Comparison of Support Schemes for Renewables – German Case Study

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Project TradeRES

Objectives

- Develop electricity market designs for ~100% renewable power systems,
- Model and simulate new market agents, procedures and mechanisms,
- Develop open-access tools to analyse ~100% renewable electricity markets
- Engage stakeholders in the improvement and use of market simulation tools

Models

- Optimisation: Backbone, COMPETES
- Agent-based: AMIRIS, EMLabpy, MASCEM, RESTrade

Energy Market Case Studies

https://traderes.eu/

- Local
- National: Netherlands, Germany, MIBEL
- Pan-European

German Case Study
Dispatch Simulation

AMIRIS: *open **A**gent-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** at https://gitlab.com/dlr-ve/esy/amiris

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

AMIRIS

Markets
- Determine prices

Plant operators
- Control power plants

Traders
- Fulfil marketing strategies

Flexibility providers
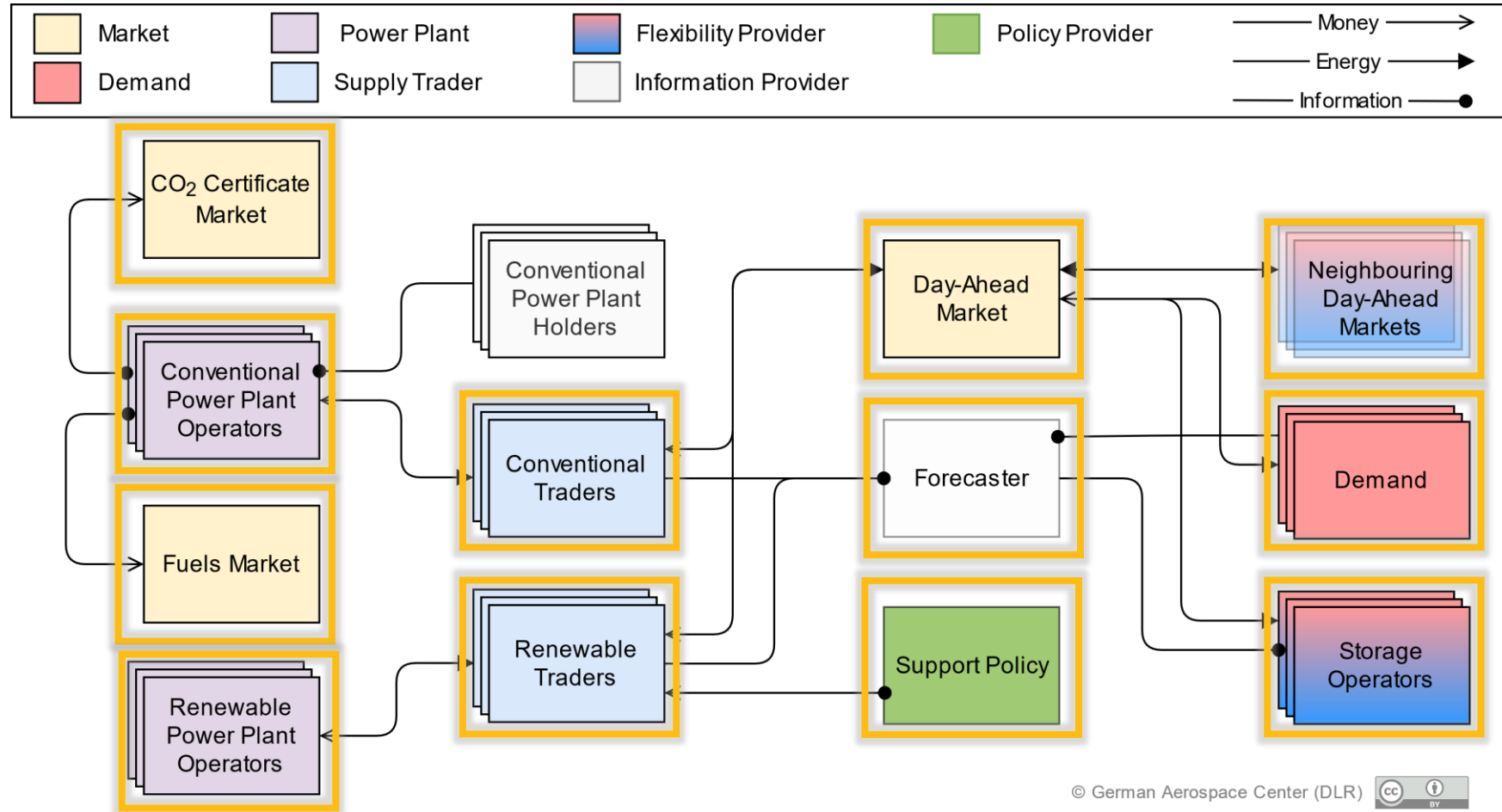- Optimise dispatch

Information provider
- Create forecasts

Policy
- Provide support

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→ More details: See yesterday's skill workshop on AMIRIS

German Case Study
Research Question

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

Approach

- Dispatch simulation with AMIRIS

- Considering different support policies

- Compare market performance indicators

German Case Study
Research design

Analysed support instruments

- "**None**": no support

- "**MPFIX**": fixed market premium (ex ante)

- "**MPVAR**": variable market premium (ex post) with a monthly reference period

- "**CFD**": two-way Contracts for Differences as extension to the market premium (ex post) with a monthly reference period

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

- "**Financial CFD**": Financial CfD, as suggested by Schlecht et al. (2023) with country average as reference plant

Parameterization

Premia design

Iteratively adjusted, such that each RES technology finances their total costs within a 0.1% tolerance band

Scenario

Scenario data from Backbone

Preliminary results

Preliminary result
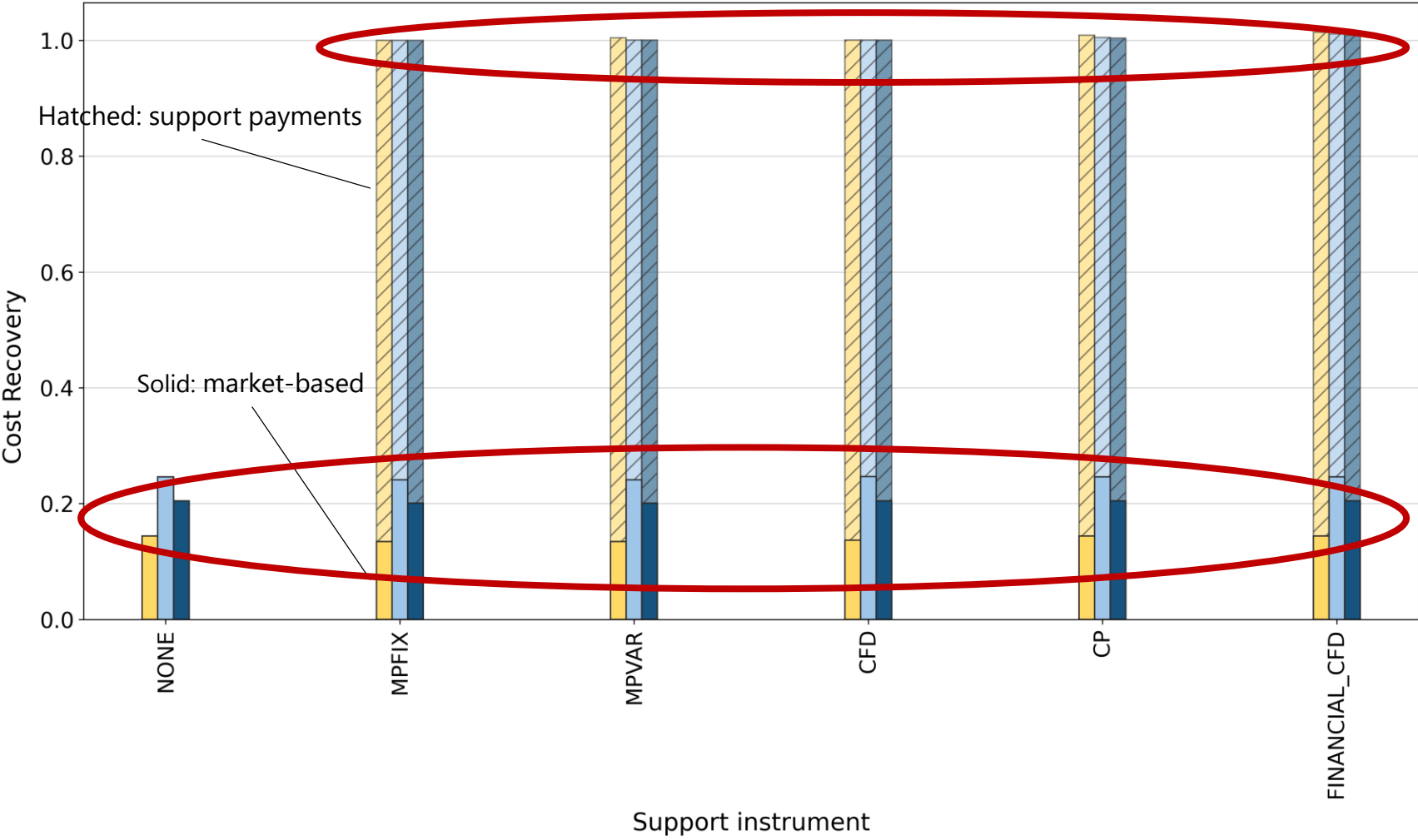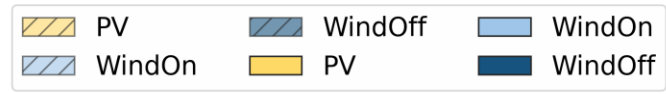
- *No market-based refinancing* in any case

- Refinancing with support: *ideally parameterized* (!) market designs

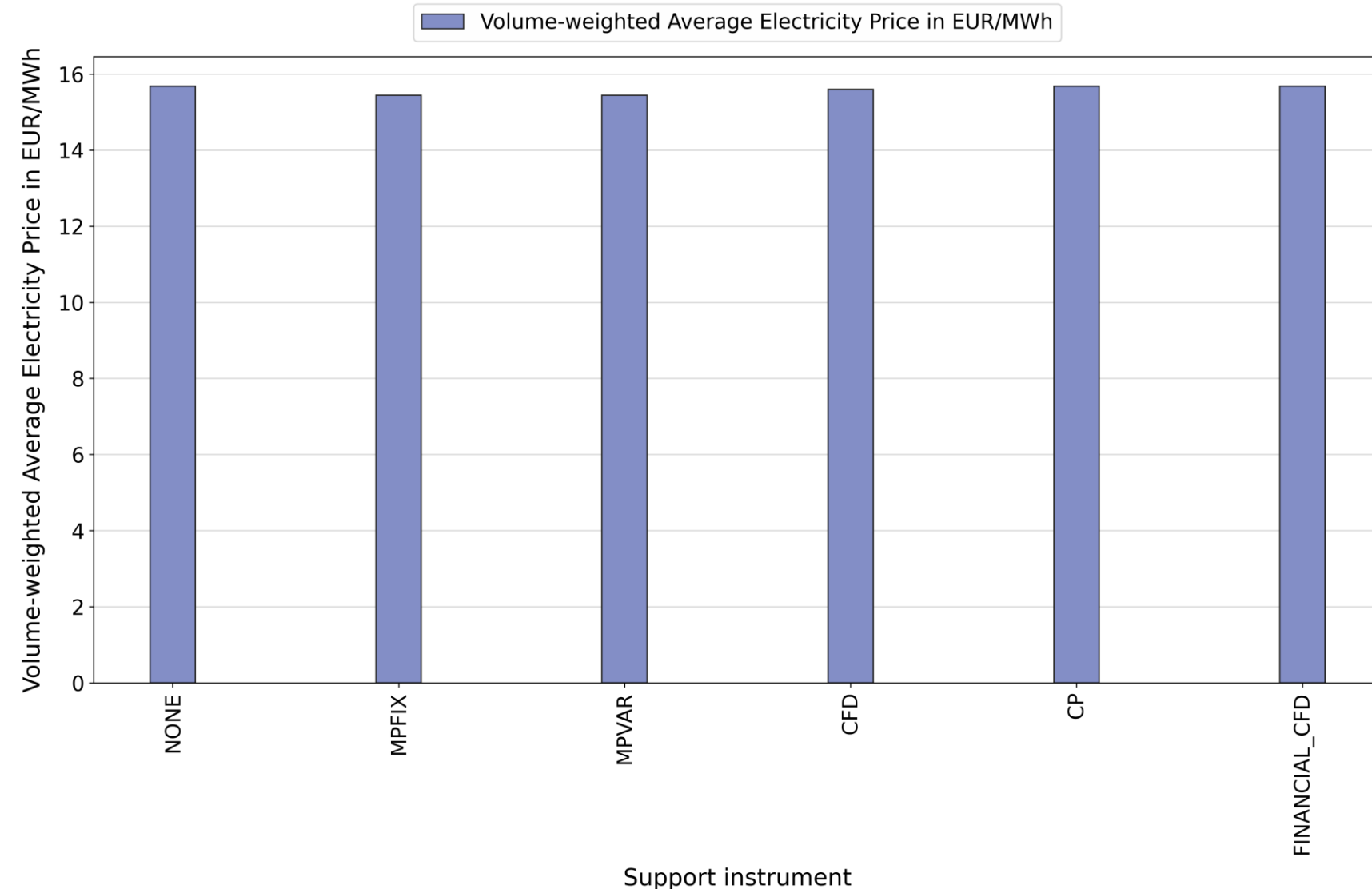# **Market performance**
Average electricity prices

- *Quite low*
- *Stable* across instruments

Causes

- *Flexibility* scheduled according to optimizer
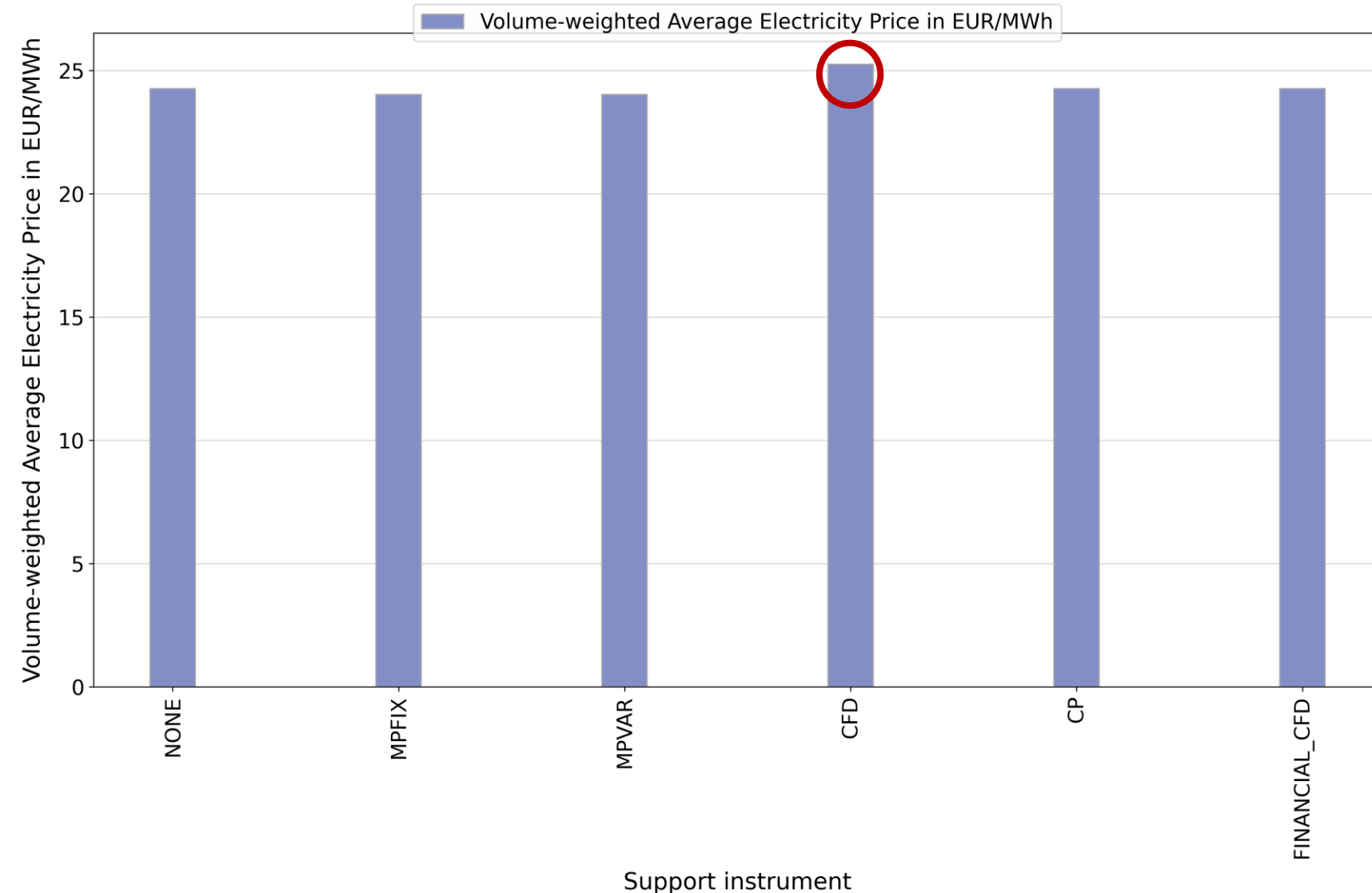- Low hydrogen prices: 46 €/MWh on average

Market performance
H$_2$ price 150 €/MWh: Electricity prices

Volume-weighted Average Electricity Price in EUR/MWh

Support instrument

- Average prices *increase* ~9 €/MWh
- *Additional* increase in case of *CfD* ~1 €/MWh

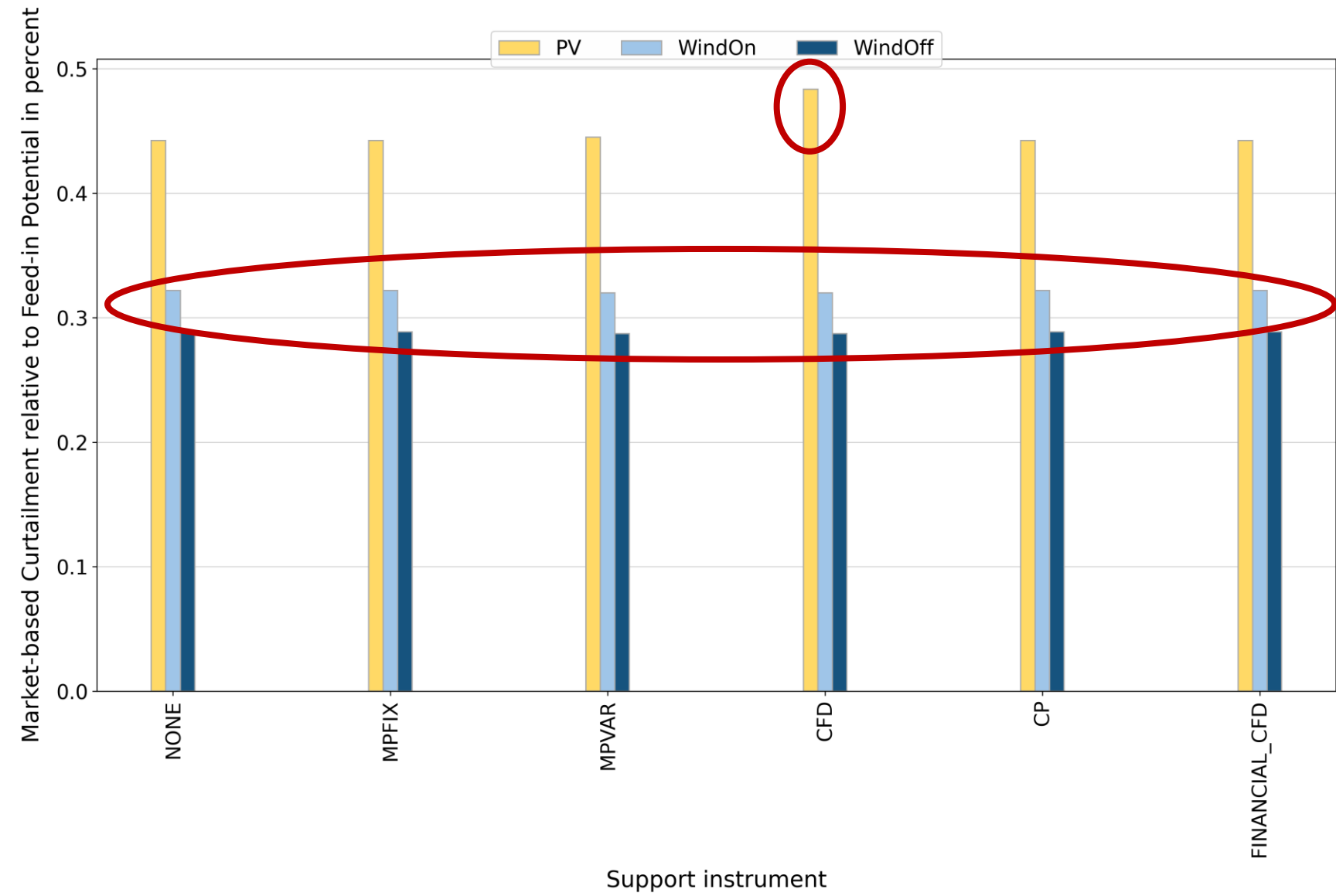# Market performance
H$_2$ price 150 €/MWh: Market-based curtailment

- Similar curtailment for wind at any support instrument
- *Increased PV curtailment* in CfD due to *payback period*

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Market performance
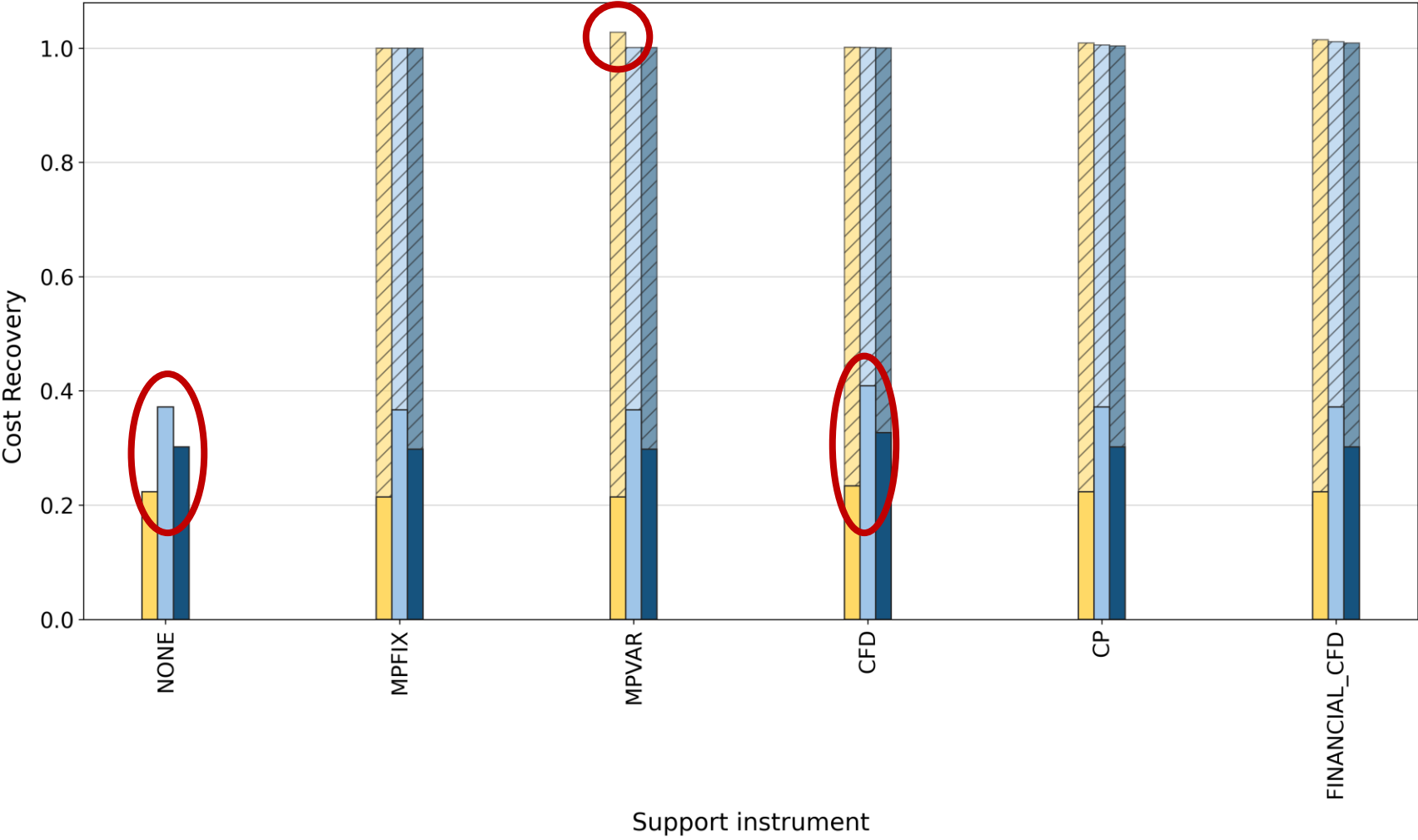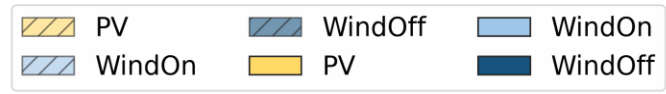## H₂ price 150 €/MWh: Cost recovery

- Overall higher market-based refinancing
  ~10 percentage points

- CFD: PV avoids payback – wind profits

- MPVAR: PV profits from high prices in one month

Summary & Outlook

Summary

- Support instruments are likely required to de-risk RES investments
- No fundamental discrepancies between assessed instruments *if perfectly parametrised*
- But: missing ex-ante information in real-world applications lead to different investment risk profile

Outlook

Investment risk profiles
- Effects of different support policies on refinancing risks

Endogenization of flexibility
- of storages and electrolysers
- first results show that market-based refinancing is clearly increased