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:

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

<table>
<thead>
<tr>
<th>Technology</th>
<th>Capacity [GW]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photovoltaics</td>
<td>200</td>
</tr>
<tr>
<td>Wind Onshore</td>
<td>80</td>
</tr>
<tr>
<td>Wind Offshore</td>
<td>20</td>
</tr>
<tr>
<td>Gas CC</td>
<td>30</td>
</tr>
<tr>
<td>Gas Turbine</td>
<td>20</td>
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<tr>
<td>Hard Coal</td>
<td>15</td>
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<tr>
<td>Lignite</td>
<td>10</td>
</tr>
<tr>
<td>Biomass</td>
<td>7</td>
</tr>
<tr>
<td>Run-of-River</td>
<td>6</td>
</tr>
<tr>
<td>Storage</td>
<td>20</td>
</tr>
</tbody>
</table>
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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