TradeRES

New Markets Design & Models for
100% Renewable Power Systems

Market Designs, Actor Decisions and Market Values: Assessment of Remuneration Mechanisms for Future Electricity System Scenarios

Case Study C of project TradeRES

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

https://traderes.eu

Case Study C: Germany
Research question

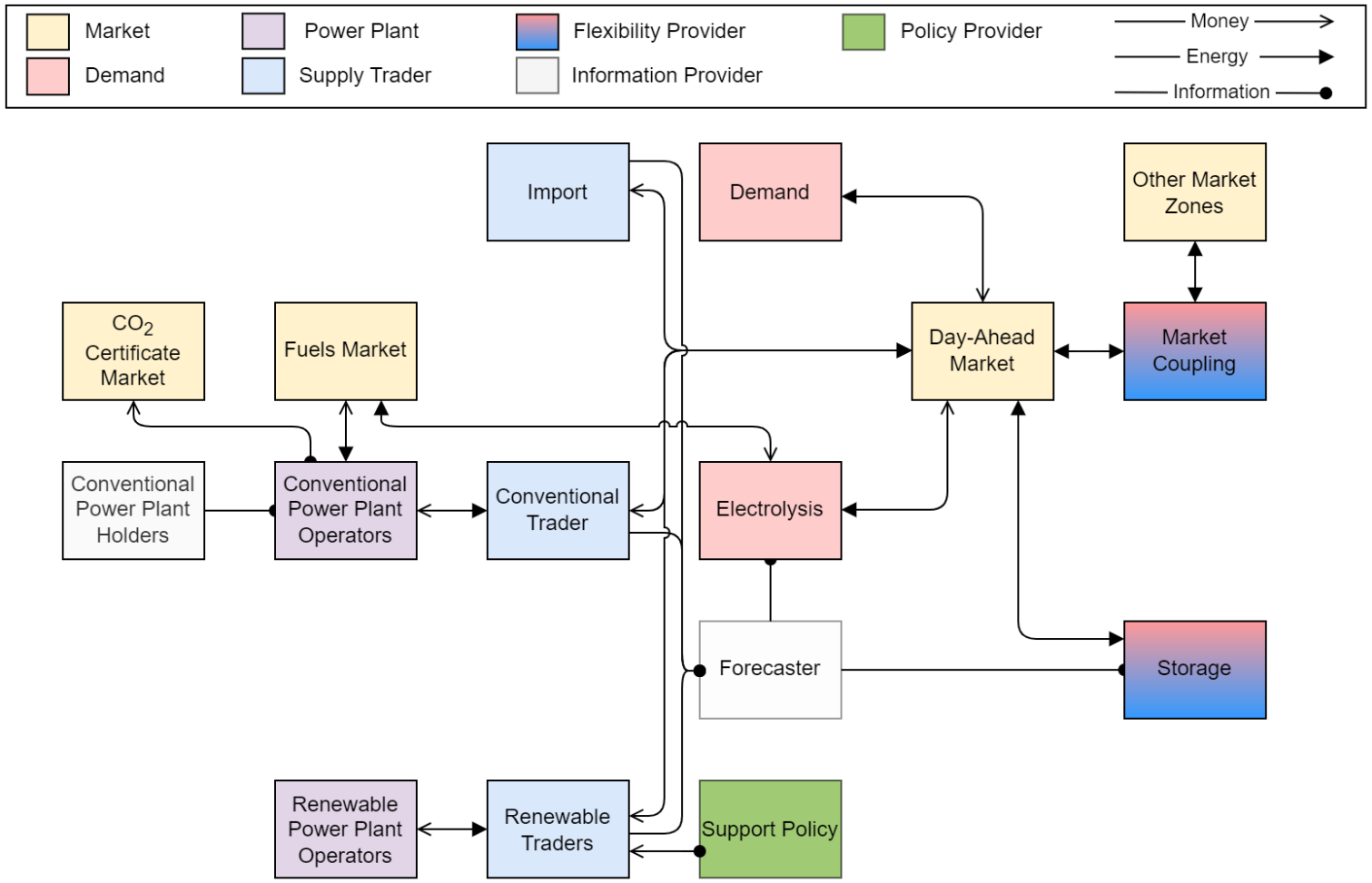
*Are **RES remuneration schemes** needed and if so, how should they be designed?*

Approach

- Dispatch simulation of electricity market
- Vary support instruments
- RES traders consider support instruments in their bid
- Check market performance indicators

AMIRIS

Agent-based **M**arket model for the **I**nvestigation of **R**enewable and **I**ntegrated energy **S**ystems



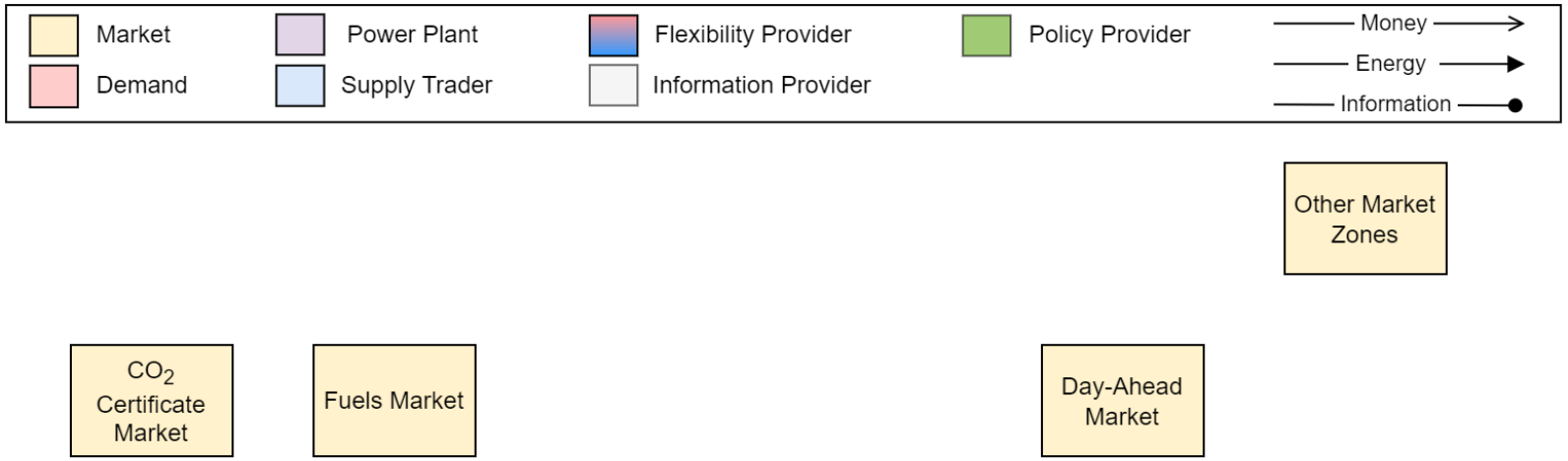
- is an **agent-based** model for the power market
- models **business-oriented,** strategic dispatch decisions
- considers **different regulatory framework conditions**
- is available **open source**

https://dlr-ve.gitlab.io/esy/amiris/home/

AMIRIS
Agent Types

Markets

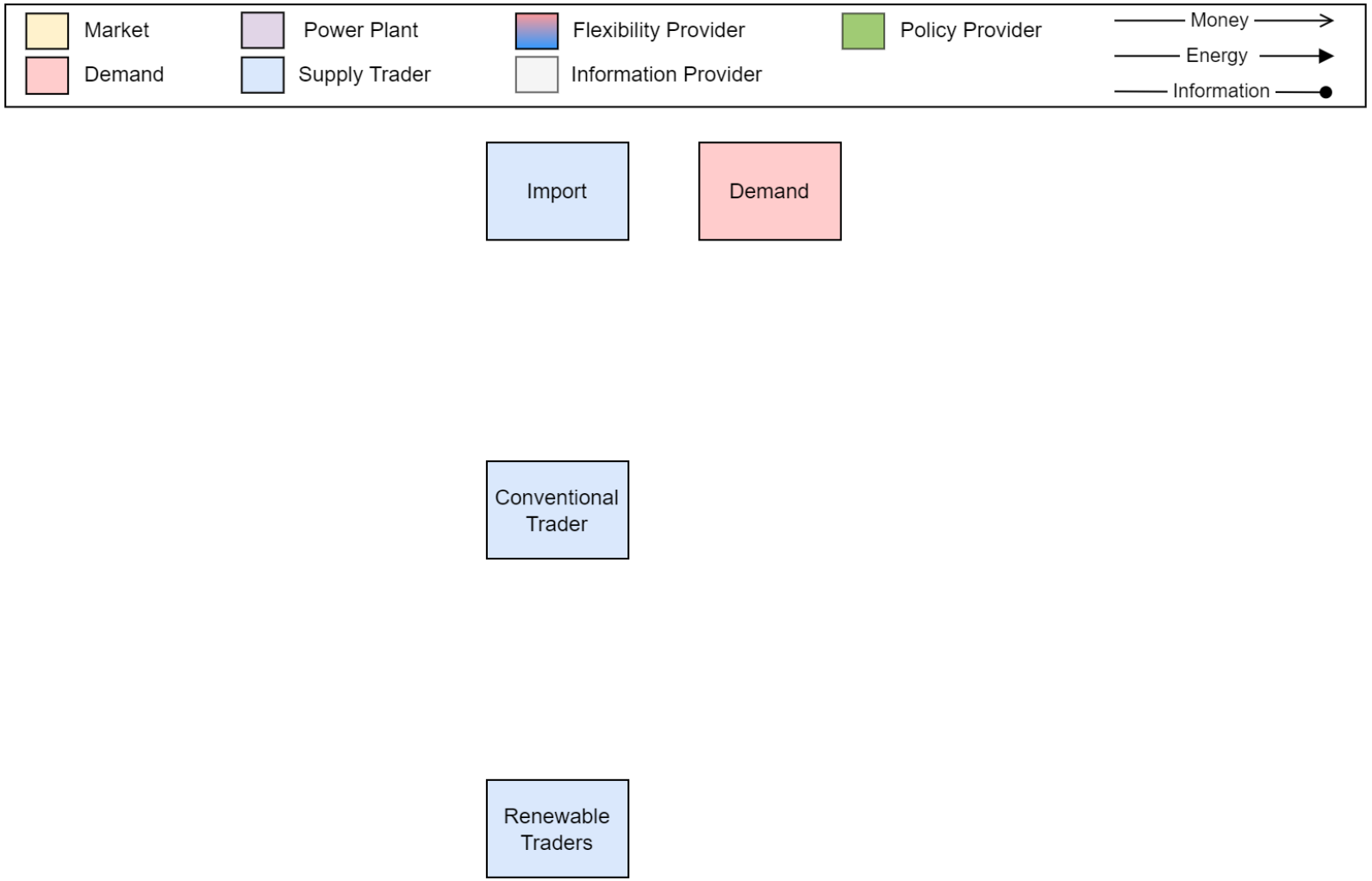
- Determine prices



AMIRIS
Agent Types

Markets
- Determine prices

Traders
- Fulfil marketing strategies



AMIRIS
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Markets
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Plant operators
- Control power plants

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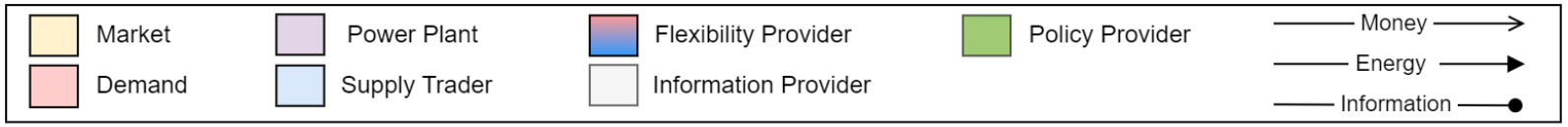
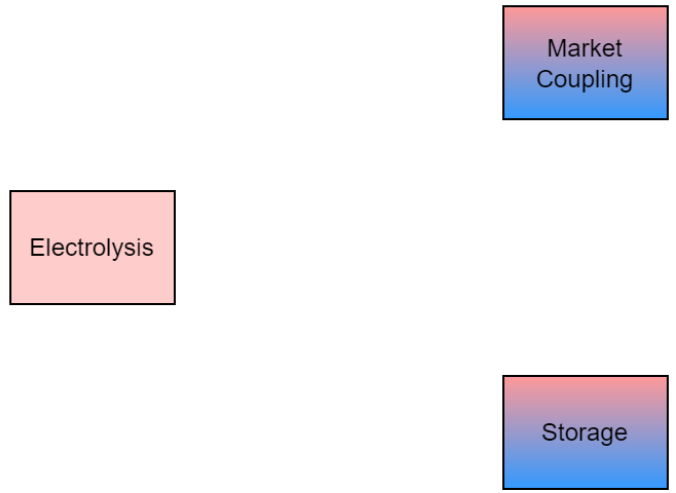
Flexibility providers
- Optimise dispatch





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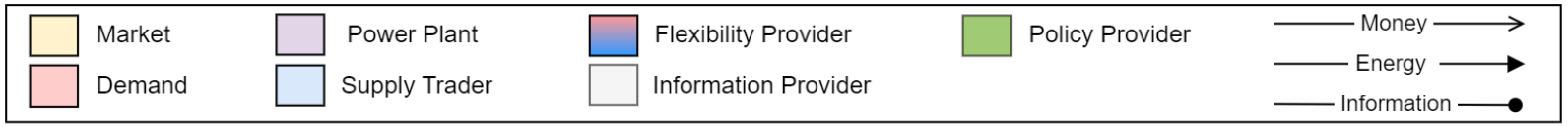

Markets
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Traders
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Plant operators
- Control power plants

Flexibility providers
- Optimise dispatch

Information provider
- Create forecasts

Forecaster

AMIRIS
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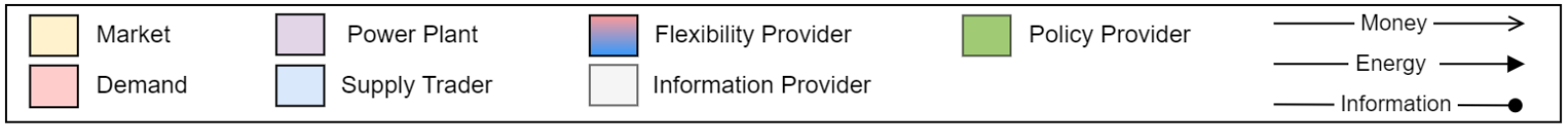

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Information provider
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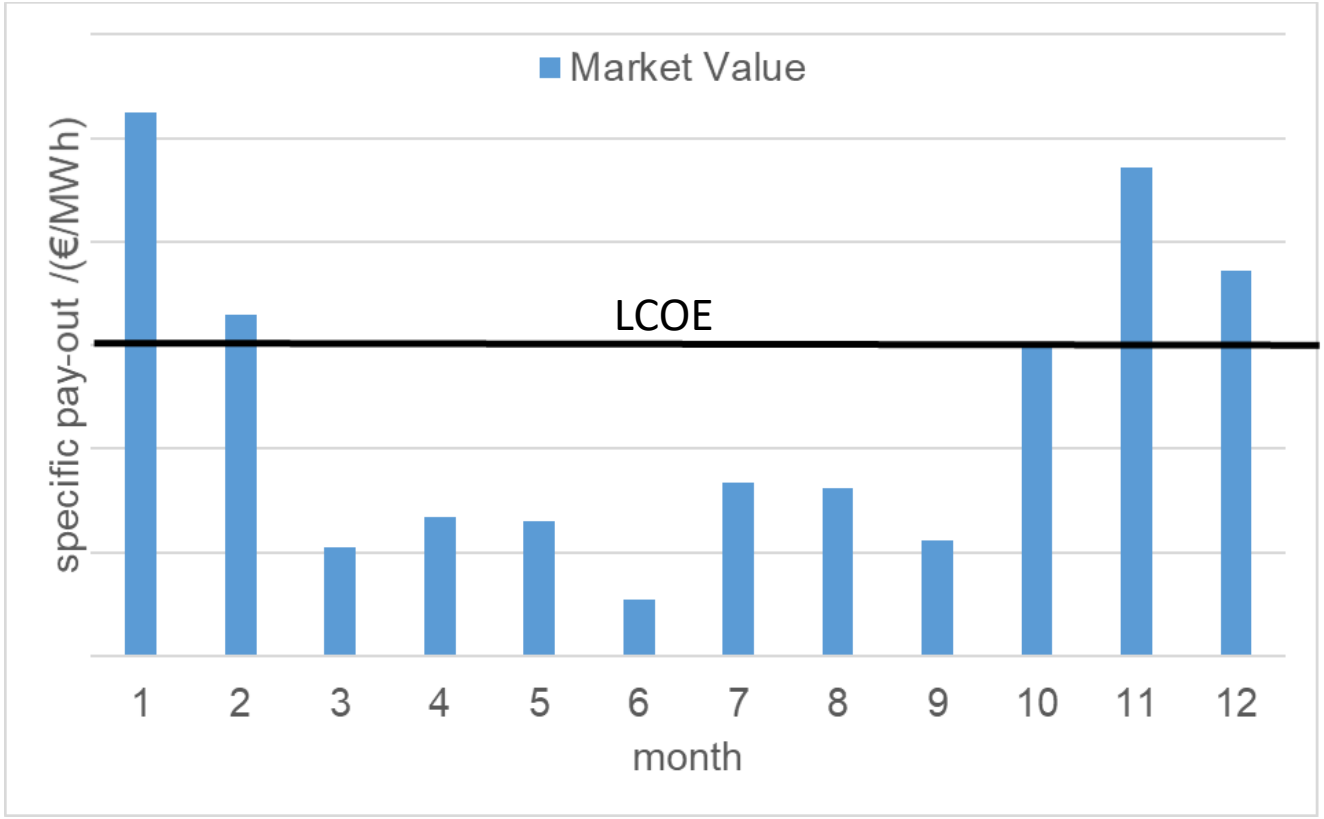
Policy
- Provide support

German Case Study
Research design

Analysed support instruments

- "**NONE**": no support



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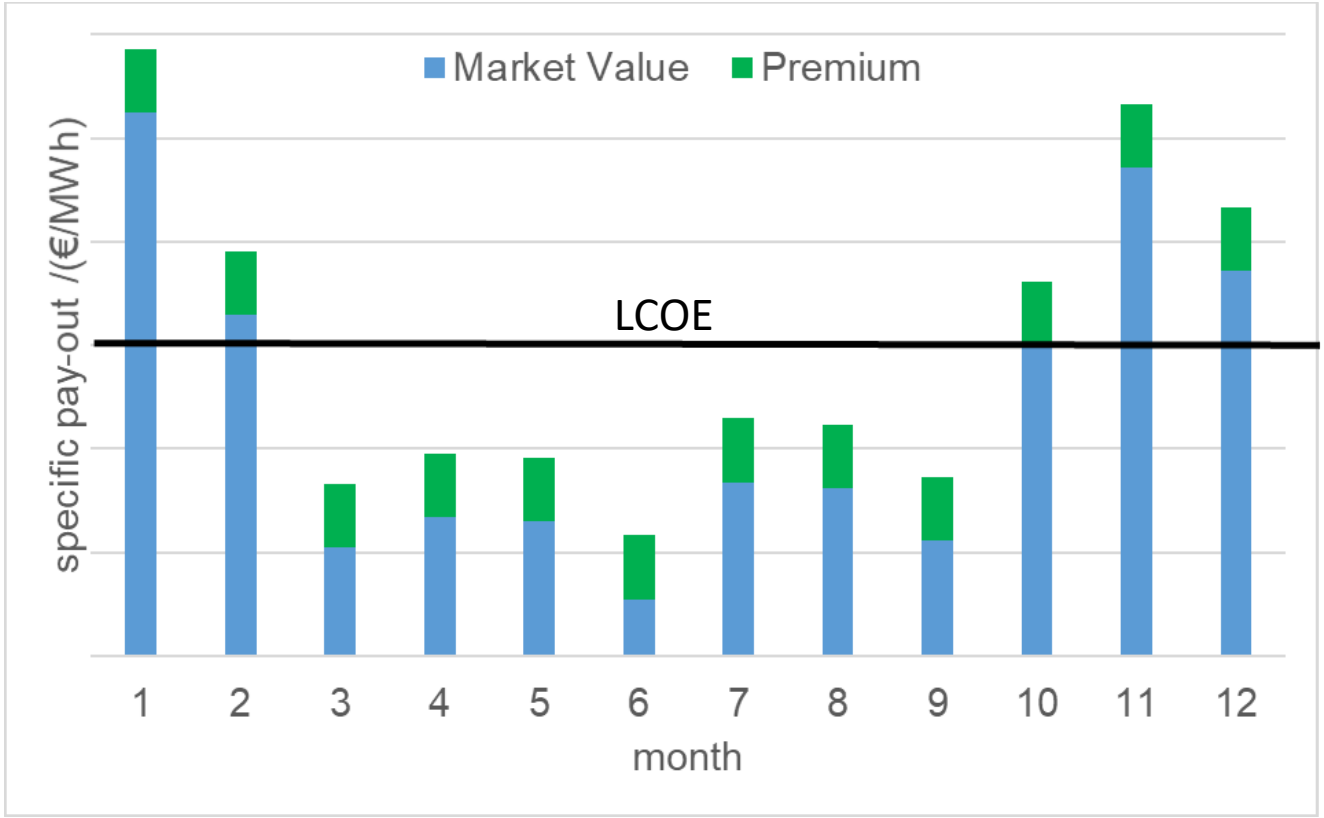
Analysed support instruments

- "**NONE**": no support
- "**MPFIX**": fixed market premium (ex ante)



→ **Support instruments influence bidding behaviour**

German Case Study
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Analysed support instruments

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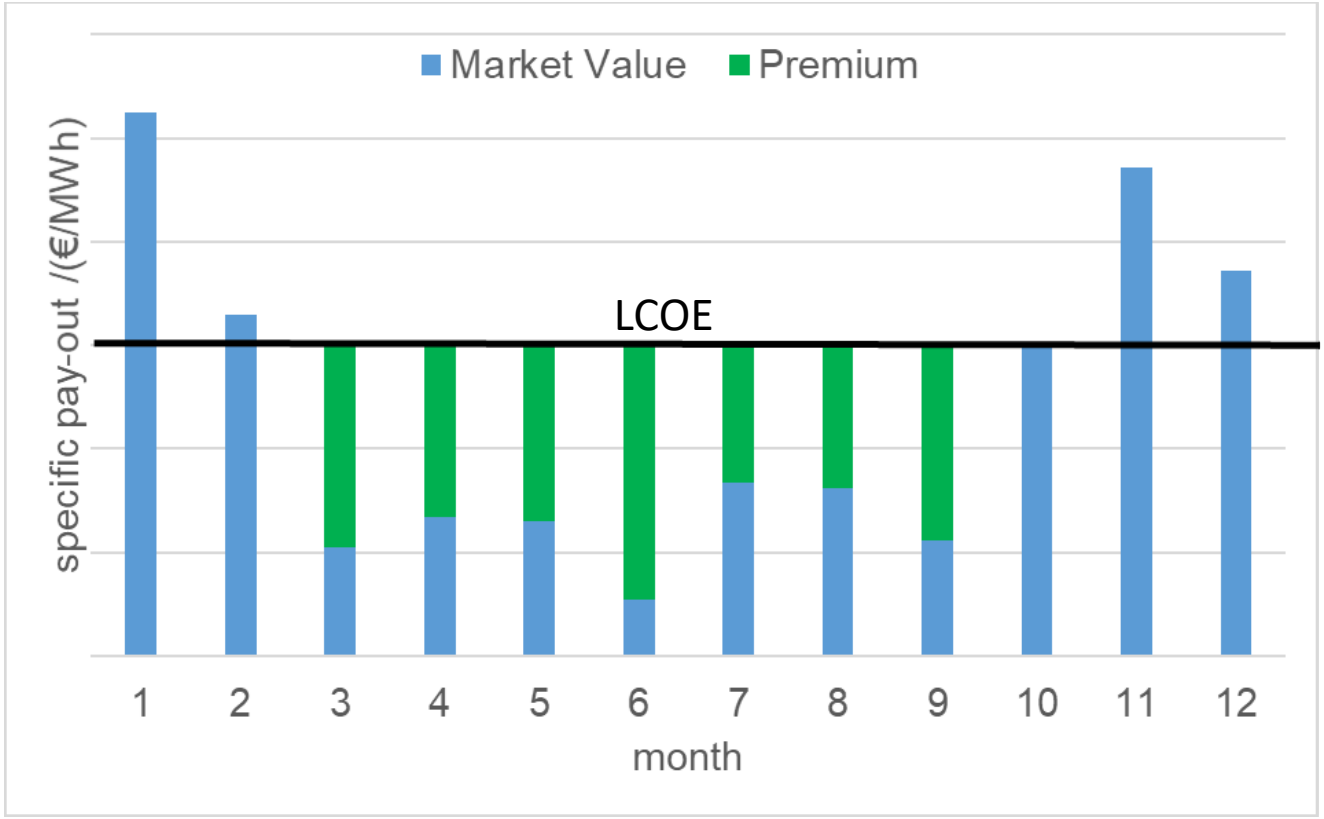

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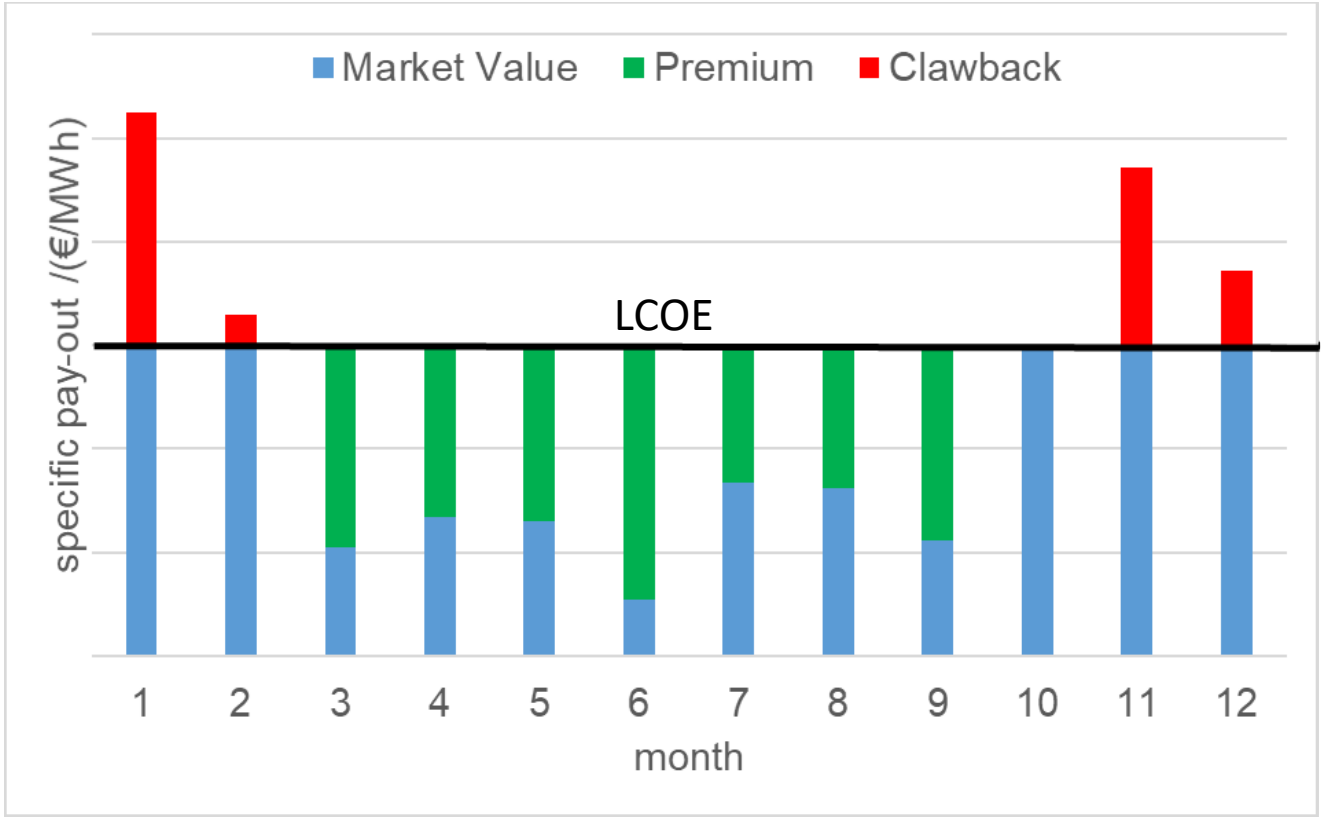

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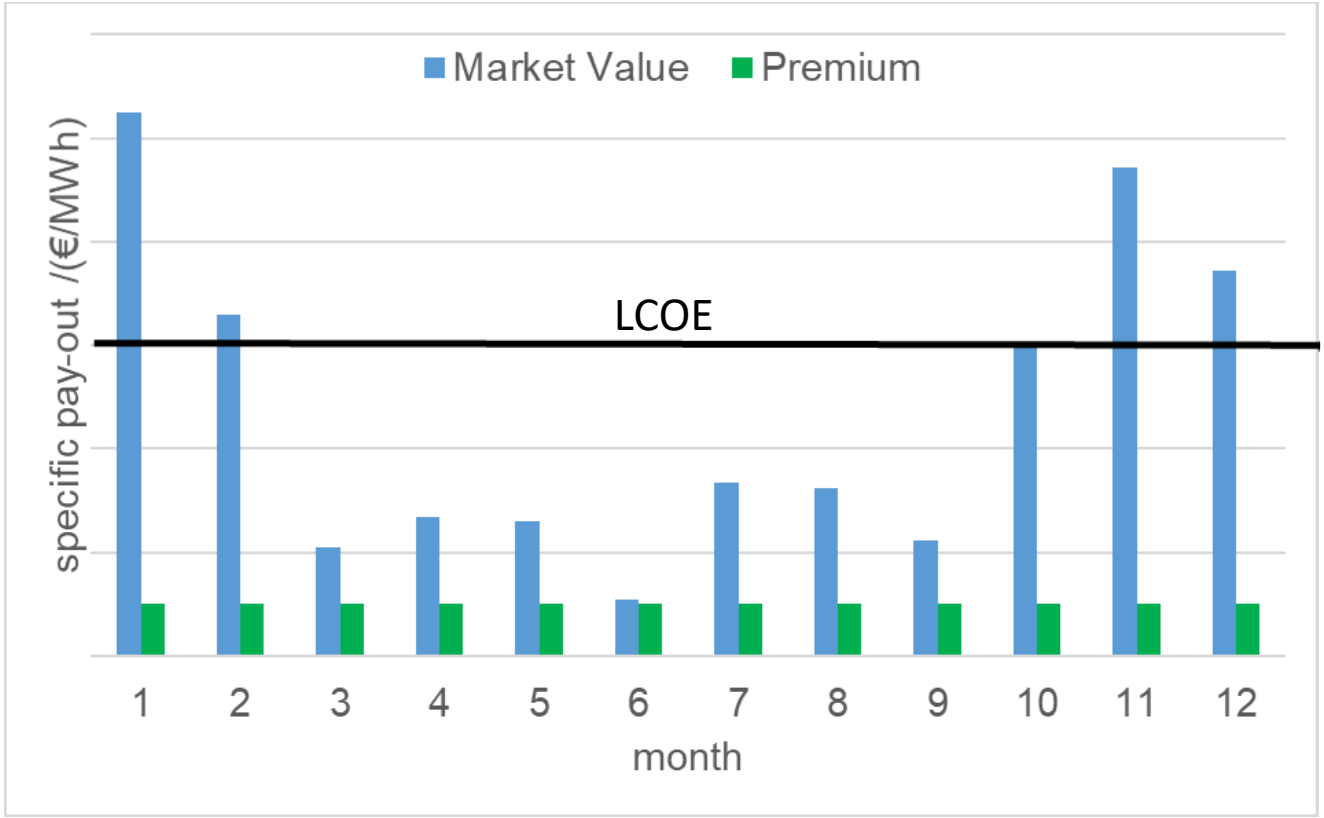
- "**CP**": fixed capacity premium



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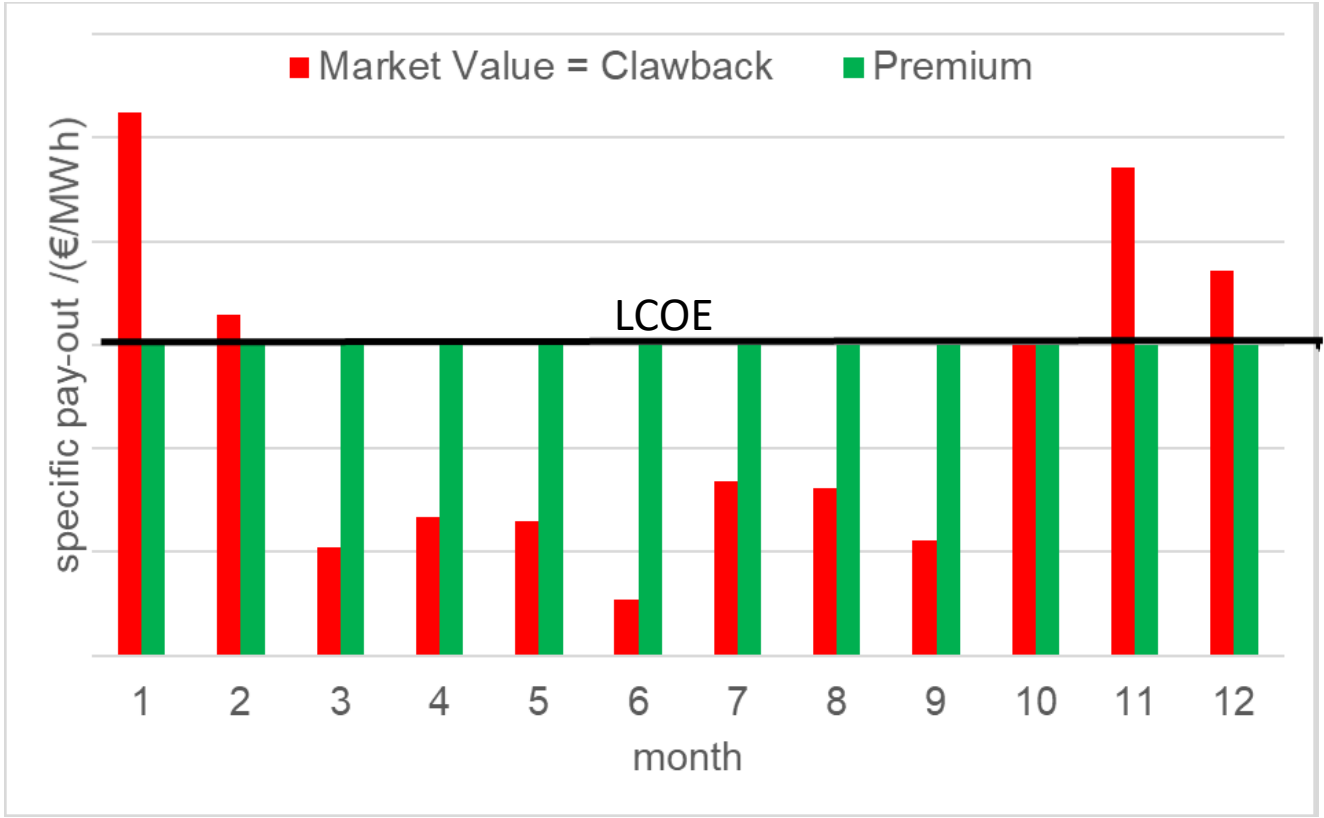
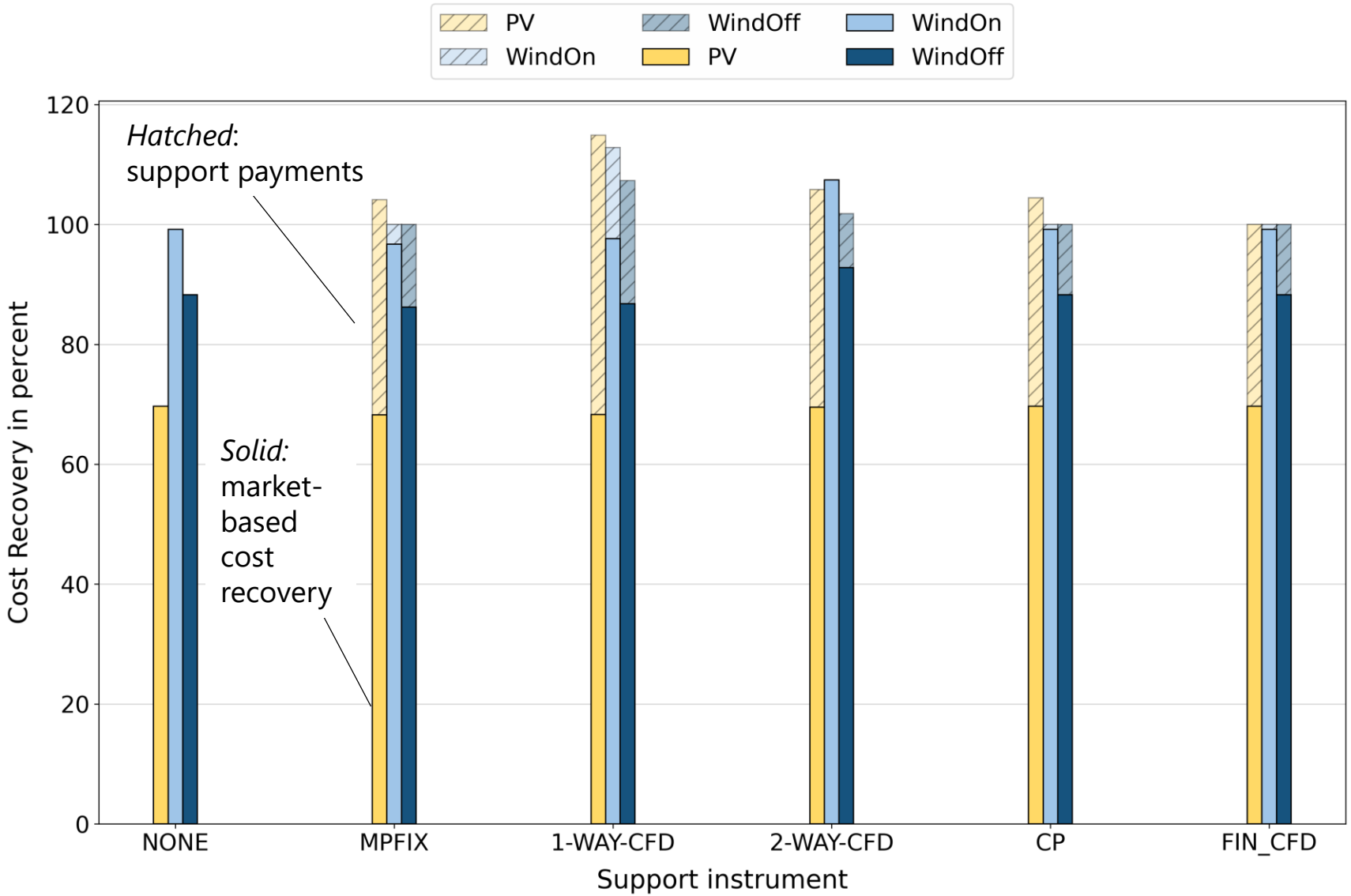
- "**CP**": fixed capacity premium
- "**FIN_CFD**": Financial CfD, as suggested by Schlecht et al. (2023) with country average as reference plant



→ **Support instruments influence bidding behaviour**

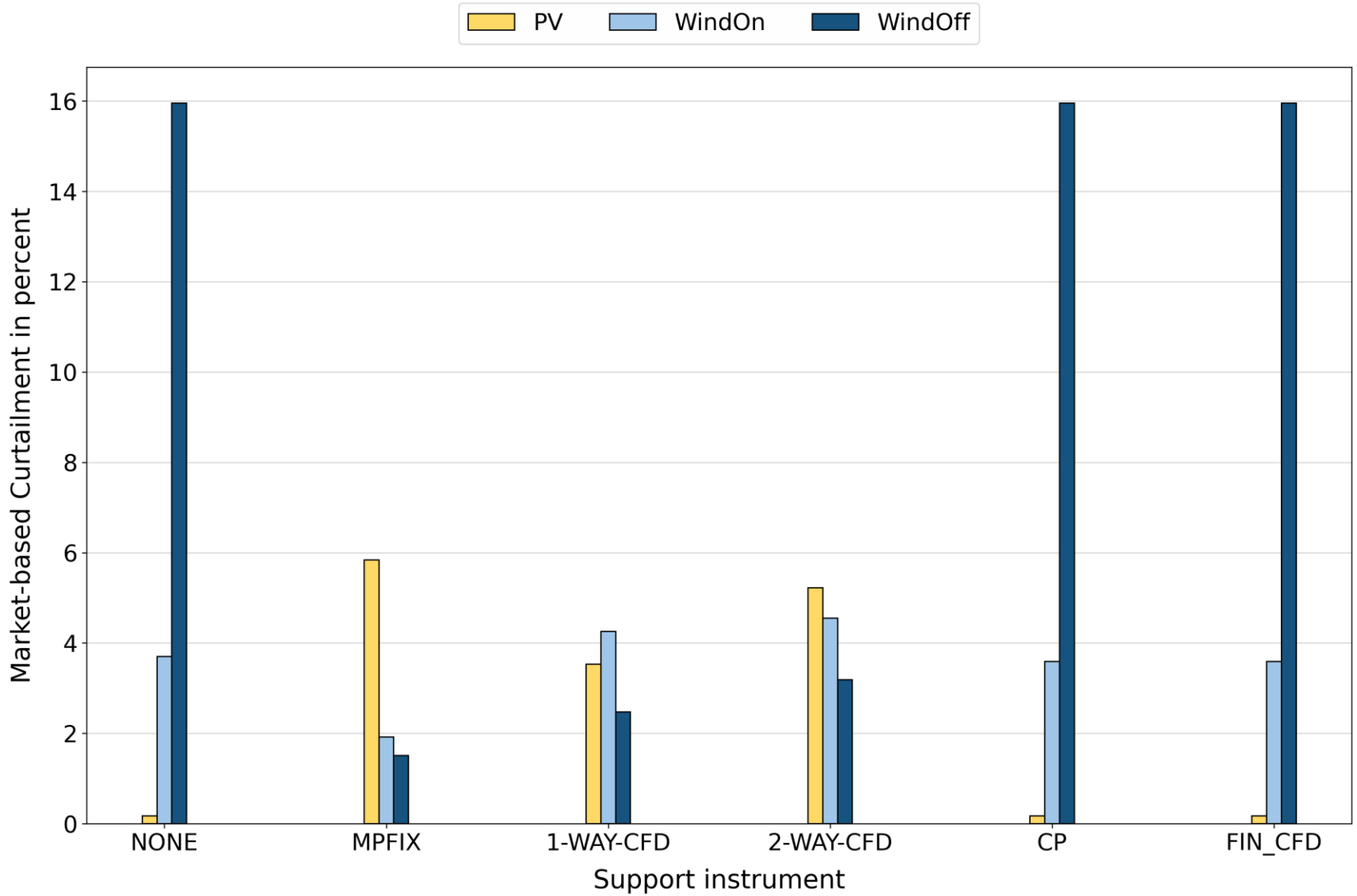
Cost recovery rates for vRES
Scenario S1



- No market-based refinancing for **rooftop PV** in any case
- **Wind** can (almost) recover costs on the market
- **1-WAY-CFD** and **2-WAY-CFD**: additional support payments during months with insufficient market incomes
- **2-WAY-CFD**: higher prices due to negative premia in clawback periods and corresponding bidding / curtailment
- **Refinancing with support**: *ideally parameterized* market designs

Market-based curtailment of vRES

Scenario S1



Offshore wind

Highest variable costs among considered vRES technologies

→ Heavy **curtailment** for NONE, CP and FIN_CFD (no dispatch distortions)

MPFIX & CFD

Bids & merit order impacted by expected premium payments

→ **Displacement** of PV by offshore wind

Summary and conclusion

- Support instruments are likely required to *de-risk RES investments*
  - Especially for rooftop-PV
- 2-WAY-CFD tends to
  - Increase market-based cost recovery
  - Increase market prices
  - Increase curtailment

- Results are *highly sensitive* with regard to scenario assumptions
  - Flexibility stabilizes market values for RES

Try AMIRIS yourself