Design of Support Schemes for Renewables

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Decarbonising our economies

Roadmap for moving to a competitive low carbon economy

Source: EC(2011)
Electricity from renewables has become competitive with most fossil fuels

Global levelised costs of electricity for large-scale renewables 2010-2017

Source: IRENA (2017)
Future costs reductions expected

Levelised costs of electricity for wind, solar and concentrating solar, 2010-2020

Source: IRENA (2017)
Renewables are growing everywhere

Cumulative solar PV capacity by region, 2006-2016

Source: IRENA (2017)
This Talk

• Renewables: a game changer
• The need for a new market design
• The renewable auction revolution
• Support schemes for renewables
  – Auctions
    • Design options
    • Case studies: Germany and UK
• Concluding remarks
• [References]
Renewables: a game changer

- Zero marginal costs
- Intermittent
- Modular
- Entry of fragmented players
- New role as backup for thermal energy
- Demand response
- Storage
- Electric car

Lower and volatile wholesale prices
Need to re-think market design

- Shift of focus from the short to the long-run
- Need to de-risk investments
- **Auctions for long-term contracts**
  - Renewable energy
  - Back up capacity
- Liquid spot markets
- Important role for System Operators
- Market integration through interconnections
The renewable auction revolution

48 countries run renewables auctions, and 27 are seriously considering it

Global Tendered Projects by Bid Price and Capacity, 2014-2016

Source: GTM Research
The renewable auction revolution

In Europe, 13 countries use auctions for RES, 5 are in the process of implementing them.
Approaches setting support schemes

Objective: set cost-efficient support for RES

• **Administrative approach**

• **Competitive process:**
  – Certificate (quota) schemes
  – Auctions
Administrative approach

• price/quantity set by the administration

Challenges:

• **Asymmetric information**
  – Investment and operational costs

• **Specificities of each plant**
  – Location, maturity, etc.

• **Adjustment over time**
  • As costs of renewables go down

• **Credibility**
  • Vulnerable to retroactive cuts
Quota system (green certificates)

• Quantity based support scheme:
  – Demand side obliged to buy certificates
  – Supply side can sell certificates for every RES projects
  – Certificates can be traded bilaterally or through an exchange

Challenges:

• not very successful (UK, Italy, Poland... have abandoned it)
  – regulatory risks, leading to excess volatility and high capital costs
    • Newbery (2016): in the UK, move from ROCs to auctions reduces cost of capital from 6% to 3%, saving GBP 2.25billion/year
  – overcompensation for lower-cost technologies if technology neutrality
Design of Renewables Auctions

Design criteria:

• **Eligibility of technologies:** technology-neutral vs. technology-specific

• **Contract design:**
  – payment per KW + market price, or
  – payment per kWh (Feed-in-Tariffs, Fixed premia, Floating premia, CfDs)
Other Design Criteria

Auction design options

• **Pricing rule:** pay-as-bid or uniform pricing
• **Selection criteria:** winning bidders are
  – **Price-based tenders:** those offering lowest prices
  – **Multi-criteria tenders:** combination of multiple criteria (volume, location, environmental impact, etc.)

• **Price caps/price floors:** max/min bid level
• **Frequency:** periodic versus ad-hoc
• **Volume to be tendered**
Eligibility criteria

- **Participation**: size, type of candidates, national vs. cross-border

- **Prequalification**: financial securities, technical requirements such as building permits, land use planning

Others

- **Penalties for non-compliance** (or delays)
- **Tradability of support entitlements**
Technology neutrality vs. Technology specificity

• In technology neutral auctions, different RES compete against each other, with the aim of determining the most cost-efficient one.
  – In EEAG framework: default bidding scheme
  – Technology specific tenders only allowed under specific conditions: lack of competition or need to ensure diversity of RES technologies.

• Problems with tech-neutral auctions:
  – Over-compensation
  – Fail to support the long-run cost-efficient technologies
  – high concentration of RES installations in the same area (congestion)
Fixed vs Floating premia

**Fixed premia:**
- RES receives a fixed premium over the reference market price (€/MWh)
- Potentially combined with a capacity payment (€/MW)
- Certainty over the level of support
- Uncertainty over the level of total payment

**Floating premia:**
- The premium is inversely proportional to the market price
  - CfDs: premia can be negative
- Uncertainty over the level of support
- Certainty over the level of total payment
Fixed vs Floating premia

Main arguments in favour of fixed premia:
• Incentives to perform better
• Leveled playing field wtr conventional technologies

Main arguments in favour of floating premia:
• Because RES producers face little price varia\ntna, costs of capital are reduced
• Newbery (2016) estimates this has saved the UK system 2.5B GBP
Pay-as-bid vs. Uniform pricing

- **Pay-as-bid**: winning projects paid according to their bid
- **Uniform pricing**: paid according to the highest bid
- If **competitive conditions**, both auctions are equivalent:
  - Pay-as-bid: bid close to the highest accepted bid
  - Uniform: bid at your cost, resulting payment equals highest cos
- Otherwise, if **strategic behaviour**:
  - Incentives to overbid: risk of not winning vs increased market price for all winning bids
  - Winners’ curse: winning is bad news as others believe future costs will be higher
European Experience

• Auction-based schemes tend to lead to lower prices more than administrative fees
• Auctions have shown a strong potential to drive price reductions in new RES
• In Europe, most auctions have been:
  – pay-as-bid format
  – for premia (ether fixed or floating)
  – technology specific
  – restricted to national players
Case study: Germany

- It applies to all installations above 100kWs if they intend to obtain the premium
- Reference value: since 2017, set through an auction; fixed for 20 years
- Market Value (MV): technology specific weighted **monthly** average of market price
- One-way contract: if market price > reference price, investors do not pay back
- RES has balancing responsibilities
Case study: UK

• CfDs provide revenue certainty to RES investors
• Reduce the borrowing costs of financing RES projects
• Encourage competition both within and between generation technologies
• Improve the affordability for consumers (generator pays back if high market price)

FITs with Contracts for Differences (CfD)

- Compensation from the CfD
- Strike price set in auction; fixed for 15 years
- Revenue from selling electricity in the market
Case study: UK

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Compensation from the CfD

Market revenue £/MWh
FIT CfD payment £/MWh
Monthly electricity price
### Case study: UK

<table>
<thead>
<tr>
<th>Technology</th>
<th>Capacity (MW)</th>
<th>Admin Strike price 2014 (£/MWh)</th>
<th>Lowest auction clearing price Jan 2015</th>
<th>Maximum % saving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large solar PV</td>
<td>72</td>
<td>£120</td>
<td>£79</td>
<td>34%</td>
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<tr>
<td>Onshore Wind</td>
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<td>£95</td>
<td>£79</td>
<td>17%</td>
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<tr>
<td>Energy from Waste CHP</td>
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<td>Offshore Wind</td>
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<td>£114</td>
<td>18%</td>
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<tr>
<td>Advanced Conversion Technologies</td>
<td>62</td>
<td>£140</td>
<td>£114</td>
<td>18%</td>
</tr>
</tbody>
</table>

Source: Simplified from Newbery (2016a, Table 1).

Comparison between administrative prices and prices set through the 1st auction for new RES.
Concluding remarks

• For a least-cost energy transition, it is paramount to design market mechanisms to:
  – encourage cost reductions
  – Pass such cost reductions to consumers

• Auctions for renewables, that reduce risk exposure (FiTs, CfDs or FiTs with floating premia)...
  – Reduce costs of capital
  – Promote greater participation and competition

....eventually transforming current market arrangements
Thank You for your Attention

More info and papers at www.eco.uc3m.es/nfabra
References

• CEER (2016) Key support elements of RES in Europe: moving towards market integration, Ref. C15-SDE-49-03, 26 January
• Ecofys (2014) Design features of support schemes for renewable electricity, Task 2 report
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