



TradeRES

New Markets Design & Models for
100% Renewable Power Systems

The European market perspective: prices, profits and costs

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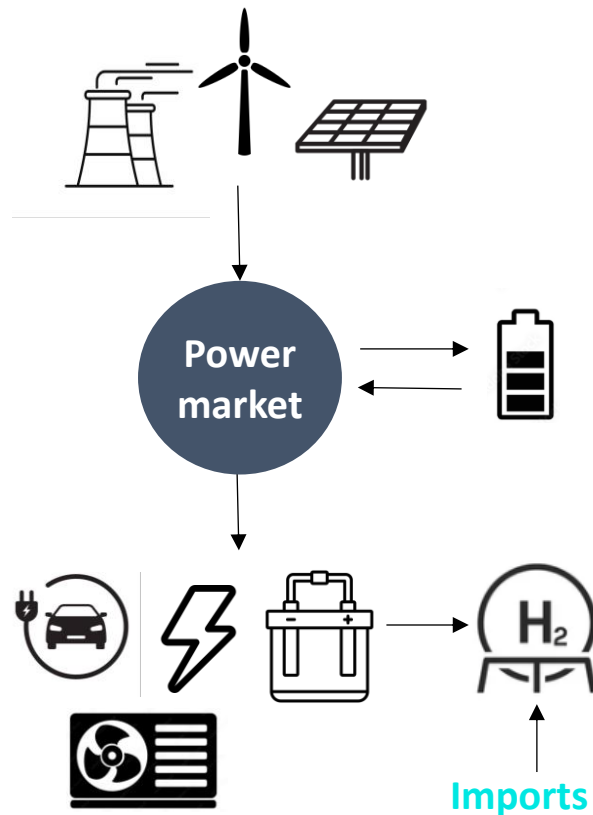
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 864276



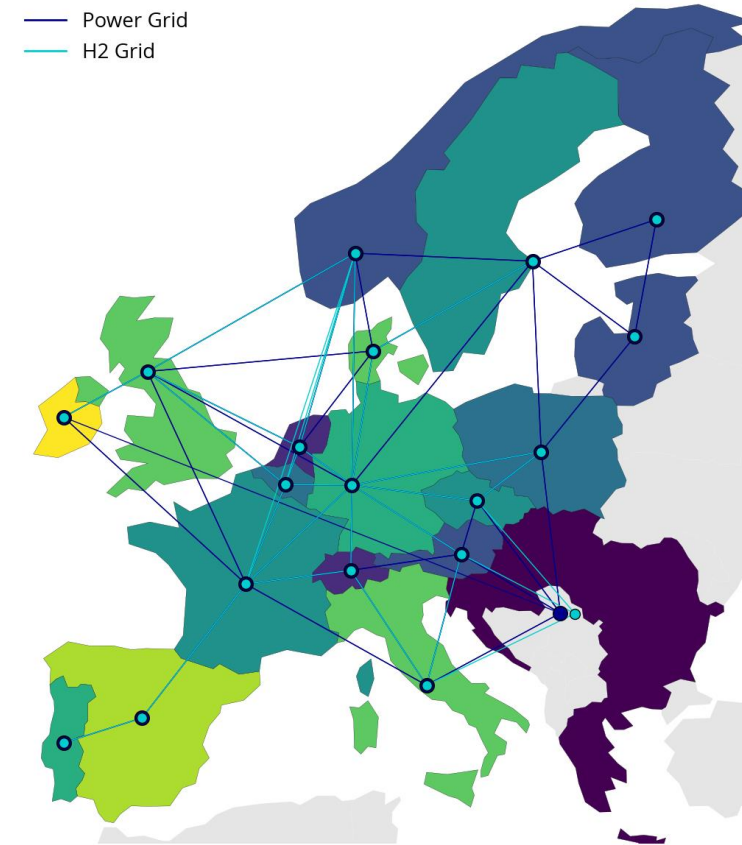
Study on price formation, profits and costs

Sector-coupled energy system optimisation model covers EU27+

Technological scope



Geographical scope

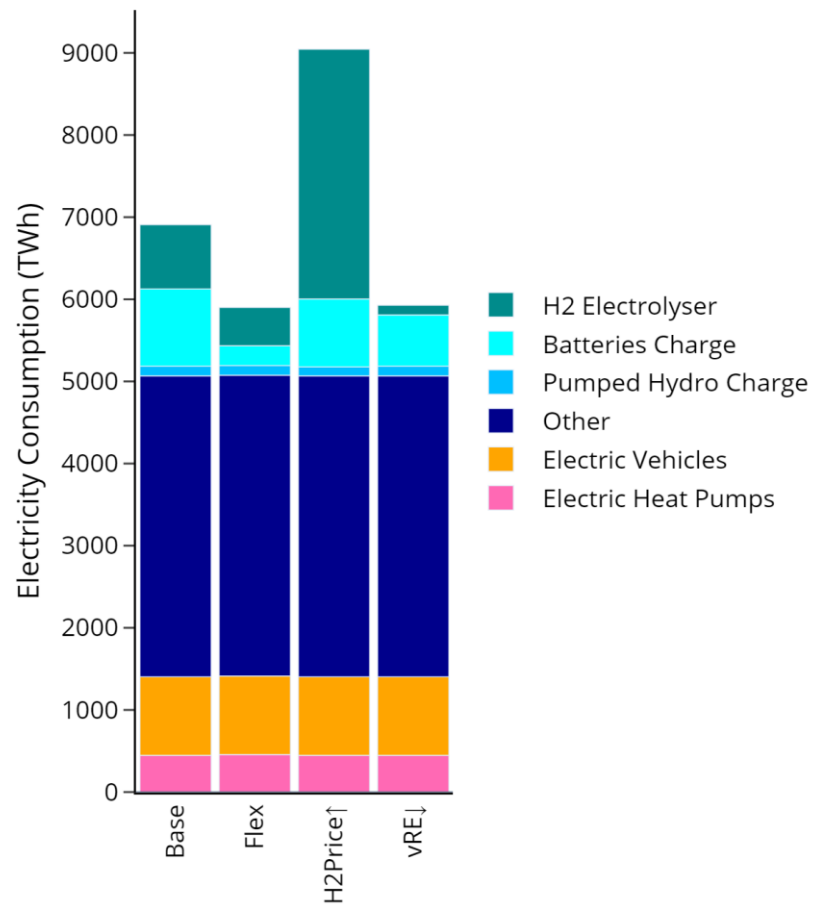
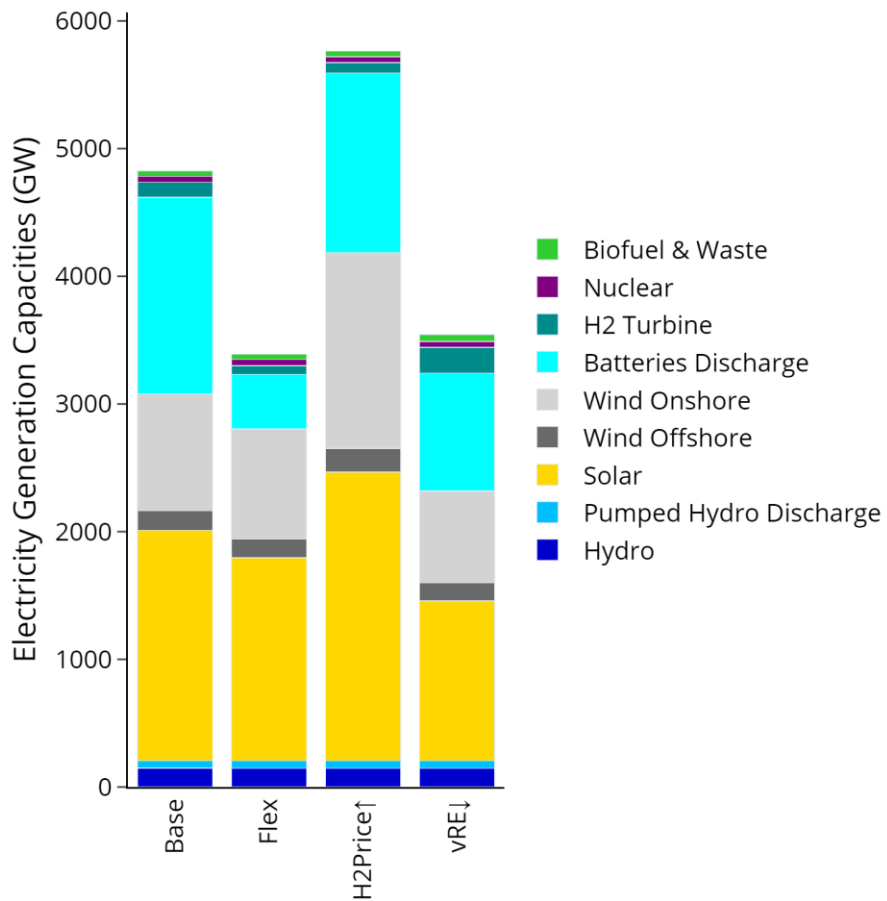


ESM Backbone: Helistö, N. et al. (2019), https://gitlab.vtt.fi/backbone/backbone/-/tree/TradeRES?ref_type=heads
Workflow Manager Spine Toolbox: Kiviluoma, J. et al. (2018), <https://github.com/TradeRES/TradeRES-Backbone-demo>
TradeRES Dataset: Helistö, N., Johanndeiter, S. et al. (2024), <https://zenodo.org/records/10692698>



Study on price formation, profits and costs

Capacities largely driven by H2 import price and flexibility



Base (~S3) scenario characterised by

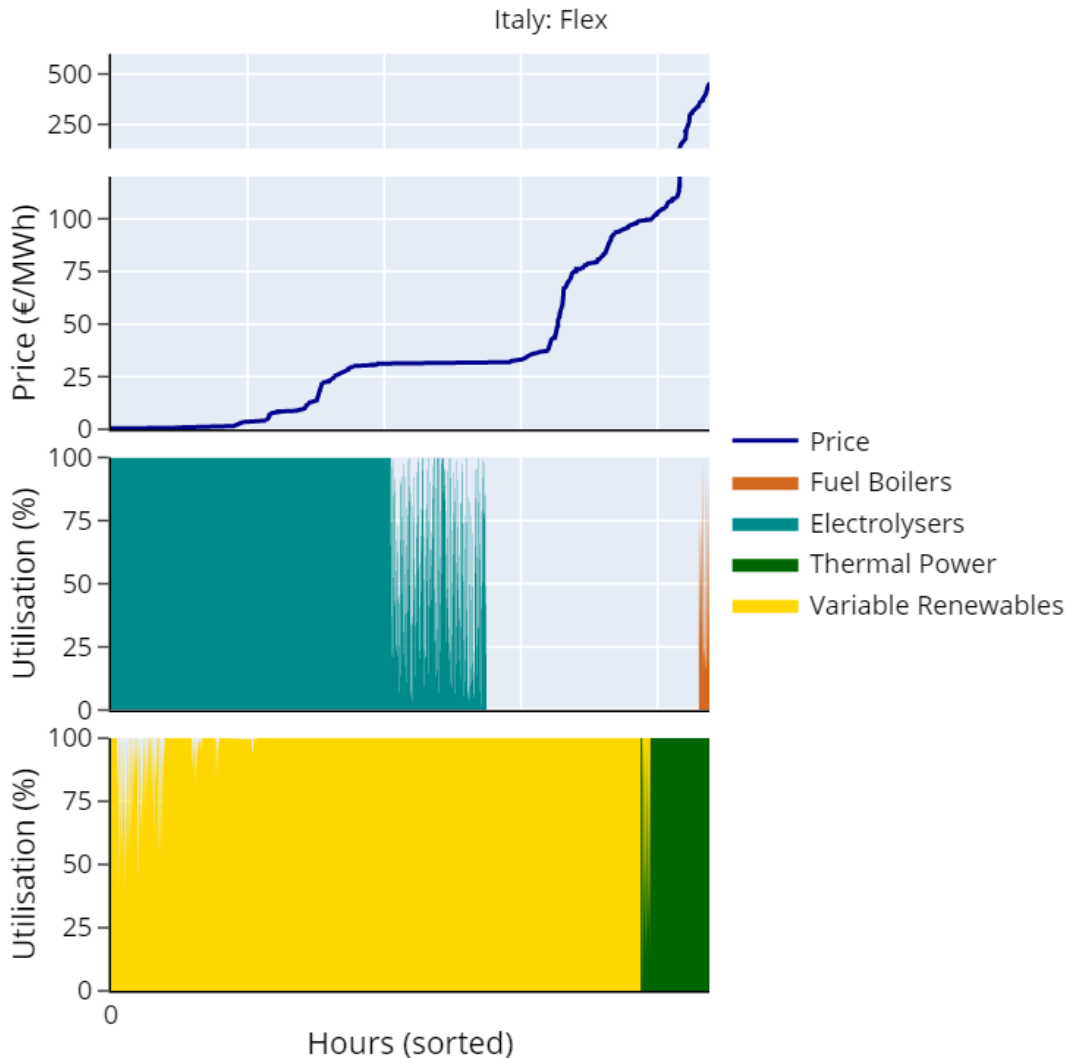
- vRE-share $\geq 95\%$
- Almost no demand-side flexibility
- H₂ price of 45 €/MWh

Scenario variations:

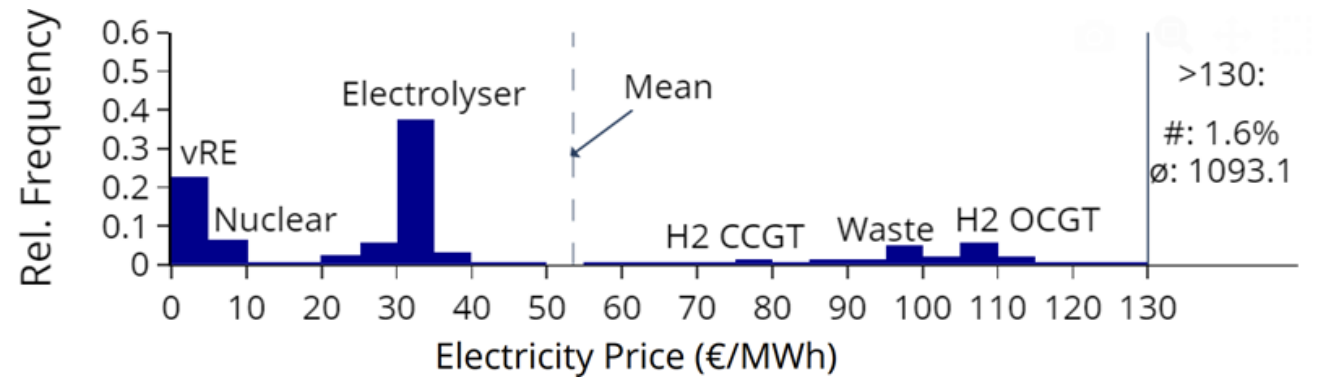
- *Flex*: fully flexible EVs and HPs
- *H2Price↑*: H₂ price of 117 €/MWh
- *vRE↓*: vRE share $\approx 85\%$

Study on price formation, profits and costs

Cross-sectoral demand becomes price-setting in future markets



Distribution of electricity prices in Base scenario





Study on price formation, profits and costs

Volume-weighted average prices highly vary with assumptions

Base
EU Mean: 52.9 €/MWh



Flex
40.0 €/MWh



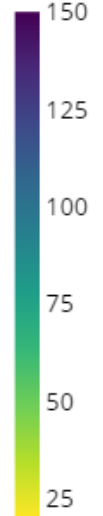
H2Price↑
63.5 €/MWh



vRE↓
74.8 €/MWh



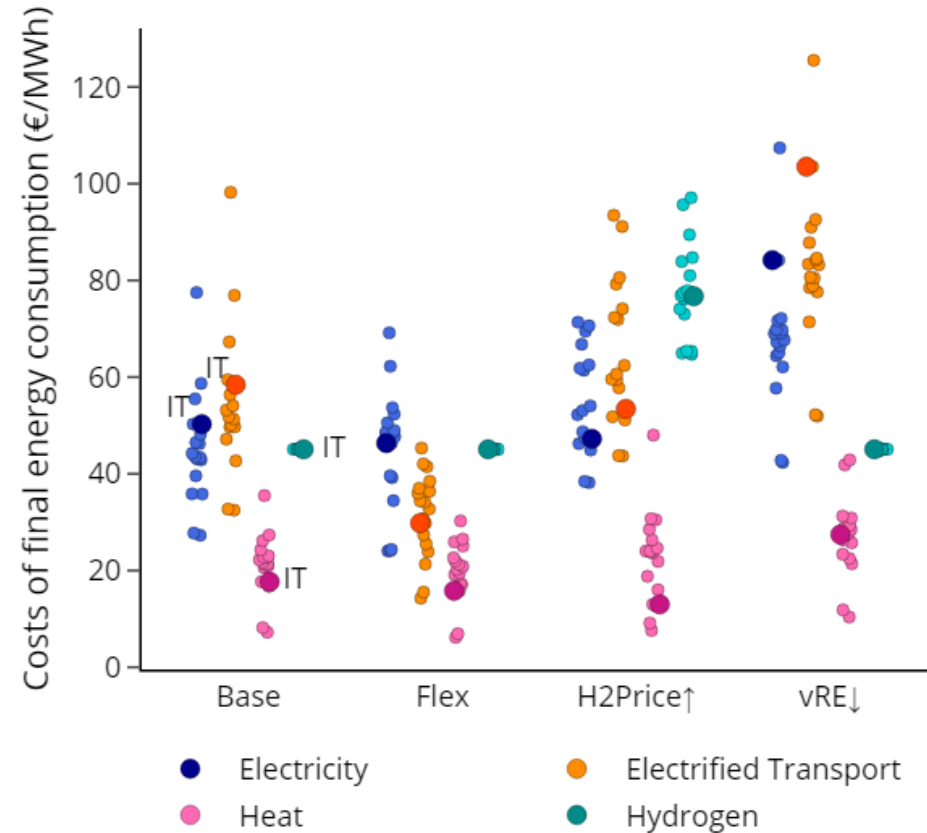
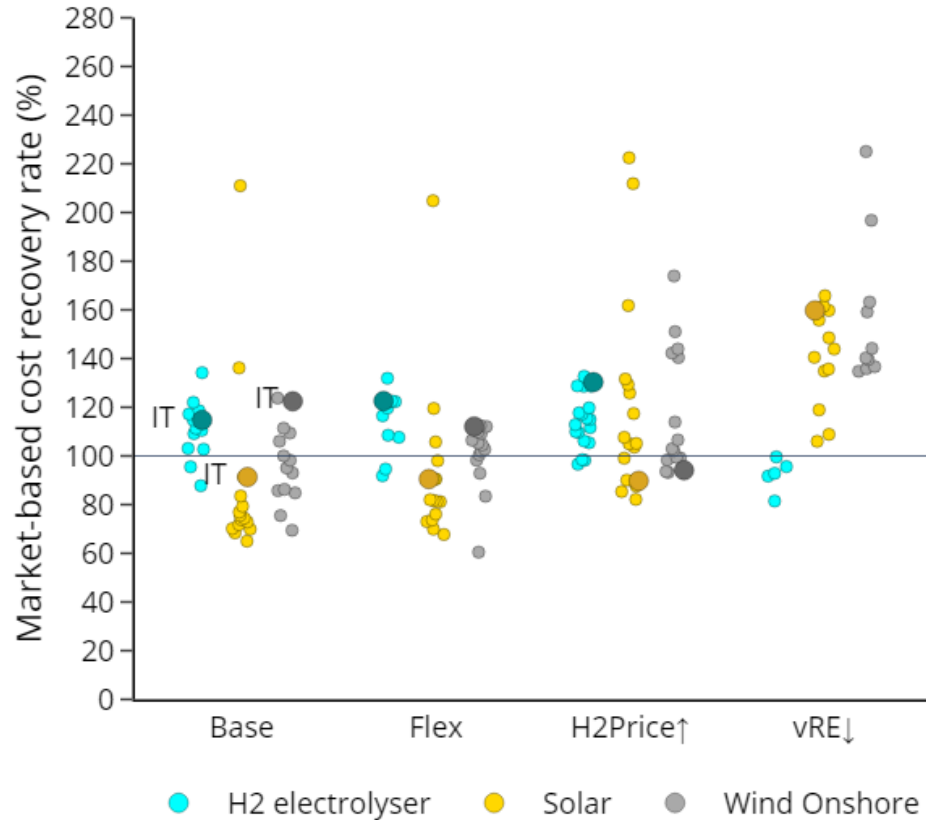
Price (€/MWh)





Study on price formation, profits and costs

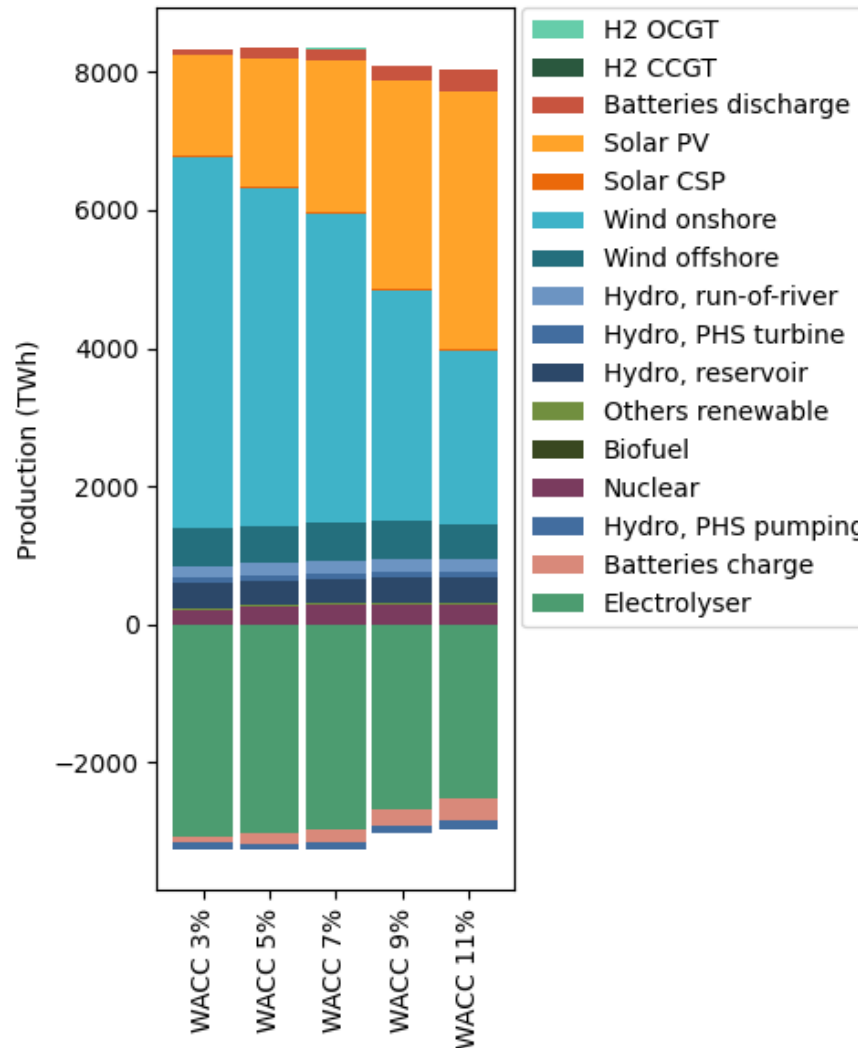
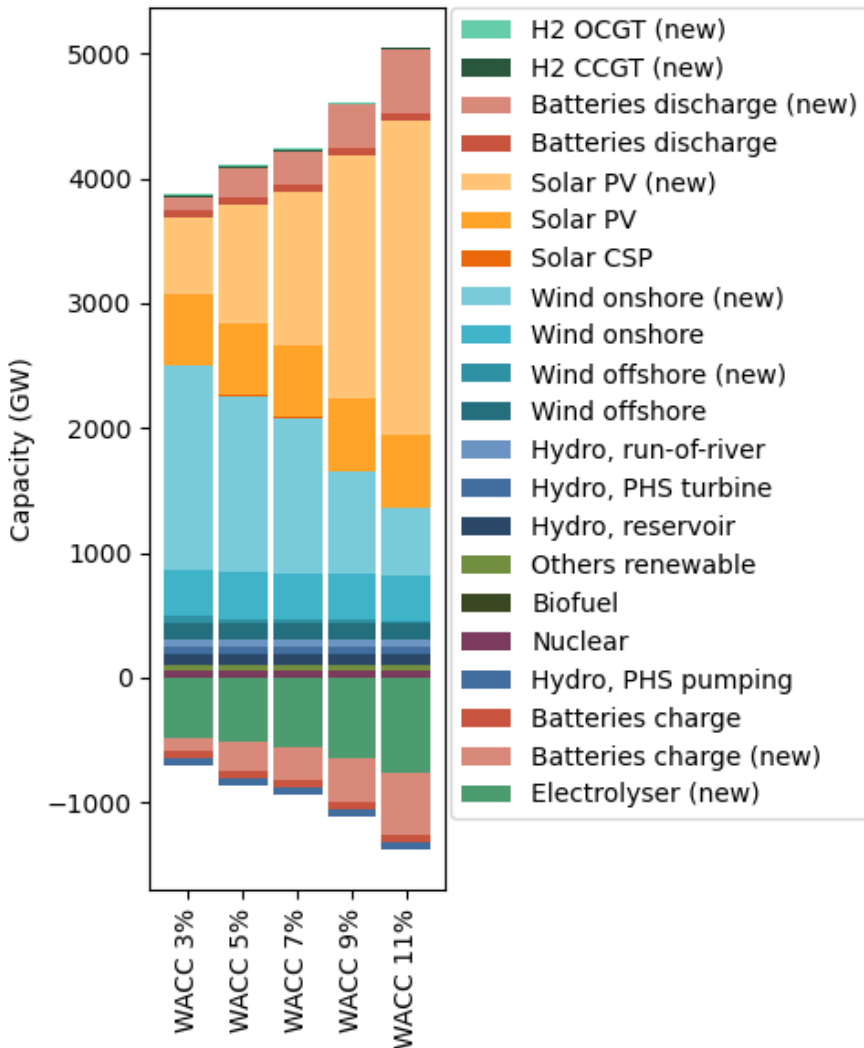
Solar, wind & inflexible electricity consumers exposed to price risks



VRE can be profitable in future markets, yet they are exposed to high revenue risks. Risk can be addressed by instruments such as CfDs that also address consumer price risk.

Study on the impacts of wind power WACC

Lower WACC increased wind power and hydrogen production



Wind power WACC was varied from 3% to 11%

Decreasing the WACC of wind power:

- Increased wind power investments, while decreasing solar PV, battery and electrolyser investments
- Increased electricity production and domestic hydrogen production

WACC: weighted average cost of capital



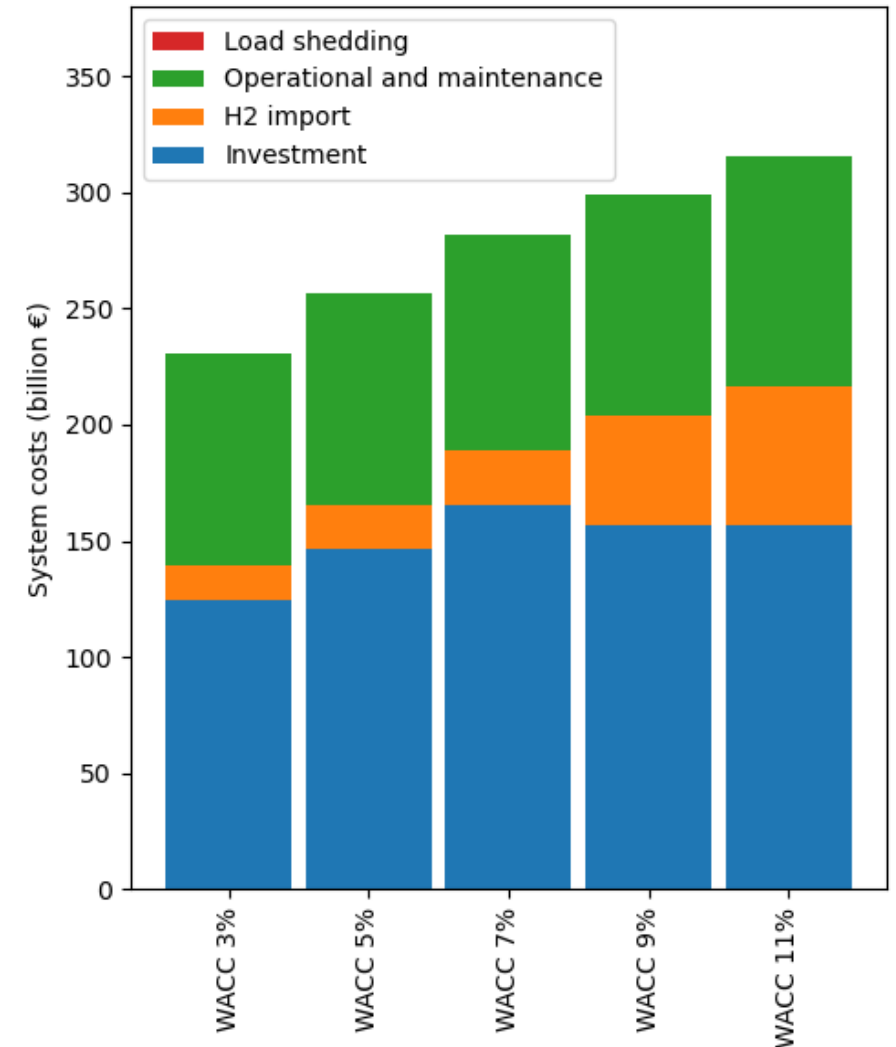
Study on the impacts of wind power WACC

Lower WACC had a huge impact on system costs and fuel imports

Decreasing the WACC of wind power from 11% to 3%:

- Decreased the annual system costs by 27% (84 billion euros)
- Decreased hydrogen import costs by 75% (45 billion euros)

Society has much to gain by keeping financing costs low through risk management mechanisms.





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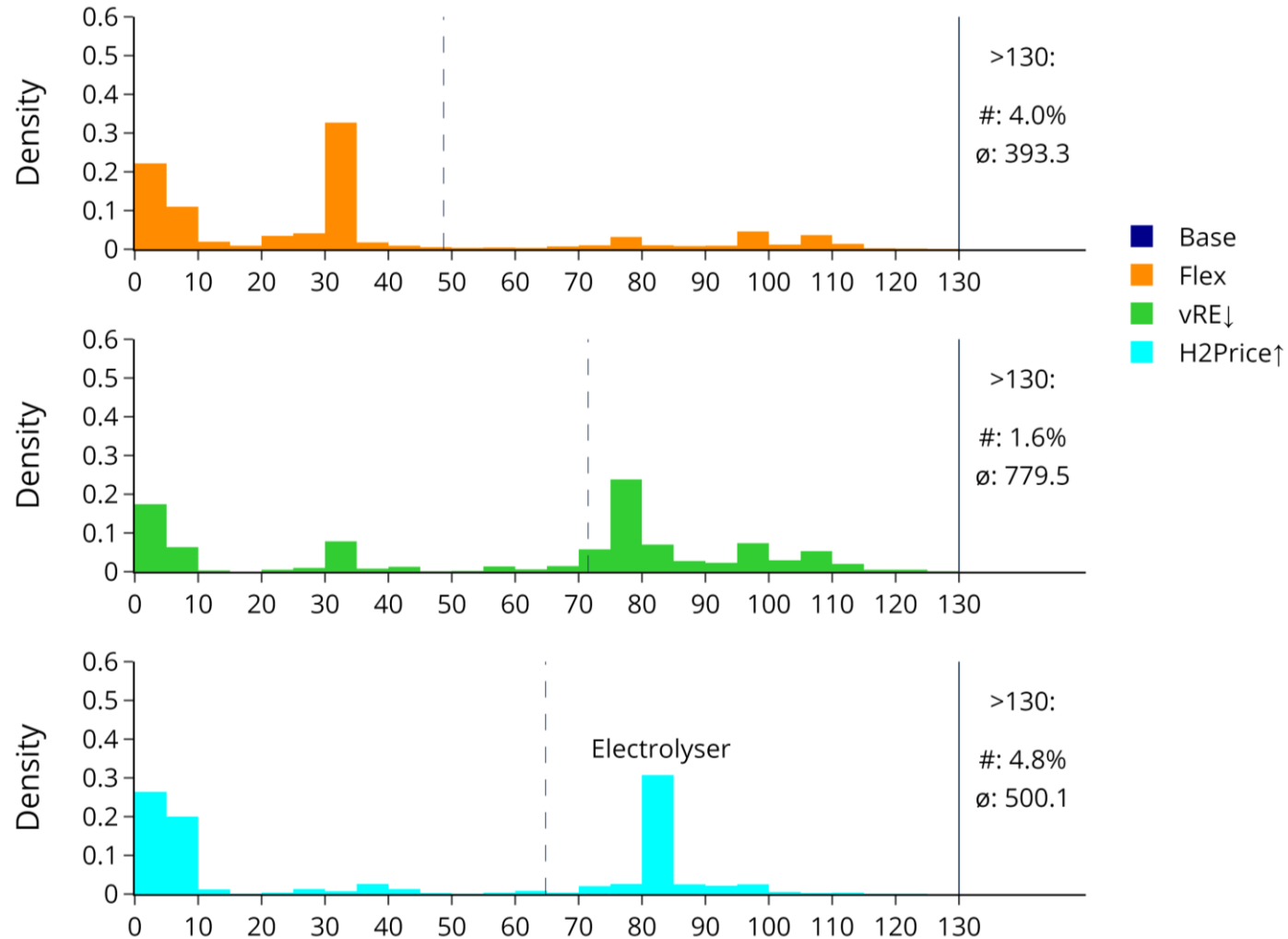


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Study on price formation, profits and costs

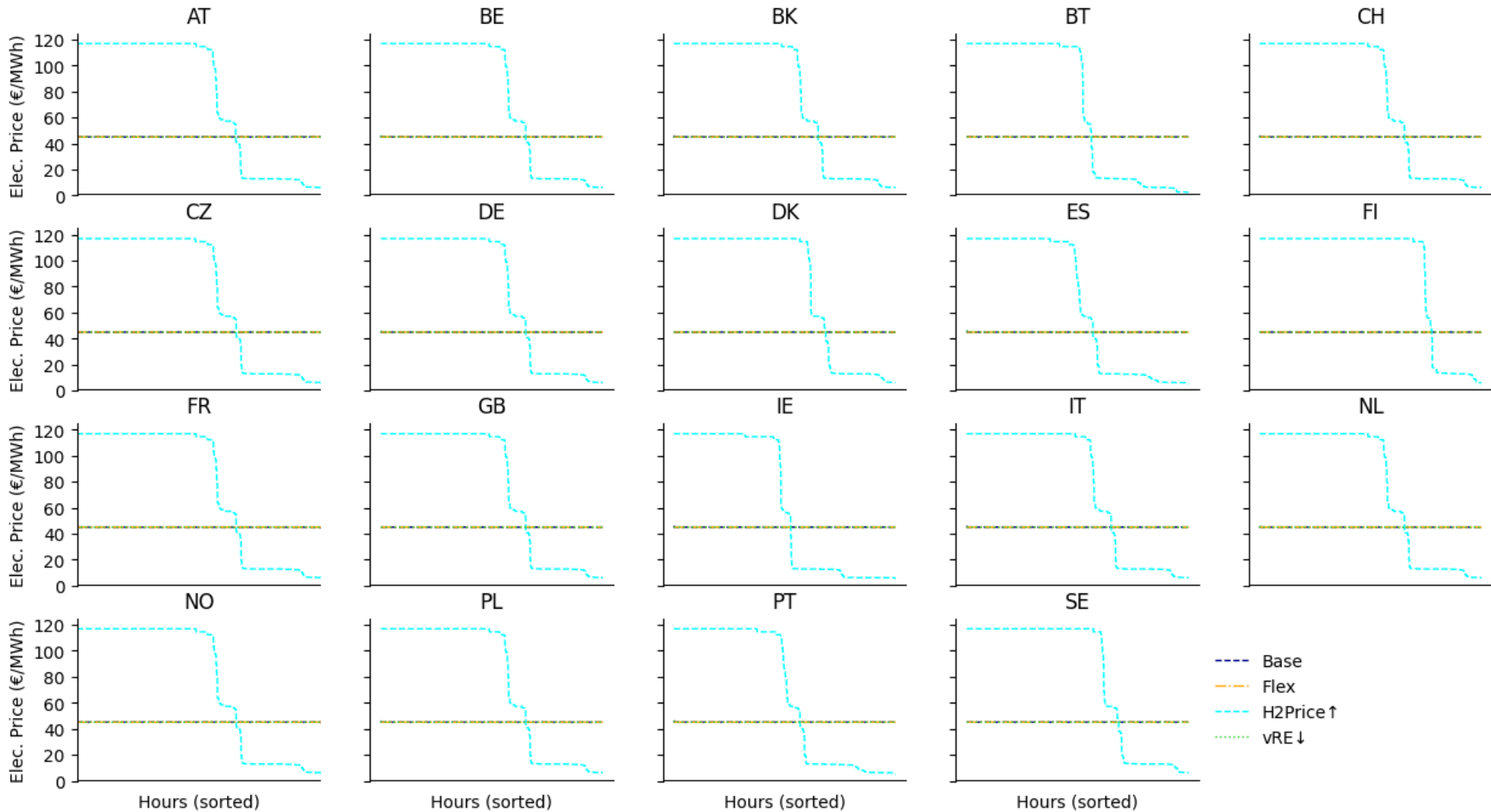
Price-setting technology depends on vRE share and H2 price





Study on price formation, profits and costs

European H2 prices





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