MARKETS VS. LISTED PRICING FOR ACCESS TO DISTRIBUTION NETWORKS

Christine Brandstätt & Rahmat Poudineh

June 9th 2021, 1. IAEE Online Conference 2021
OUTLINE

1. Motivation
2. Restricted Network Access
3. Listed Prices vs. Market-Based Allocation
4. Conditions for Equivalence
5. Design Options
6. Implications in Practice
7. Conclusion and Outlook
**MOTIVATION**

- Historically:
  - Users have universal access rights to their full connected capacity at listed prices.
  - Network operator supplies corresponding capacity at minimum cost.

- Recently:
  - Listed pricing for small restrictions in access rights.
  - Buy back from the network operator to correct previously assigned universal access.

- Future?
  - Assign restricted access in a market-based way.

- Analyse markets for differentiated access to network capacity as an alternative (or complement) to universal access and listed pricing.
RESTRICTED NETWORK ACCESS RIGHTS

examples:

- heat pump accepts controllable access for withdrawal during the day, rather than random access all day
- electric vehicle has access to additional capacity at the workplace rather than at home
- PV has access for injection into the neighbourhood only, not to sell to users connected via transmission grid

➤ assigned with certain advance
➤ possibly in bundles
➤ traded subsequently
ALLOCATION OF UNIVERSAL ACCESS

- utility for universal access is combined utility for peak & off-peak
- decreases for 2\textsuperscript{nd} unit as no utility from a second unit of off-peak via listed prices
  - price for access to both periods at capacity cost
  - users with utility /willingness to pay ≥ capacity cost buy access via auction market
  - users bid truthfully
  - network operator accepts all bids ≥ capacity cost in both settings
    - network operator builds capacity of 5 units at cost of 15
    - all demands obtain a first unit, demand 2 and 3 obtain a second
    - demand surplus of 6 (sd1=0, sd2=2, sd3=5)

<table>
<thead>
<tr>
<th>units demanded</th>
<th>user 1</th>
<th>user 2</th>
<th>user 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>off-peak</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>peak</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>utility per unit</td>
<td>off-peak</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>peak</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>combined utility</td>
<td>1st unit</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>2nd unit</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

capacity cost

|             | 3 |

---

N\_1 \quad L\_1 \quad N\_2

\[ g_1 \quad d_1, d_2, d_3 \]
ALLOCATION OF RESTRICTED ACCESS

utility for restricted access is per peak & off-peak period

via listed prices
- price for access to peak period at capacity cost
- access to off-peak period at variable cost (here 0)

via auction market
- users bid truthfully
- network operator pairs and sorts bids
- accepts all bid pairs with willingness to pay ≥ capacity cost

in both settings
- network operator builds capacity of 4 units at cost of 12
- all demands obtain off-peak access, 2 and 3 also obtain peak
- demand surplus of 6 munits (sd1=1, sd2=2, sd3=5)
EQUIVALENCE UNDER OPTIMAL CONDITIONS

preconditions:

- network operator has incentives to build optimal capacity
  - monopoly regulation necessary with pricing and auctions alike

- knowledge of long-term marginal cost of the network
  - difficult to precisely distinguish cost for different parts of the network and different types of uses
  - affects pricing and auctions alike

- knowledge of network users utilities
  - projected based on past manifestations for listed pricing
  - revealed via market allocation, but prone to strategic behaviour and market power
  - benign circumstances for demand revelation can be created via market and product design

<table>
<thead>
<tr>
<th></th>
<th>universal access</th>
<th>restricted access</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>user1</td>
<td>user2</td>
</tr>
<tr>
<td>off-peak units</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>peak units</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>utility</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>cost</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>surplus</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>
### AUCTION DESIGN

#### Repetitions
- Short access periods
- Closer to real-time

+ More attractive chances for entrants
+ Higher predictability for demand
+ Lower likelihood of default via bankruptcy

- Enables learning, signalling and retaliation
- Less certainty for capacity investment
- Higher transaction cost

#### Bid Transparency
- Sealed / anonymous > open bids
- Descending > ascending auctions

+ Prevent learning and signalling
+ Encourages involvement of weaker bidders

- Reinforces uncertainty about common valuations

#### Pricing Rules
- Uniform > discriminatory price
- Trigger price
- Second price rule (at margin)
- Reserve price

+ Encourages truthful bidding / reveals demand
+ Reduces winners curse / auction inefficiency
+ Introduces quantity risk

- May limit revenue and efficiency

---

June 9th 2021

C. Brandstätt
allowing resale

- corrects allocation via grandfathering or uninformed listed prices
- reduces risks of long-term products
- helps develop capacity efficiently

- legitimizes transfers between colluding competitors
- shifts surplus from regulated operator to private parties
- higher transaction cost

correcting allocation via grandfathering or uninformed listed prices

encouraging resale

- use-it-or-loose-it/trade-it/-pay
- allowing intermediaries

- prevent predatory behaviour
- encourages involvement of weaker bidders
- anticipating future competition with long-term products
IMPLICATIONS IN PRACTICE

wind generator in export constrained part of the grid

- benefits from differentiating access, e.g. peak, local or curtailable access
- benefits from adapting access rights over time
- challenge of entry deterring by incumbents
  - less relevant in congestion-blind electricity markets
  - network operators can adapt capacity via grid enhancing technology or forced curtailment
- challenge of monopsony power for incumbents
  - short access periods increase competition, in theory also help collusion, but likely detectable in small, clearly arranged network sections
  - potential for intermediaries

electric vehicles in import constrained part of the grid

- benefits from differentiating access, e.g. peak, local or curtailable access
- challenge of assessing value of flexibility for inexperienced users
  - optional universal access and price taking bids
  - aggregators to mediate complexity and limit transaction cost
- challenge of monopsony power for incumbents
  - likely detectable with uniform household user types
  - risky when curtailment is linked to value of access rights
CONCLUSIONS AND OUTLOOK

constantly evolving distribution grids with increasingly flexible users
- restricted network access helps to coordinate different aspects of network use
- market-based allocation enables continuous adjustment of capacity allocation trend towards market-based allocation of access rights.

preconditions: adequate design of products and market rules
- balance between short- and long-term allocation (competition, risks)
- balance between complexity and individual fit (efficiency, transaction cost)
- control market power
  - adjust to specific setting (substitutable / complementary access, prevent learning / signalling)
  - facilitate detection and antitrust
- reveal value of access and thus inform regulation and efficient system development (e.g. uniform pricing)

concerns in addition to efficient allocation
- social: not entirely rational, unexperienced users
- political: hesitation to rely uncertain price-based reactions for security of supply

June 9th 2021
C. Brandstätt
THANK YOU FOR YOUR TIME AND ATTENTION.

ANY QUESTIONS OR COMMENTS?

Christine Brandstätt
Research Associate - Energy Economics
Bremen Energy Research | Jacobs University Bremen
Campus Ring 1|28759 Bremen | Germany
c.brandstaett@jacobs-university.de