New Business Models for Distribution Network Operators

Conferencia regional de generación distribuida (GD)
25 Oct 2016, Santiago de Chile

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Drivers for change and emerging trends
Drivers for change

- **3Ds of change for local grids**
  - Distributed resources
  - Digitisation
  - Decarbonisation

- **Two-way flows of energy and data across all levels of network**

Image source: RMI
Three domains of change

- **Technical: more complex power flows**
  - New technologies, role of data

- **Economic: new value streams**
  - Innovative business models change customer engagement in energy markets
  - Social fairness at stake: tariffs and taxation

- **Institutional: new roles and responsibilities**
  - Inconsistencies between commercial arrangements and grid operations
  - Technological changes challenge today’s institutional setting and regulatory paradigms
Distributed Energy Resources (DER)

- Distributed energy resources (DER) are typically modular and/or small scale, connected to a local network, with the capability to provide (or facilitate) energy or system services.

- Examples:
  - distributed renewables, especially solar photovoltaics (PV)
  - small combined heat and power (CHP) plants often running on natural gas
  - Battery storage systems and actively controlled demand

*DER are a cornerstone in the transition to clean, 21st century energy systems.*
Things can move quickly …

Driven by the policy framework in the UK, distributed solar PV was economically very attractive, triggering rapid deployment.
... and multiple trends combine
2015 – The year EVs went mainstream

- With 550 000 EVs sold in 2015, the global electric car stock reached 1.26 million (0.1% of global car fleet)
- This went hand in hand with a tenfold increase in the global market for batteries

IEA (2016), Global EV Outlook
Charging EVs emerging role for local grids

Charging networks for EV – TESLA super chargers in US, public charging in Amsterdam, 2016

Key point: Charging points for EV will increasingly be a major load on local grids – adapting planning frameworks for both distributed generation and EVs will be relevant going forward.
Blockchain: Technology revolution ahead

Key point:

Wholesale market liberalisation was only possible due to computer technology – a new innovation step may now allow for transactions without a central clearing house.

Image source: WSJ
Implications for DSOs
Current situation in many countries

Payment for provided services

Consumers pay fixed & volumetric charges
→ No incentive to reduce peak load contribution

Net Energy Metering is applied for DER
→ Reduced revenues for utilities
→ No incentive for DER to provide system services
Concerns: grid costs and integration

- Grid cost concerns
  - T&D costs 30-50% of retail costs, but only 0-15% recovered through fixed payments for efficiency/equity reasons
  - Self-consumers pay less but still benefit from the grid; cross-subsidy!
  - Self-consumption may call for some network tariff changes
    * Preferably toward some time-based grid pricing structure, e.g. California bill adopted in September 2013: small fixed fee introduced, and time-of-use pricing forthcoming

- Integration concerns
  - Self-consumption and surplus in-feed may increase imbalance of supplier without prosumers paying for this
  - Depending on correlation with system demand:
    - Serving residual demand more/less costly to meet per kWh than average
    - Excess generation more/less valuable than average
  - Tariff-design for injections should reflect value of electricity
Concerns: taxes, surcharges, subsidies

- Forgone tax revenue concerns
  - Less energy sold, less taxes raised
  - Taxation of self-consumption problematic
  - Evaluate taxation framework, avoid double taxation
    - E.g. charging VAT on systems and on excess electricity

- Forgone renewable energy surcharge concerns
  - Tariffs often contain surcharge for RE
  - A RE surcharge on RE self-consumption?
  - Contributing to learning investment that has lead to socket-parity

- Forgone cross-subsidy concerns
  - Customers with highest prices have biggest incentive
  - May be due to cross-subsidies to other consumer groups
  - Anticipate impact on overall revenues
Objectives

Key objectives

- Provide load management incentive

- Enable reliable revenue

- Enable and remunerate DER-auxiliary services
New markets can emerge

- The State of NY launched the Reforming the Energy Vision (REV) initiative.
- Under REV, existing and new stakeholders compete on local markets for energy services, approaching the customer with innovative business models.
- The utility becomes the market facilitator.
- Enhanced demand-side participation reduces grid investment needs.

Key point: By welcoming new stakeholders with innovative business models, REV seeks to find market-based solution to tackle new system needs.
Many questions

- How far to go with unbundling:
  - Network ownership, operations; supplier; aggregator ...

- How to adapt regulatory incentives:
  - How much innovation is good?

- How do we adapt planning standards and when to invest?

- How to handle the interface between transmission and distribution level?
A possible framework of dos and don’ts

1. **DSO Activity**
   - If not a monopoly:
     - Is it a new activity?
       - Yes:
         - Is there potential for the activity to be open to competition?
           - No:
             - Core activity
           - Yes:
             - Are there special justifications for DSOs to carry out the activity?
               - Yes:
                 - Allowed under conditions
               - No:
                 - Not allowed
       - No (competition exists):
         - Not allowed

Image source: CEER
## Distributed resources: areas for policy attention

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<th>Assessment &amp; Modelling</th>
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Conclusions

- A number of drivers are aligning to fundamentally change local grids – away from passive distribution towards active networks of electricity and data
- Change can happen quickly and experience shows that regulation and policy is often poorly prepared
- Regulatory reform needs to consider all three layers
  - Technical
  - Economic
  - Institutional
- Hot topics for reforming DSOs
  - How much unbundling?
  - How to adapt regulatory incentives?
  - How to adjust planning standards?
Thanks

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Fundamental roles in the electricity system

(Regulator)

Integrated utility

Unbundled utility

Transmission system operator

Distribution system operator

Retailer

Aggregator

ICT provider
New ways to conceptualise roles

The energy integrator role framework

- Advanced energy network management
  - Physical and real time
  - Balances energy resources on D side
  - Conducts balancing (situational aware and inc/dec)
  - Measure actual dispatch

- System and process integration
  - Viable DER dispatch schedule
  - Actual dispatch

- Distributed resource enablement
  - Enable a “market” of DER offers
  - Campaign manage DER participation
  - Maintains market transparency
  - Core DER market maker

- Settlements
  - Validates dispatch
  - Market monitor
  - Sustainability measurement
  - Settlement

- Analytics and optimization
- System planning
- Information infrastructure management

New deal (policy, regulation and business model)

Image source: IBM