Effects of RES support mechanisms on short-term markets

Post 2020 evolution of the Target Model: Quantitative assessments

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Overview

- Objective
- Methodology
  - ROM model
  - Scope
- RES support mechanism
- Results
- Conclusions
Objective

- Analyze performance in the short-term of different RES support schemes
  - Long-term clean capacity auctions
  - Feed-In-Premium fixed
  - Feed-In-Premium floating
  - Long-term clean energy auction
Methodology

Input data
• Installed capacity
• Generation characteristics

Without RES support mechanism

Operation model (ROM)

Optimal operation

Compute required RES support

Operation model (ROM)

Operation
• Production
• Marginal prices

Invest cost
Recovery?

Compare results to optimal operation
Methodology: ROM model

- Operation model developed in IIT-Comillas
- Used in other EU projects
  - MERGE, SUSPLAN, TWENTIES...
- Unit commitment: represent day-ahead market
  - Technical constraints generation units: thermal and hydro
  - Operating reserves
  - Network
Methodology: scope

- Spain, France and Portugal in 2030
  - 1 year – 8,760 hours
  - Vision 3 TYNDP 2014
- Generation
  - Detailed generation units in Spain, France and Portugal
- Not real-time operation
- Network
  - No internal network
  - Interconnections between countries
Methodology: RES support schemes

- Long-term clean capacity auction
  - Provide subsidies out of the market
    - Based on capacity
  - Revenue obtained by subsidy is guaranteed
    - It does not depend on energy dispatched
  - Agents do not have incentives to dispatch more
    - Offers do not change
Methodology: RES support schemes

- Feed-In-Premium: fixed
  - Apply a premium over market price
    - Different for each country and technology
  - Revenue depends on the energy sold in short-term market
  - Incentive to produce more energy
    - Change in the offers

\[
Revenue(g, h) = Production(g, h) \cdot [market\_price(h) + premium(g)]
\]

\[
Offer(g) = marginal\_cost(g) - premium(g)
\]
Methodology: RES support schemes

• Feed-In-Premium: floating
  • Premium = reference value – reference market price
  • Conditions:
    • Reference market price computed for long period
    • Energy remunerated does not depend on energy dispatched (gross production)
  • Agents do not have incentives to dispatch more
    • Offers do not change

\[
Revenue_{\text{support}}(g) = \text{Gross}_\text{Production}(g) \cdot [\text{ref}_\text{value}(g) - \text{ref}_\text{market}_\text{price}(g)]
\]

\[
Revenue_{\text{market}}(g, h) = \text{Production}(g, h) \cdot \text{market}_\text{price}(g, h)
\]
**Methodology: RES support schemes**

- **Long-term clean energy auction**
  - Pre-determined amount of energy sold in the long-term
    - Premium over the market to this energy
    - We assume 50% of potential energy
  - Whole amount of energy remunerated at market price
  - Obligation to generators to produce the energy sold in the long-term
    - Change their offers to guarantee the dispatch
    - Hours with most probability to be dispatched and obtain higher revenue in the market: expensive hours
Results: revenues without support scheme

- OtherRES technologies require support
  - OtherRES obtains very low incomes due to its low generation
- France generation requires support
  - Wind and solar also

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System | Average price [€/MWh] |
-------|-----------------------|
Spain  | 104                   |
France | 60                    |
Portugal | 110               |

Market RES
Results: system operation

- Capacity auction and FiP floating have same operation that optimal
- Application of fixed FiP
  - OtherRES produces more (0% to 9%)
  - Replaces nuclear and CCGTs

Optimal

FiP fix

- Nuclear
- Coal
- GT
- CCGT
- Oil
- OtherNonRES
- Hydro
- Wind
- Solar
- OtherRES
Results: system operation

• Application of energy auction
  • OtherRES replaces CCGTs
Results: market prices

- Spain and Portugal are very correlated
- FiP (fixed) and energy auction reduce prices
  - Especially in France
### Results: market prices

**FiP fix**

<table>
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<th>Units</th>
<th>Location</th>
<th>Unitary revenue [€/MWh]</th>
<th>Marginal price [€/MWh]</th>
<th>Coefficient</th>
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**Energy auction**

<table>
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<th>Unitary revenue [€/MWh]</th>
<th>Marginal price [€/MWh]</th>
<th>Coefficient</th>
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<tr>
<td>OtherRES</td>
<td>Portugal</td>
<td>304.6</td>
<td>122.6</td>
<td>2.5</td>
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</table>

- Interference with efficient short-term signals
- RES generation supported is producing electricity with higher costs than other cheaper options
Results: costs

- **FiP (fixed)**
  - Total dispatch costs 35% higher than optimal dispatch
- **High production with OtherRES technologies**
- **Energy auction**
  - Lower cost increase than FiP (fixed)
Conclusions

• Long-term clean capacity auction
  ➢ Revenues do not depend on energy sold in the market (capacity)
    ➢ No incentives to generators to sell more energy in short-term
  ➢ No interference with short-term operation → optimal

• Feed-In-Premium: fixed
  ➢ Revenues depend on energy sold in the market
    ➢ Incentives to generators to sell more energy in the short-term
  ➢ Changes optimal short-term operation
  ➢ Marginal prices are reduced
  ➢ Increases generation dispatch costs by 35%
Conclusions

• Feed-In-Premium: floating
  ➢ Revenues do not depend on energy sold in the market
  ➢ No incentives to generators to sell more energy in short-term
  ➢ No interference with short-term operation → optimal

• Long-term clean energy auction
  ➢ Revenues depend partly of the energy sold in the market
  ➢ Incentives to generators to sell more energy in the short-term
  ➢ Changes optimal short-term operation (less than FiP fixed)
  ➢ Marginal prices are reduced (less than FiP fixed)
  ➢ Increases generation dispatch costs (less than FiP fixed)
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Thank you very much for your attention