

Self-reinforcing deflationary price dynamics under the variable market premium scheme

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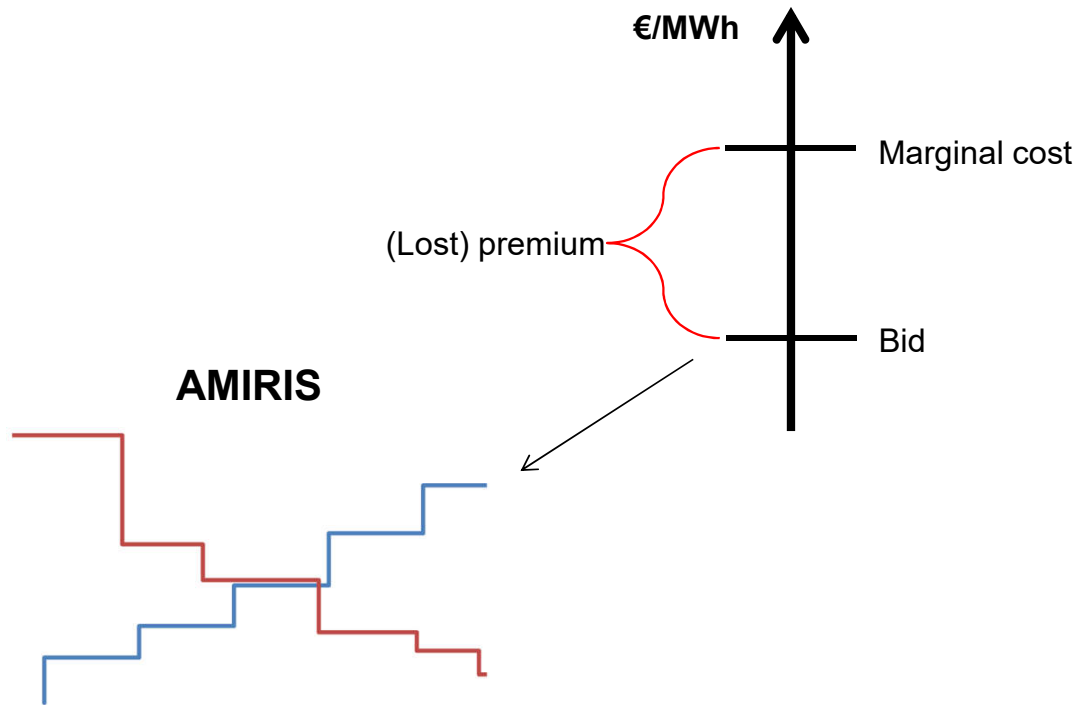
Motivation

- In a lot of European countries current transition goals comprise very high shares of renewables
- Widely applied instrument: Variable market premium
- **Pre-studies have shown: Growing shares of variable renewables that receive a market premium put downward spiral of prices and accordingly increasing premia in motion**
- Simple and an extended scenario analysis with the agent-based electricity market model AMIRIS



AMIRIS - Agent-based electricity market model

Bidding considers premia



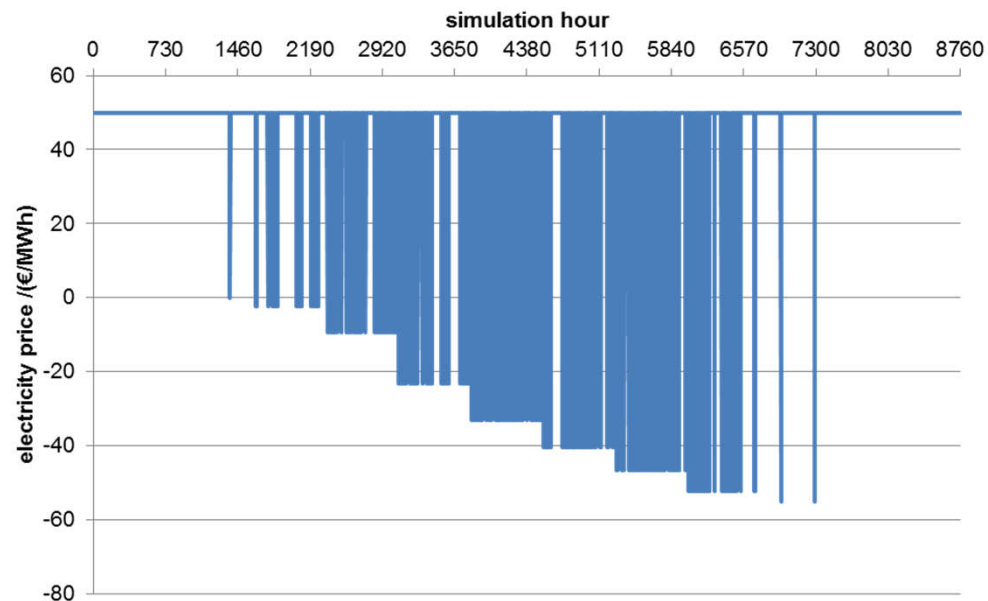
Simple scenario: Results I

Scenario setup:

- 1 gas power plant (120 GW)
- 1 PV power plant (200 GW)
- carbon price: 0 Euro/t
- constant fuel prices

Results at the spot market:

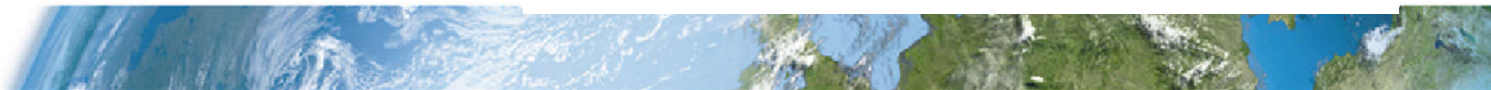
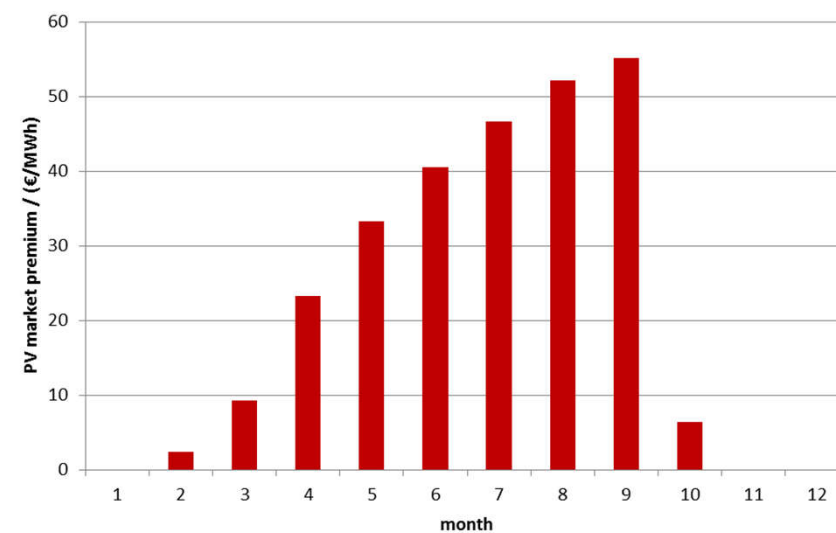
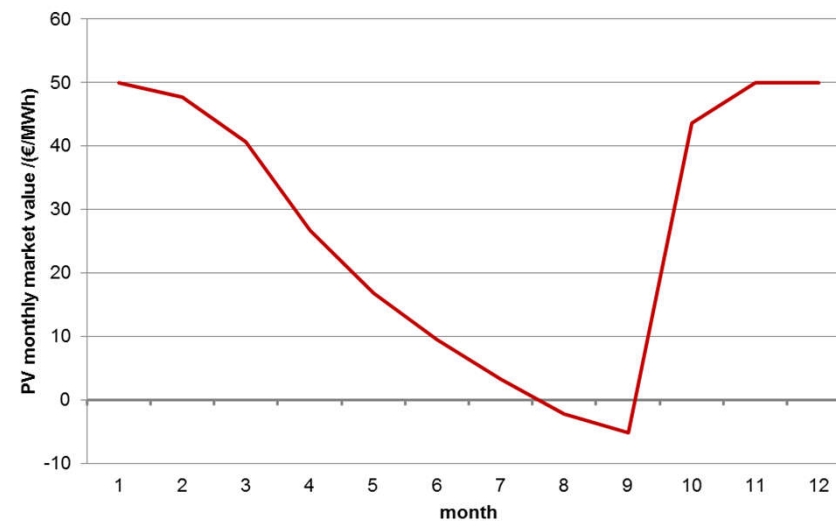
- In hours with a negative residual load, PV becomes price setting
- PV is able to bid at marginal cost minus the variable market premium (of the last month)
- Negative prices occur and continue to decline (as long as PV is able to cover the demand)



Simple Scenario: Results II

What happens?

- With decreasing prices, PV's average monthly value starts to decline
- To ensure refinancing, the variable market premium needs to be increased to cover the LCOE
- PV bids will include this increased premium and prices become even more negative as long as PV is still price-setting
- This requires another increase of the premium, etc.

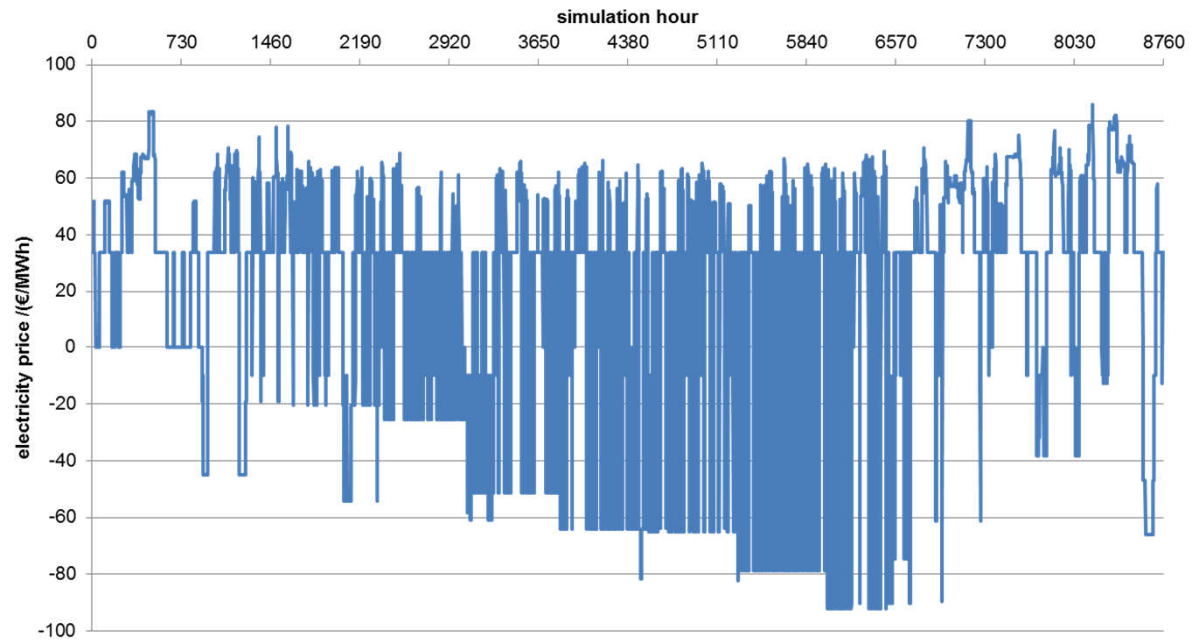


Extended scenario: Scenario setup & electricity prices

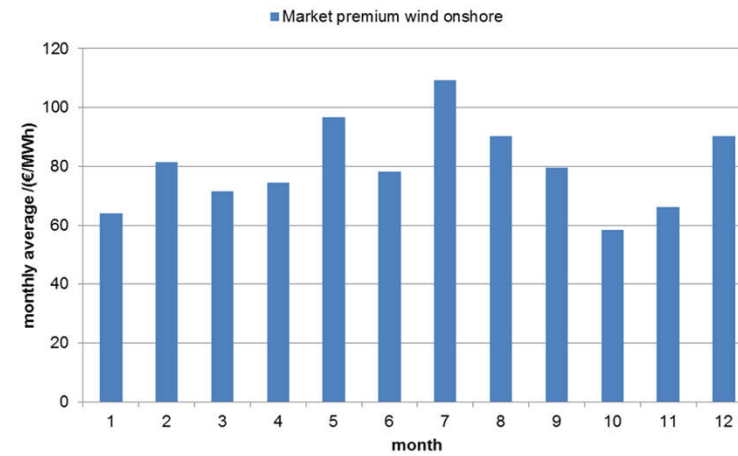
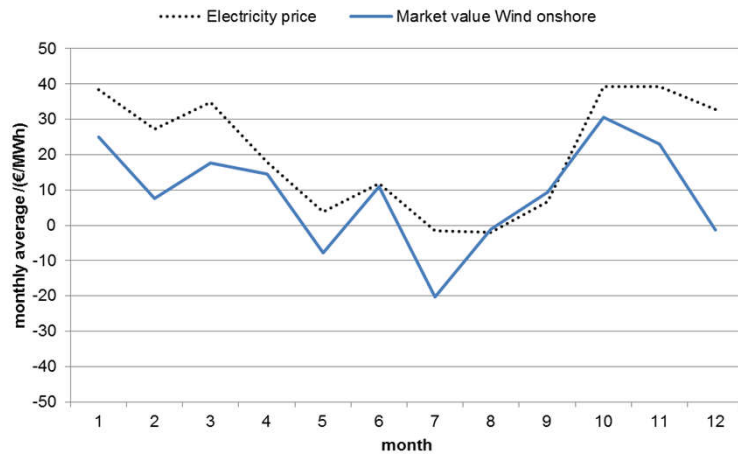
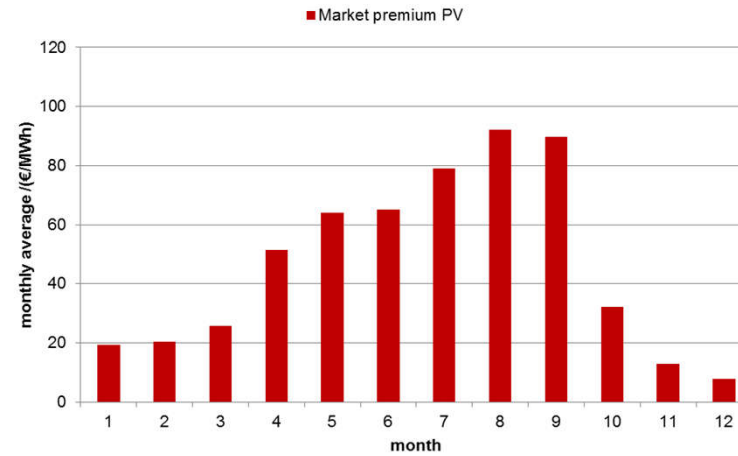
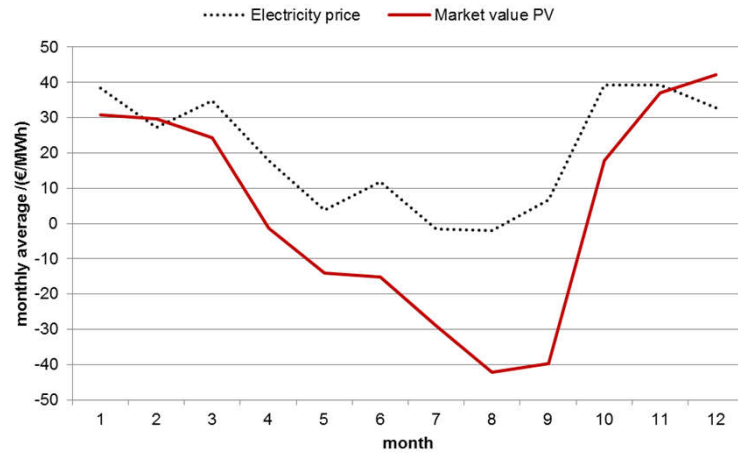
Scenario setup:

Technology	Capacity [GW]
Photovoltaics	200
Wind Onshore	80
Wind Offshore	20
Gas CC	30
Gas Turbine	20
Hard Coal	15
Lignite	10
Biomass	7
Run-of-River	6
Storage	20

- carbon price: 50 Euro/t
- constant fuel prices



Extended scenario: Results PV & wind onshore



Discussion & conclusion

- Self-reinforcing feedback loop once fluctuating renewables that receive a market premium become price-setting
- Agent-based simulations substantiate this hypothesis
- Further impacts:
 - 6-hour-regulation (implemented in the renewable energy source act 2014 in Germany)
 - new demand from P2X technologies
- Extended analyses required...



Outlook

- Variable market premium seems not to be designed for markets where VRE are price-setting
- Its role in refinancing power plants and its costs are increasing rapidly
- The described dilemma is not trivial to avert in the current market setting:
 - “Voluntary” change in bidding behavior not to be expected
 - Upper and lower limits would jeopardize refinancing
 - Fixed market premium would also entail immense investment risks
- **Is the premium’s steering effect at very high VRE-shares still efficient and effective?**
- **How can refinancing be ensured in future?**



Thank you for your attention!

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A photograph of the Earth's horizon as seen from space, showing the blue atmosphere, white clouds, and green and brown landmasses. The image is partially cut off on the right side.

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