From distribution networks to smart distribution systems: Rethinking the regulation of European electricity DSOs

- Results of the THINK study -

Sophia Ruester
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With smart distribution systems

- DSOs cannot continue to do “business-as-usual”
- Data volumes and the value of data will increase drastically
Background

Technological advances are reshaping today’s electricity market

Advent of “distributed energy resources” (DER):

- Transmission level
- Distribution level
- Distributed generation
- Distributed storage
- Electric vehicles
- “Prosumer”
- DG
- Storage
- Demand response (DR)

Challenges:
- Increased volatility of net demand
- Much variation and uncertainty of flows in D grid and at T interface (even reverse flows)
- Network architecture becoming more complex & expensive

Potentials:
- Diversity of services with economic value in local electricity markets
- DER may successfully compete with centralized generation
- New tools for system control by the DSO

Background

Why this THINK report?

- In the light of these market developments and resulting challenges & potentials ...
- ... and to contribute to the current debate on DSO regulation (e.g. Smart Grid Task Force, London Forum, Eurelectric, EDSO, etc.)
- ... we ask

1. Why & where do we need to rethink the current regulation of DSOs?

2. How can the regulatory compact be adjusted to incentivize DSOs
   - ... to effectively integrate DER into electricity markets?
   - ... to effectively employ DER for their own purposes?
# Background

Whole spectrum of regulation to be reviewed

- **DSO as a regulated entity:**
  Get remuneration, incentives to innovate and tariffication right

- **DSO as a key player along the supply chain:**
  Get the boundaries vis-à-vis the TSO and the market right

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## #1 – Adequate remuneration of DSOs

Revisit regulation

- Increasing amounts of DER require **substantial investments** to
  - Properly connect all new resources
  - Set up ICT infrastructure that empowers DSOs to employ DER for their daily grid operations

- Therefore, two **regulatory mandates:**
  - Account for increasing total costs of distribution (losses, grid reinforcement, etc.).
  - But at the same time also incentivize investments in active system management to cushion those costs

- A **sound regulation** that efficiently incentivizes DSOs to engage in active system management has to take account of:
  - a) Changing OPEX and CAPEX structures
  - b) The optimal choice among both
  - c) How to incentivize DSOs to deploy innovative solutions
#2 – Adequate distribution network tariffs
Revisit tariff design

- **No sound methodology** to design network charges for the different agents that may connect to the grid
- Moreover,
  - Business models might exploit existing ill-designed network tariffs
  - Absence of economic signals
  - Hidden subsidies
    (e.g. volumetric network charges combined with net metering; exemptions from grid tariffs)
- Grid users become complex, **sophisticated agents**
  - With very diverse consumption and/or production patterns
  - Able (and willing) to react to price signals
  - A **sound grid tariff design** should be able to convey efficient economic signals
    - Any hidden subsidies should be removed and replaced by sufficient but direct subsidies that do not turn into inefficient signals
    - Tariffs should reflect the true costs (or benefits) of different types of load and generation for the system

#3 – DSO boundary vis-à-vis the TSO
DSOs become active system operators

- General responsibilities of network operators with respect to grid management do not change
  - but the set of tools available to perform the tasks is enriched by DER
- Some of the services DER can provide are relevant for either the TSO or the DSO
  - whereas others might be of interest for both types of network operators
  - Regulation needs to guide DSO-TSO interactions, in particular in:
    a) **TSO-DSO coordination**
      - Hierarchy of decisions for system balancing
      - Protocol of DER committed for which operations, to whom, for which time-frame
    b) **TSO-DSO differentiation**
      - Via a careful product definition
        (Time of delivery, geographic scope, technical features)
#4 – DSO boundary vis-à-vis the market

## Challenges

**Basic DSO/DNO tasks**

- "Get basic regulation of DSOs right"

**Commercial business models**

- "Get markets & enabling regulation right"

Different areas where there is no consensus about who should be responsible:

- **DSO?**
- **Commercial access?**
- **Third regulated party?**

"Get DSOs’ roles, boundaries & responsibilities right"

## Three areas investigated in the report

**Ownership/management of metering equipment**

- UK vs. DE vs. IT

**Data handling**

- DSO vs. Central Data Hub vs. Data Access-Point Manager
- Smart Grid Task Force EG3 (2013)

**EV charging infrastructure**

- DSO vs. Charging Infrastructure Operator vs. Independent e-Mobility Provider
- Eurelectric (2010)

Different models – regulated as well as liberalized – have been proposed:

All models have their pros and cons:

- Doubts about non-discriminatory neutral market facilitation
- Higher incentives to innovate
- Higher trust from consumers
- Solving ‘chicken-and-egg’ problem
- Possibility to socialize cost
- Difficulties related to implementation
- Extra regulatory efforts
- Economies of scope/size
#4 – DSO boundary vis-à-vis the market

Volumes – and value of – data increase

- Ensuring stable system functioning and QoS
- Ensuring efficient grid planning

Data = key input for
Ensuring stable system functioning and QoS

While aggregated data is enabling the market...

... personal data is driving it!

Commercial operations

Should aggregated data be managed and provided by a single regulated entity?

If yes, should this be the DSO?

## #4 – DSO boundary vis-à-vis the market

Should new tasks become DSO activities?

[More detailed conclusions on the three individual areas in our report]

In general:

- Tasks may – or may not – be offered at lowest cost and in a more qualitative way by DSOs as compared to other third regulated or commercial agents
- Suitability of a certain model will depend on system-specific conditions
  [e.g. potential scale/scope economies, degree of uncertainty regarding best technological solutions, concerns with respect to possible market entry barriers, etc.]

- As system complexity increases, an insufficiently unbundled DSO could either stay with a restricted set of tasks...
  ... or the DSO could expand its portfolio of activities, but accompanied with an increasing level of unbundling
- Mandate minimum set of requirements on data handling
  [How data are obtained, stored, made available and privacy is preserved – as far as possible independently of from data model]
Synergies between DSOs and ICT
Some thoughts

How to achieve cooperation and synergies between DSOs and ICT companies – while maintaining level-playing field in the market?

• “Joint venture” model?
  – Communication infrastructure for smart grids becoming part of smart grid infrastructure
    i.e. falling into regulated domain
  – ICT companies providing their expertise in building and operating this new infrastructure
    i.e. generating revenue outside the regulated domain

• Tasks of DSOs could be disaggregated into a set of services
  – Business approach shifting from “managing assets” to “managing a portfolio of services”?

Looking forward to your thoughts!
Contact: sophia.ruester@eui.eu