

Supergen Energy Networks Hub Workshop

Stakeholder Engagement for Markets and Regulation - 14th May 2019,

University of Bath, Level 6, 83 Pall Mall, St James's, London SW1Y 5ES

Meeting Notes

Attendees:

Marcia Poletti

Ofgem

Lewis Dale

National Grid

Hui Yi Heng

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Frances Warburton

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Yuankai Bian

University of Bath

Thomas Morstyn

University of Oxford

Andrew Wright

Supergen EN Hub IAC Chair

Nigel Turvey

WPD

Zhibo Ma

National Grid

Alex Howison

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Furong Li

University of Bath

Catherine Adams

University of Bath

David Tolley

University of Bath

Michael Pollitt

University of Cambridge

Chris Harris

npower

Iain Shepherd

National Grid

Antonio De Paola

University of Bath

Iacopo Savelli

University of Bath

Dimitrios Papadaskalopoulos

Imperial College, London

Morning session: Understand industry priorities

1. Introduction – Andrew Wright

Andrew began by welcoming everyone to the workshop, outlining the main themes for the day, and highlighting the key partners in the research. The workshop sits within the Markets and Regulations strand of the project.

He said he hoped that the hub would produce a multi-sector, whole systems approach, with substantial high level engagement between the industry and academic sectors. Innovation was necessary for whole system efficiency. This session would focus on network access.

There will be a strong focus on diversity, equality and inclusion. There would also be international reach as the hub seeks to develop links with other countries.

2. Presentation - Network Access Challenges from New Markets and Regulation, Marcia Poletti, Ofgem

Marcia began by emphasising that the energy system had changed significantly over the past 10 to 15 years. Decarbonisation, heat policy and battery storage were all technological developments that influenced the way regulation should manage the emerging challenges. The challenges that power industry facing are mainly caused by the introduction of renewable generation, which increased from 5% in 2000 to 25% currently.

The main regulatory involvement across the energy system was:

- A need to ensure that there is independent decision making, even though the different energy markets would interact. Independent decision making would be on carbon tax, whole system optimisation, code development, data management etc.
- The overall energy system (heat, electricity, gas) should be considered holistically.
- The plethora of industry Codes prevented innovation; perhaps they were no longer fit for purpose and evolution was necessary.
- Data architecture and data security were aspects that needed careful consideration.

Consumer protection remained essential amidst a growth in:

- Product complexity. Despite the increasing complexity of the electricity system with many actors and rules, consumer protection must also be enforced by providing simple products.
- Currently 70% of consumers are disengaged. Consumers may not want to mobilise their flexibility due to the increased product complexity. Ofgem need to understand the consumer behaviours in the market and other choices/reasons behind purchase; and might regulate market activities instead of license.
- The emergence of Intermediaries
- The advent of transactional platforms, whose purpose may not always be clear
- An understanding and measurement of consumer protection.

There are many extraneous pressures that influence consumer choice, but markets remained important for regulation.

Greater use of markets would need price signals and cost-reflectivity that might cater for:

- Constraints
- Time of use/peak usage
- Intermittency
- Ancillary services
- Whole systems
- Carbon
- Heat, gas, electricity

Problem with current costs:

- a) Some of them are socialised, e.g. transmission
- b) Carbon emission is missing
- c) Should capture and reflect inefficiencies
- d) Benefits are dispersed among too many players

Some ideas about how to improve the pricing. Adjust the percentage of ancillary services on the total energy price. All the markets are interconnected, how to avoid double/under charge. How to provide right signal for short-term operation (efficiently) and long-term investment (where, when, how much). The necessity of increasing the granularity of locational pricing.

Currently key aspects of energy markets are not fully captured. Costs can be socialised, missing (e.g. carbon emissions) or captured inefficiently, or the benefits dispersed amongst too many

players. We will need to make better use of markets to facilitate the provision of robust, low cost, and decarbonised energy.

The energy system is going through a radical transformation with many changes that create challenges and opportunities for electricity networks. Current network access and charging arrangements are not sufficient to address these changes. There are two linked reviews underway to develop reform proposals:

1. **The Targeted Charging Review (TCR)**. This seeks to remove some of the remaining embedded benefits and to allocate fairly the residual charges.
2. **Access and forward-looking charging reform**. The aim is to ensure that electricity networks can be used more efficiently and flexibly so that users can have the access needed at the same time avoiding unnecessary costs.

There is an increasingly constrained distribution system with greater demands placed upon it. What are the messages to be gained beyond time of use signals? What signals are needed for electricity networks to inform decision-making? These could be:

- Signals for short-term operation to effectively manage congestion which need to be dynamic as network use variable
- Signals for long-term investment, where, and how much capacity to add

As energy systems change in the future will it be necessary to add more granular systems? Constraints are an important issue. In the future – the 2030s - there will be more electrified heat and transport, higher concentration of renewables.

There are a number of building blocks for providing pricing signals around network operation and investment. These include: Zonal Pricing; Nodal Pricing; following the “Telecoms” model; shadow pricing; and Status Quo/ Administrative price setting. Aggregators and Flexibility Platforms (such as Green Sync); Congestion Feedback; and Access Markets all provide prospects for change. The choices for the end user could be simple, sophisticated, or complex.

Problems need to be solved:

- a) The appropriate granularity for the system, zonal or nodal pricing? The increased granularity creates a new problem for data collection/management. Consumers do not want volatile prices.
Thoughts on this point: Nodal prices are both time and space cost reflective, but can be very volatile and the local liquidity is low. How to shape the system to safely deploy nodal prices? Consumers do not want price risk, how consumer protection should operate in this context?
- b) Avoid double charge for example the locational signal on the connection upfront charges as well as the ongoing charge.
- c) The degree and balance of the signal for consumers.

Questions: Andrew Wright questioned whether customers were actually interested in price signals or granularity?

3. Transmission Cost-recovery - Balancing Between Investment and Operational Costs, Iain Shepherd, National Grid ESO

Iain Shepherd outlined his role within National Grid which included NOA (Network Options Assessment). Their annual report looks at projects over 20 year horizon. The ESO will review each project submitted by the TO. The System Operability Framework (SOF) that examines the impact on system quality, the 10 year statement, and the Network Options Assessment (NOA) would all be relevant in these reviews.

The assessments would include looking at:

- Transmission boundary conditions
- Options available
- Voltage stability, which is a growing problem
- Maintaining system inertia
- The possible utilisation of storage.

4. How DSO Could Deliver Network Capacity and Meet Customer Needs? Nigel Turvey, WPD

Nigel Turvey began by outlining the functions of a DSO (Distribution System Operator) and its evolution from DNO (Distribution Network Owner). The principal driver for this evolution was the change in the generation mix as a result of the shift to decarbonised distributed generation.

Traditionally the DNO (Distribution Network Operator) provided a network that will be sized to support a multiple of maximum demand and/or maximum generation output. On the other hand a Distribution System Operator (DSO) utilises smarter network solutions (automation, power flow control technologies), and non-network solutions (ancillary services, local and regional network balancing, constraint management) to provide additional network capacity. A close relationship and interaction must be kept with the ESO.

Nigel then moved on to discuss the drivers for change which were both regulatory and political. They included the Governments Industrial Strategy and the BEIS/Ofgem Smart System and Flexibility Plan.

The DSO vision was to:

- facilitate the transition to a low carbon economy
- enhance system security
- keeping network costs down and facilitate third party flexibility access to national and international markets
- facilitate quicker and lower cost connections.

Open data and data confidentiality were major issues.

The DSO strategy objectives included:

- enabling flexible power trades
- active network management by 2021
- a strategy for Electric Nation & EV
- Regional Development programs
- Enhanced system security, especially RoCoF relay settings
- Facilitating low carbon connection – 9.9 GW now connected in WPD

- Signposting future investment needs
- Arranging flexible power tenders
- Community and council based local energy markets.

WPD has been using scenario based forecasting since 2016 to build a regional picture of demand, generation and storage uptake.

There are three sources of Electricity System Flexibility: Large Power Stations; Electricity Network “Smart Grid” and Distributed Energy Resources. But flexibility can also be inherent within the network by utilising features such as asset ratings, voltage regulation, load management, and assets for reactive power production and absorption.

To inform market flexibility markets of requirements, WPD has committed to publishing “signposting” information which describes the constraints that would trigger significant load related reinforcement.

In conclusion Nigel pointed out that there is:

- significant change and uncertainty appearing
- a need for a clear vision for the future
- a need for WPD to make use of network flexibility, and seek third party flexibility
- address perceptions around conflicts of interest.

5. How Can Future Retailers Understand Customers’ Network Needs and Enable Optimum Capacity at Least Cost, Chris Harris, NPower

Chris began by providing some context to his talk. Having worked in the Central Electricity Generating Board and having also been a commodity trader at an investment bank he had seen both sides of the markets debate. He believes firmly in markets as opposed to centralised planning. A market approach is the “least bad” option.

The Climate Change Emergency Changes everything. The future must be electric. He questioned the use of piped gas in the future, and whether it would be better to convert to the electrification of heat and transport.

The 2050 Big Picture: The Climate Emergency presents an opportunity to charge customers and citizens with their responsibility to work together on the challenge. Before Climate Emergency, the most common belief was that technology would solve the issues. If there is recognition that we need active citizen involvement in the low carbon journey this could be achieved with the “D’s”.

The driving D’s are Decarbonisation and Digitisation. The former leads to Decentralisation. This, along with digitisation and citizen involvement, leads to the Democratisation of participation in energy markets. Other Ds follow; such as the Diffusion of research and development into consumer markets and the need for better policy Decisions (for example, the role of piped gas).

The role of the DSO or Supplier should be to bring the “gismo” to market. Questions abound such as how P2P trading should be integrated with the main market? What is the future for gas? Does it have a role?

Discussion: In the short term the market could be redesigned incrementally by developing and testing a variety of solutions for distribution constraints. There are a number of future scenarios, for example:

- i) no gas – is gas important in the future?
- ii) electric vehicles - all shared and on the move most of the time
- iii) ancillary services - decentralised to the meter?

Afternoon session: Academia's strength and gaps. How to address industry needs?

6. How New Markets May Affect Existing Network Access Arrangements, Michael Pollitt, Judge Business School, Cambridge

There are many issues for research:

- The role of DSO/TSO/ISO in the future electricity system
- Future energy and ancillary service market designs – global network distribution.
- Connection charging and incentives
- Local ancillary service markets
- Network charging principles
- Impact of PV and EV on network charging methodologies

There are 7,700 legal distribution networks in the world. The UK is one of the few that is entirely privately owned, which is unusual. The UK distribution voltage at 132 kV is the highest in the world. Few DNOs elsewhere even reach EHV. In the future there will be very different distribution systems which will have an impact on electricity supply.

Conclusions: The future is very uncertain. There is no clear right answer to future market and network charging arrangements globally. Economic principles are important (as well as network physics). These should include equity and efficiency.

There are lots of claims made about the future of energy systems which require careful theoretical/first principles consideration, case study evidence, and cost-benefit analysis. There is a lot to learn from international experience since many other markets have the same issues.

The most important future issues for networks include the decarbonisation of heat and what to do with the gas network.

7. How Could Network Access Arrangement Be Developed in a Highly Uncertain Energy Future, Furong Li, Bath

- There were many different risk and reward dichotomies.
- Flexibility was shifting from central to regional markets.
- Traditionally passive customers could become active customers, and so provide system flexibility.
- Trade-off exists between short-run operational efficiencies and future long term investment efficiencies.
- Increased regional operational intelligence could provide opportunities for flexibility
- There was significant uncertainty to be catered for in DER generation and demand growth.

Furong identified key research questions:

- How to develop a two-tier system that could offer security and affordability during energy transition?
- How to factor differing capacity provisions/increased optional efficiency into network pricing?
- How to quantify 'value of wait' for an investment option with differing/changing levels of generation and load uncertainty?
- How to quantify/estimate current and future operational capability from differing degrees of network and customer flexibility?
- What are the key drivers to determine the right balance between cost recovery from investment and operation, **time to reinforce and time to wait**?

8. The early career researcher then presented their research findings. There were presentations from:

- **Thomas Morstyn** - on liquidity and granularity questioning whether prosumers can provide flexibility for the system, and emphasising the importance of markets staying interconnected.
- **Dimitrios Papadaskalopoulos** – on assessing the value of flexibility, and the modelling needed to move from a centralised to a distributed optimisation. He high-lighted the dangers of group think as illustrated by the 01.30 peak that emerged with the introduction of Economy 7.
- **Antonio de Paola** – on the capability of thermostatic loads acting in energy frequency markets
- **Ran Li** – on the importance of price elasticity in electricity supply, or the lack of it! He believed that attitudes and technological change were the keys.

9. The workshop concluded with some final reflections from David Tolley on the measurement of customer consumption, and the difficulties of the present settlement methodology.

He suggested that when all customers were equipped with half-hour measuring (smart) meters then taking data to a hub at the 11 kV transformation point would reduce the volume of half-hourly data that needed to be transferred to a central settlement system. It would also facilitate the emergence of community based platforms that would enable local trading, against a centrally determined half-hourly price, and congestion management. These platforms would be managed by the local DSO, and the role of supplier reduced simply to providing hedging possibilities.

Power Line Carrier would be the obvious communication technology for the meter to 11kV hub since the circuit was already established, and there would be no transformations in the circuit to disrupt the signal.

He ended the session by congratulating the conference organisers on the content of the event, and thanking everyone for attending.