TradeRES

New Markets Design & Models for 100% Renewable Power Systems

System adequacy in ~ 100% vRES Power Systems

Final Webinar | November 19th 2024

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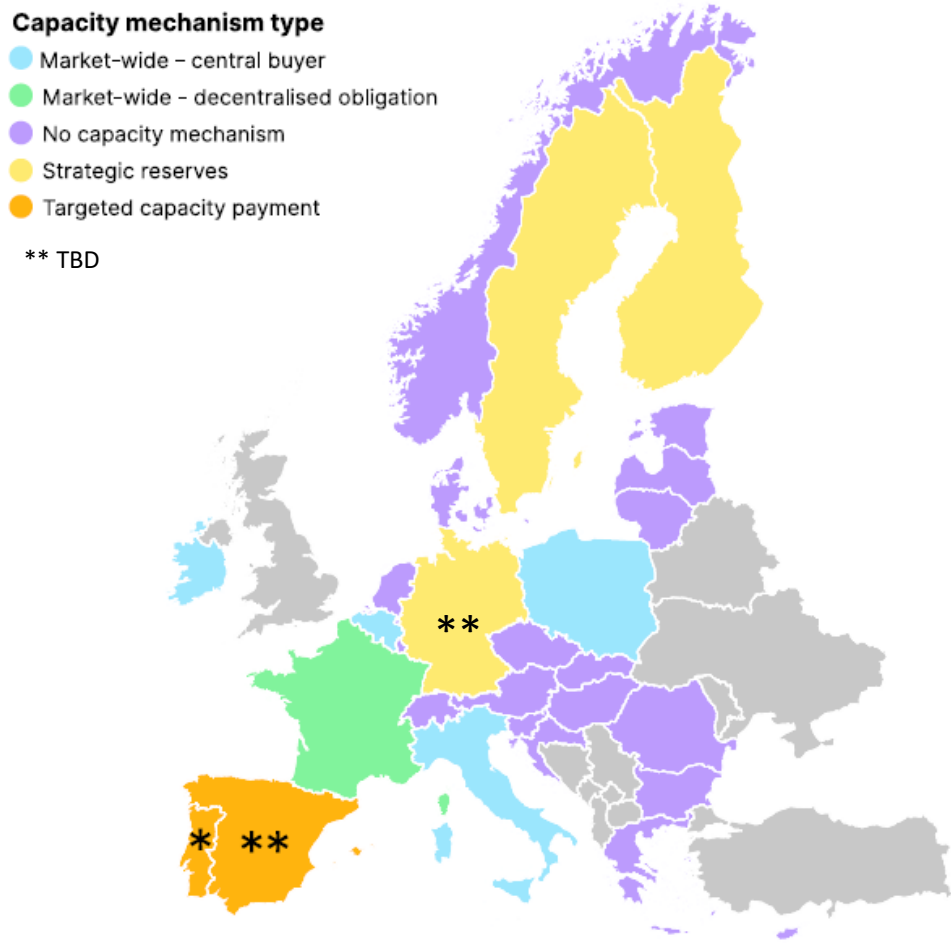
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 864276

Motivation

- Few scarcity prices due to price caps, limited demand flexib
- Low hedging levels due to risk aversion, random curtailmer
- Too many uncertainties: policy interventions, demand incre fuel, CO2 prices, weather…

Research Questions:

- Can an Energy-Only-Market enable resource adequacy?
- How should a Capacity Remuneration Mechanism should be designed?



ACER security of supply 2022

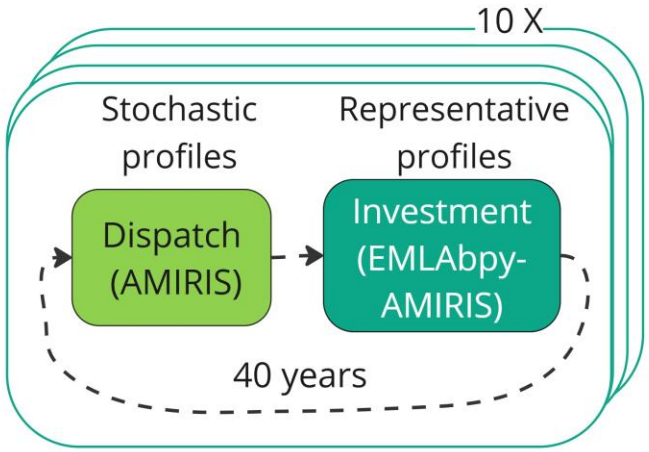
Co-simulation of 2 Agent-Based Model

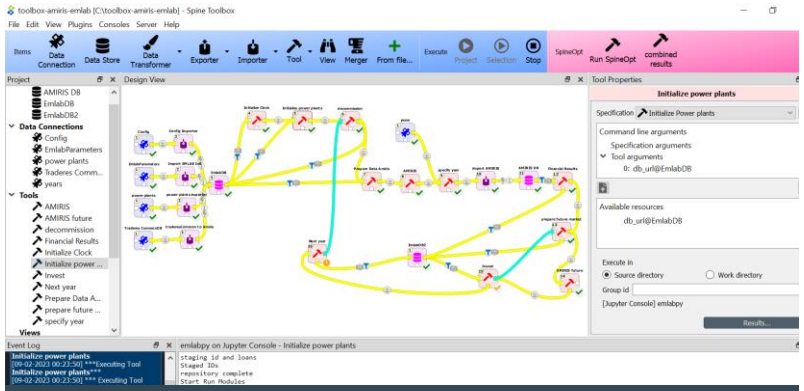
AMIRIS

- Dispatch (hourly)
- More flexibility types
- vRES support policies
- No investment decisions

EMLabpy

- Investment and decommission
  - NPV > 0
  - Myopic
  - No guaranteed equilibrium
- CRMs

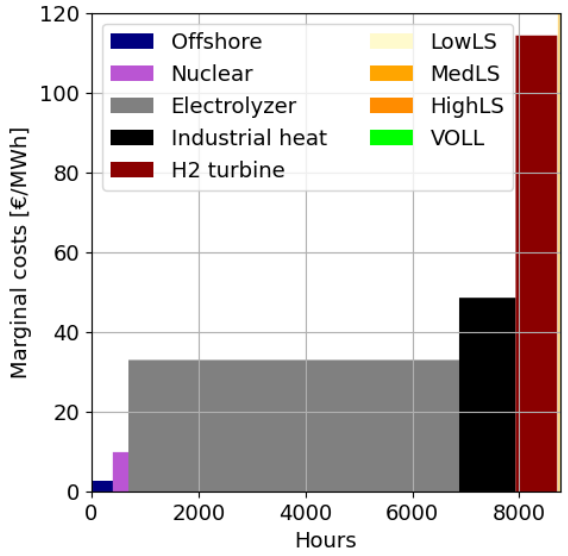


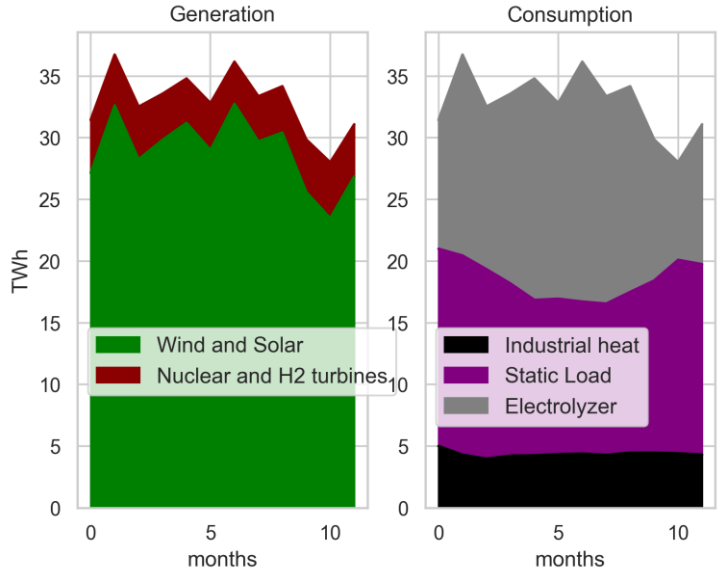


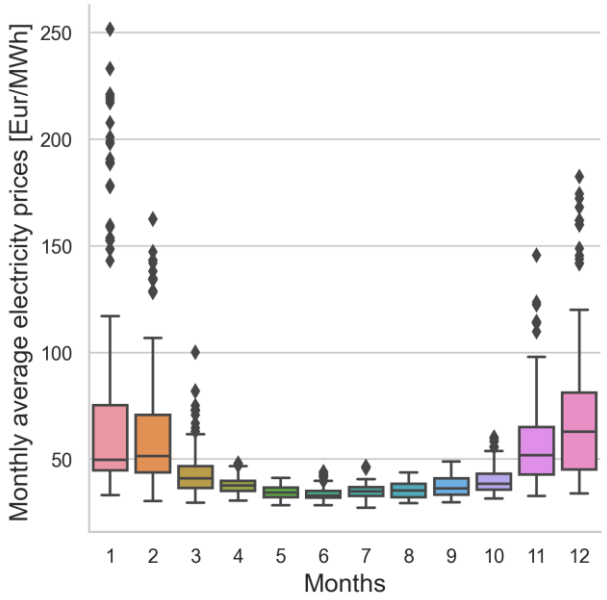
Spinetoolbox

Case Study: NL 2050

Can an EOM enable resource adequacy in a ~ 100% RES system ?

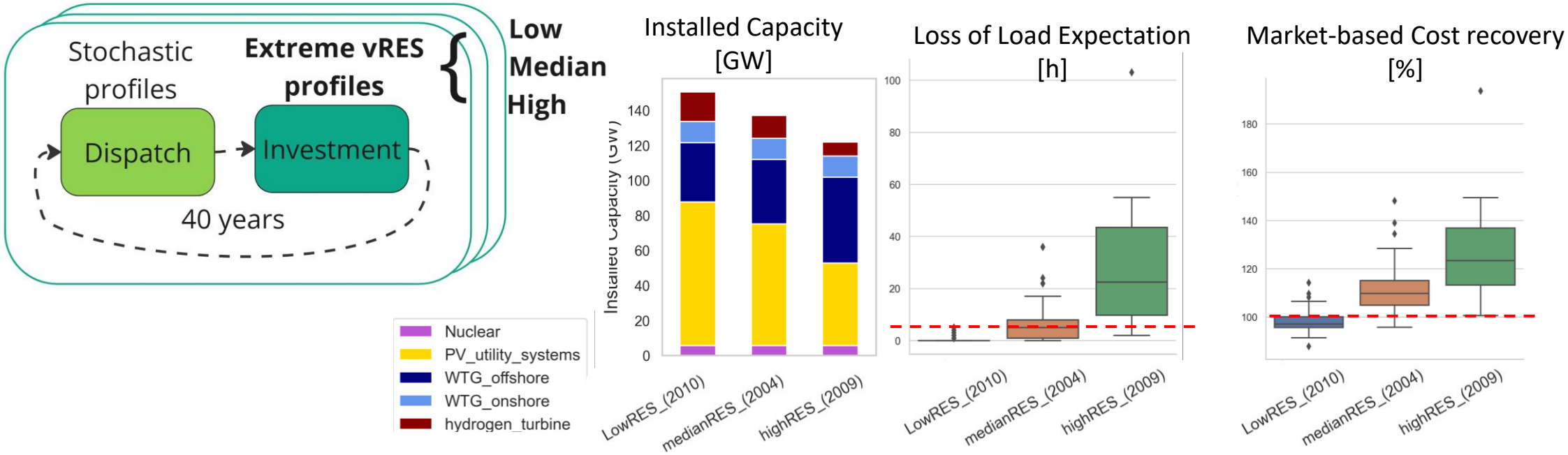






I. Sanchez-Jimenez, D. Ribo-Perez, M. Cvetkovic, J. Kochems, C. Schimeczek, L. de Vries. Can an energy only market enable resource adequacy in a decarbonized power system? A co-simulation with two agent-based-models. Applied Energy 2024

Would companies invest to ensure reliability?

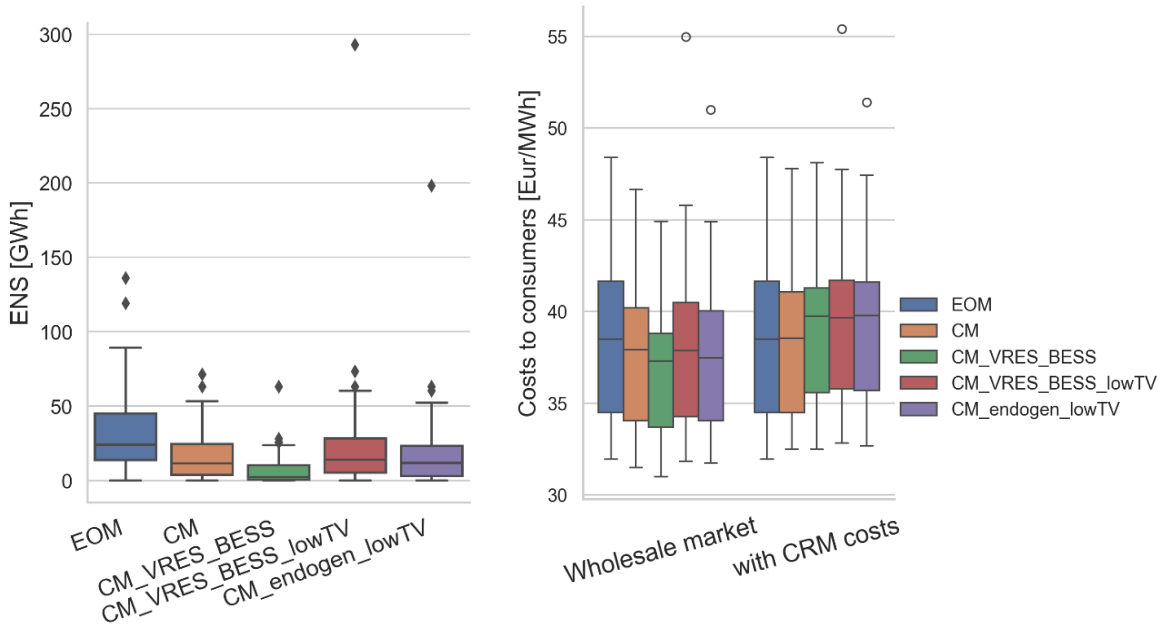


Weather uncertainty increased the variability of electricity prices by 10X and and of cost recovery by 3X.

I. Sanchez-Jimenez, D. Ribo-Perez, M. Cvetkovic, J. Kochems, C. Schimeczek, L. de Vries. Can an energy only market enable resource adequacy in a decarbonized power system? A co-simulation with two agent-based-models. Applied Energy 2024

Capacity Market

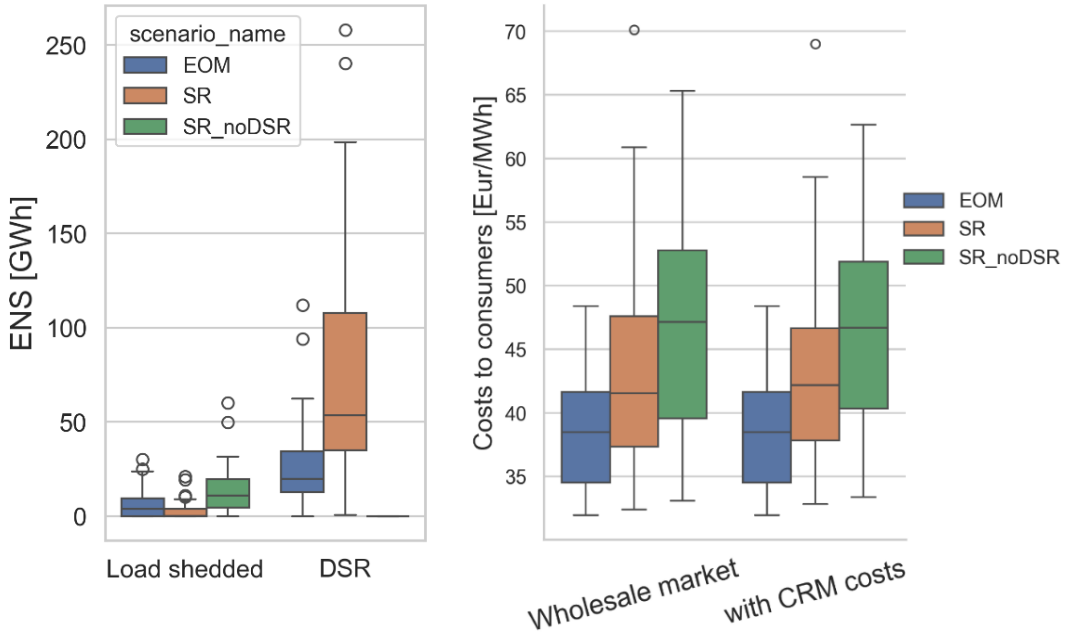
- Risk of overestimating derating factors of batteries and vRES, these were stable after 15 years
- Target capacity can be easily under or over-dimensioned
- Lower wholesale market costs, and similar costs to consumers as an EOM



Source: Sanchez-Jimenez, Bruninx, de Vries. Capacity Remuneration Mechanisms for a Decarbonized Power System 2024

Strategic Reserve

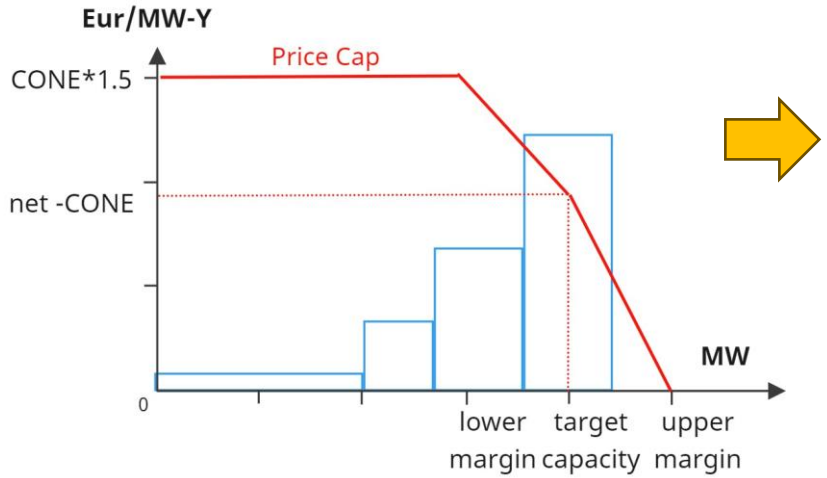
- Increased lifetime of plants in reserve, i.e. H2 turbines
- High electricity price volatility, because DSR was activated more
- The cost of the reserve was zero in the median case

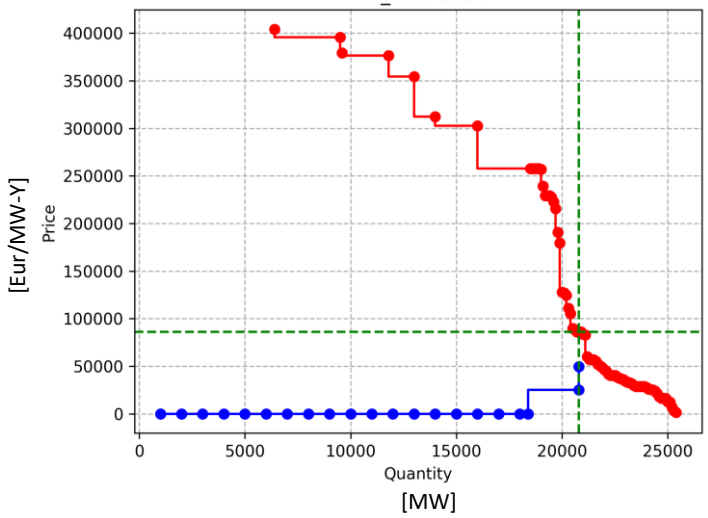


Source: Sanchez-Jimenez, Bruninx, de Vries. Capacity Remuneration Mechanisms for a Decarbonized Power System 2024

Capacity Subscription

Consumers subscribe to the capacity they need during scarcity events
Enables reliability to become a private good

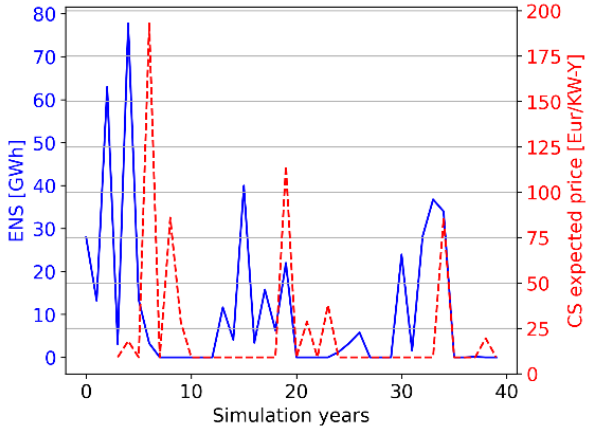


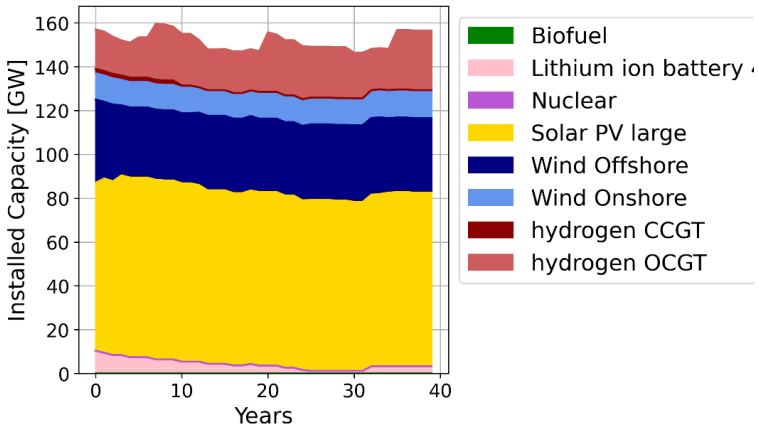


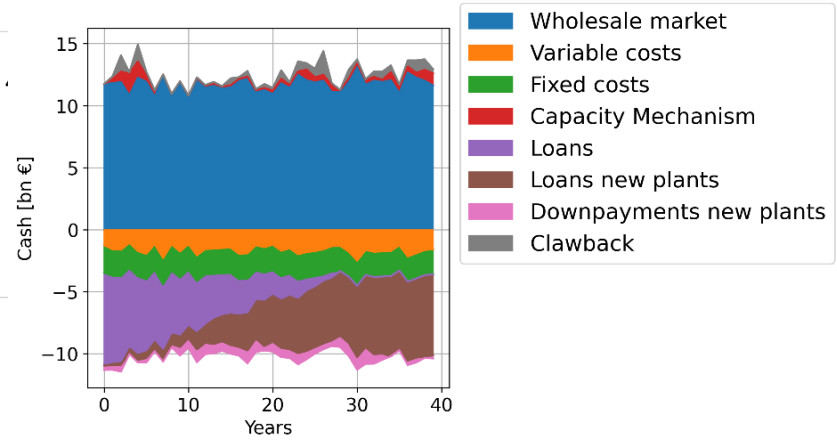
- Consumers adapt their bids based on the experienced shortages
- Generators make investments based on last year's CS price

Capacity Subscription

- Volatile and high capacity prices
- Investment waves due to myopic bids from consumers and myopic investments
- Clawback reduced cost to consumers by 1 Eur/MWh







Source: Sanchez-Jimenez, Bruninx, de Vries. Capacity Remuneration Mechanisms for a Decarbonized Power System 2024

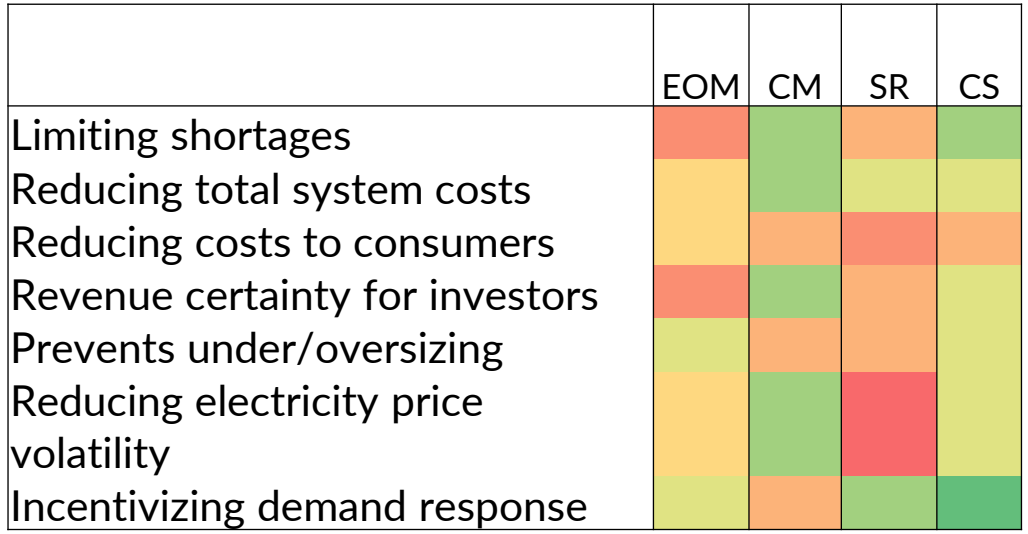
Conclusions

•A capacity market reduce shortages most effectively
•Requires central parametrization, can easily be oversized
•Possibility for long-term contracts

•Strategic Reserve extends power plants' lifetimes
•It can incentivize more flexible generators.
•Its activation after DSR disturbs the merit order and can make electricity prices more volatile.

•Capacity subscription is a self-regulated mechanism that reveals the need for capacity and incentivizes more demand flexibility.
•Investment cycles may occur.
•Requires guidance from retailers
•A single buyer of long-term contracts may be needed.

•Hydrogen storage may also require a CRM.



Sanchez-Jimenez, Bruninx, de Vries. Capacity Remuneration Mechanisms for a Decarbonized Power System 2024

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