ENSURING FLEXIBILITY DELIVERY: THE ROLE OF PENALTIES ON LONG-TERM DISTRIBUTION FLEXIBILITY TENDERS

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Electromobility research: Chaire Armand Peugeot

• Grid integration and flexibility services (V2G)
• Charging infrastructure deployment
• Electromobility business models
• Coordination services for long trips
AGENDA

Flexibility for distribution grids

Long-term flexibility tenders and the role of penalties

Case study: EV fleets participation according to penalty conditions

Conclusions
Power systems are facing serious challenges:

- Integration of distributed generation
- Electrification and new uses (mobility, heating, IT…)

Significant investments to upgrade infrastructure

Using *flexibility* can help distribution grid operation and planning

EVs can provide flexibility to the grid! - smart charge and V2G

- Creating value for grid operators, aggregators, BRPs, end-users
- Lowering total cost of ownership for end-users
Different frameworks to unlock flexibility

- Network tariffs
  From uniform/static to locational and variable

- Flexible (smart) connections
  Allowing faster or less costly connections
  From ‘firm’ capacity to ‘variable’

- Market-based
  Short-term flexibility markets
  Long-term tenders (UK, France)
THE CASE FOR LONG-TERM TENDERS

FLEXIBILITY TENDERS - HOW DO THEY WORK?

Identification of zones and periods where congestion might occur
- Availability required during months/weeks
- Activation in real-time, a few times per year (<10)

Contracts for 1-7 years for flexibility provision
Results from UKPN 2020 tenders show potential high value of flexibility
WHY HAVING LONG-TERM TENDERS?

When using flexibility as an alternative to investment deferral, DSOs need to be sure flexibility will be available when needed.

- High risks if only relying in short-term local markets

Risk sharing through long-term contracts

- Providing security of flex availability
- Ensuring revenues to flex operators

Penalties to ensure flexibility delivery when needed

- UKPN: low penalties to foster competition
- Enedis: aligned with balancing mechanism (system-wide)

Ensuring reliable flexibility can be a challenge for variable resources aggregators (EVs, DR)

- What is the impact of penalties on the participation of these resources?
METHODOLOGY & CASE STUDY
Simulation based methodology that mimics the tender process

• First stage: Participation evaluation (bid), considering expected EV usage patterns and tender conditions.
• Second stage: Performance evaluation, simulation of flexibility activations and computing remuneration. Considering penalties!

CASE STUDY ON EV FLEETS

EV fleets cases
Case study using real data from demo projects (Parker, DK; Electric Nation, UK):

- **Company fleet**: Always plugged-in
- **Commuter fleet**: Average plug-in 5 days/week

Tender cases
Two availability windows in study:

- **Evening (5pm-8pm)**
- **Full-day**

Three penalty conditions:

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Case</th>
<th>Threshold</th>
<th>Penalties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>UKPN</td>
<td>60%</td>
<td>0%</td>
</tr>
<tr>
<td>Medium</td>
<td>Enedis</td>
<td>80%</td>
<td>35%</td>
</tr>
<tr>
<td>High</td>
<td>-</td>
<td>90%</td>
<td>70%</td>
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RESULTS
VARIABLE AVAILABILITY PROFILES

Charging and flexibility profiles for a 30-EV fleet

Evening window

Full-day window

June 9th, 2021 1st IAEE Online Conference - GONZALEZ VENEGAS, PETIT, PEREZ
We simulated flexibility activations and computed remuneration and risk (C-VaR) for bids at different confidence levels.

- For high-reliability cases (Company + Evening window), penalties don't have much impact.  
  ⇒ Fleet will bid the maximum flexibility

- For low-reliability cases (Commuter), penalties affect the optimal bid level  
  ⇒ A trade-off between expected revenue and risk  
  ⇒ High penalties make aggregators propose only high-confidence bids
We simulated flexibility activations and computed remuneration and risk (C-VaR) for bids at different confidence levels

- For high-reliability cases (Company + Evening window), penalties don't have much impact. 
  \[ \Rightarrow \text{Fleet will bid the maximum flexibility} \]

- For low-reliability cases (Commuter), penalties affect the optimal bid level 
  \[ \Rightarrow \text{A trade-off between expected revenue and risk} \]
  \[ \Rightarrow \text{High penalties make aggregators propose only high-confidence bids} \]
**ARE PENALTIES ENSURING DELIVERY?**

The low penalty scenario allow fleets to bid high levels of unreliable flexibility

- The unsuccessful activations (UA) reach >40%
- Additional measures can limit this effect (ban from market if repeated failure)

Higher penalties ensure higher flexibility delivery

- But limit the amount of flexibility available to the DSO

=> A trade-off between lowering entry barriers and flexibility reliability

<table>
<thead>
<tr>
<th>Fleet</th>
<th>Penalty Scenario</th>
<th>Evening Bid [kW/EV]</th>
<th>UA [%]</th>
<th>Full-day Bid [kW/EV]</th>
<th>UA [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company</td>
<td>Low</td>
<td>7.3</td>
<td>0.0%</td>
<td>7.3</td>
<td>29.0%</td>
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<tr>
<td></td>
<td>Medium</td>
<td>7.3</td>
<td>0.0%</td>
<td>7.3</td>
<td>32.3%</td>
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<tr>
<td></td>
<td>High</td>
<td>7.3</td>
<td>0.0%</td>
<td>2.9</td>
<td>23.8%</td>
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<tr>
<td>Commuter</td>
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<td>9.6%</td>
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<td>4.4%</td>
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<td>1.6</td>
<td>2.9%</td>
<td>0.8</td>
<td>9.8%</td>
</tr>
</tbody>
</table>

UA: Unsuccessful activations
CONCLUSIONS

Flexibility tenders enable DSOs to procure flexibility for the long-term
• They ensure flexibility availability for DSOs as well as revenue certainty for flex operators
• First step to build liquid local flex markets

Penalties are needed to ensure flexibility delivery
• A trade-off between reliability and volume

Different penalty strategies have been implemented
• UKPN has a low penalty strategy to allow participation to new actors => Learning by doing effects
• Enedis focuses on higher reliability and standardization with national markets

Alternative measures can be designed to increase participation in local markets
• Implementing well-defined availability windows
• Allowing for firm + variable flexibility bids
THANKS! ANY QUESTIONS?