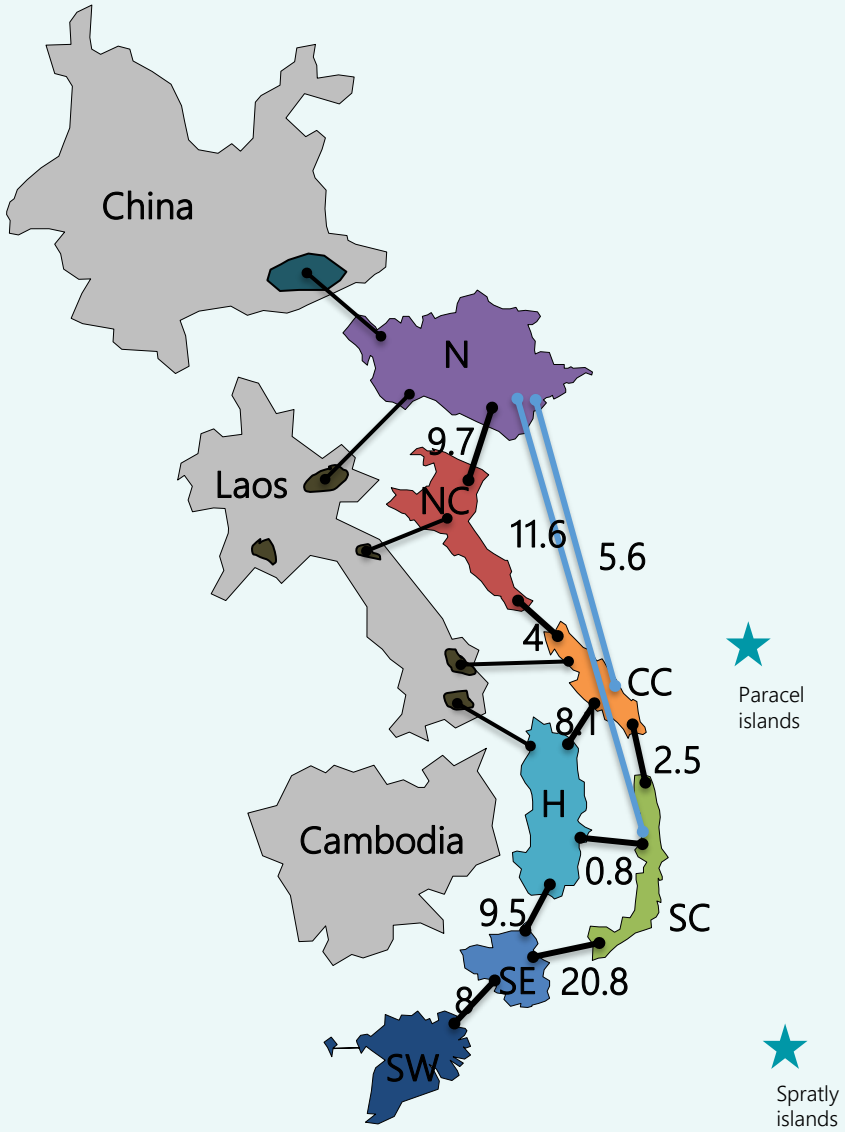
Example operation in 2050

Recommendations

Develop the regulatory framework to support large scale deployment of electric storage after 2030

Grid investments: Early and consistent expansion of transmission system





NZ 2050

Installed transmission capacity (GW). Blue is HVDC.

An adequate incentive framework will be essential for power plants to run more flexibilty.

1. **Power plant perspective: goal is to maximize profits**. → recover investments for flexibility refurbishments + remmuneration for low-load operation. *Why invest in flexibility, if there is no gain?*
2. **EVN's perspective: goal is minimize generation costs**: → Coal flexibility might enable the integration and purchase of lower-cost RE elsewhere, and avoid costlier storage investments.

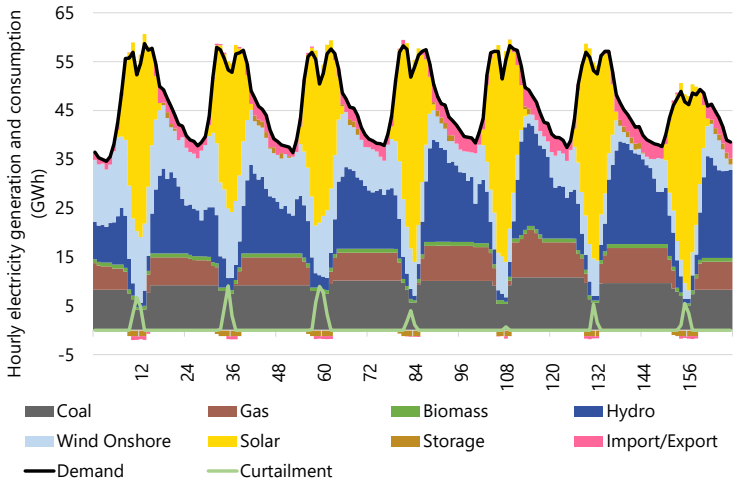


coal: USD 7-12 cents / KWh



new solar: USD 3-6 cents / KWh

EVN



Conclusions

Key message: *Delivering appropriates will be crucial to improve flexibility.*

Regulatory implications:

- **Power sector planning: <u>planning for flexibility</u>** to enable the integration of higher shares of low-cost RE, while avoiding costlier investments e.g. into storage or other solutions.
- **Power sector operation**: **<u>incentivizing an operation under the current market organization</u>** in which lowest cost generation (hydro, low-cost RE) is priorized over higher cost generation (coal, gas).
- **Power sector organization: <u>competitive generation markets</u>** deliver incentives for flexible operation (abundant electricity → low market prices → incentive for flexible operation).

Xin cảm ơn!

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