

A new balancing act for DSOs

Market, regulatory and
business model challenges



The roundtable

More than 50 senior executives and experts from ten different countries gathered in September 2014 in Brussels, Belgium for PwC's roundtable on the market, regulatory and business model challenges facing distribution system operators (DSOs). Participants were drawn from far and wide and included gas and electricity DSOs, power utility companies, industry bodies, government, regulatory and academic stakeholders as well as PwC. The moderators and speakers were:

Andrew Burgess	<i>Associate Partner, Transmission and Distribution Policy, Ofgem</i>
Iñaki Goirienea	<i>Partner, PwC Spain</i>
Dr Frank-Peter Hansen	<i>Senior Manager, Corporate Regulation, TenneT TSO GmbH.</i>
Jeroen van Hoof	<i>Global Power & Utilities Assurance Leader, PwC Netherlands</i>
Dr Erik Landeck	<i>Managing Director, Strategy, Stromnetz Berlin</i>
Dr Salvatore Lanza	<i>Advisor to Board, Italian Electricity Authority for Electricity Gas and Water</i>
Jean Lemaistre	<i>Executive Vice President, Direction Générale, GrDF</i>
Håvard Vaggen Malvik	<i>Head of Public Affairs, Nordics, Corporate Public Affairs, Statkraft</i>
Steve Mullins	<i>Global Smart Energy Leader, PwC UK</i>
Torben Glar Nielsen	<i>Executive Vice President, CTO, Energinet.dk</i>
Susanne Nies	<i>Head of DSO Unit, Eurelectric</i>
Paul Nillesen	<i>Market Design Leader, PwC Netherlands</i>
Plácido Ostos	<i>Market Analyst, Prospective and Technology, Iberdrola Renewables</i>
Jan Panek	<i>Head of Unit ENER B3 – Internal Market III: retail markets; coal and oil, Directorate-General for Energy, European Commission</i>
Dr Michael Pollitt	<i>Assistant Director, Energy Policy Research Group, University of Cambridge</i>
Ben Wilson	<i>Director of Strategy and Regulation and CFO, UK Power Networks</i>
Jan Zöckler	<i>Director, Regulation, PwC Germany</i>

Introduction

Global megatrends are combining with disruptive change inside the power sector to dramatically alter future assumptions about business models and future roles for companies. Welcoming participants to the roundtable, Jeroen van Hoof, PwC Global Assurance Power & Utilities Leader, observed: “Energy transformation is taking hold and is creating and dislocation throughout the value chain. Five global megatrends – demographic and social change; a shift in global economic power; rapid urbanisation; climate change and resource scarcity; and technological breakthroughs – are a very powerful mix in combination.”

The extent of change in the sector is profound and DSOs are right in the frontline of the impact that is coming from the rise of distributed generation as well as smart grid technology. Van Hoof observed: “All these developments are having a big effect on the DSOs and on the wholesale companies. There is a revolution going on. This is not normal change, it is disruptive change.”

The roundtable enabled participants to talk in depth about the different issues facing electricity and gas distribution networks. The proceedings had the benefit of considerable input from policy-makers and regulators, with a keynote address by Jan Panek from the European Commission’s Directorate General for Energy team and presentations from regulators in Italy and the UK.

This publication reports on the many insights that flowed from a very wide-ranging roundtable discussion. We focus on:

- The future for DSOs in tomorrow’s more decentralised and low-carbon electricity market *p4*
- DSOs & TSOs – intertwined in the new market structure *p6*
- The challenge of integrating renewables *p10*
- The future of DSO regulation *p12*

The roundtable had the opportunity to hear from Jan Panek, from the European Commission’s Directorate General for Energy. The start of his presentation highlighted the changing context that DSOs now operate in:

“DSOs are encountering a completely new situation, driven by unprecedented technological progress and new sources of energy. All this translates into a number of significant trends or new realities in the energy space. It includes a shift from completely centralised generation to more and more decentralised, a lot of it on the local low-voltage network and with a system set up for one-directional flow now having to cope with the new reality of multi-directional flows.”

The future for DSOs in tomorrow's more decentralised and low-carbon electricity market

In his keynote address to the roundtable Jan Panek, from the European Commission's Directorate General for Energy, put the latest changes in the context of the earlier introduction of market principles, customer choice and the separation of networks (transmission and distribution) from production and supply: "DSOs have already had the obligation to operate and develop the grid so that it can serve different players who compete in providing consumers with supply services. They have had to operate the network in a way that also makes the network accessible to new players. Now they are coming to a new round of challenges."

Much is made of the unpredictability of renewable generation but Panek pointed out that the key issue is that it is unprogrammable: "With the evolving modern meteorological models it is fairly predictable but it is still unprogrammable. Traditionally the challenge was to align programmable generation with predictable consumption. Now the challenge is quite different and it will become even more so with new types of loads coming onstream, such as the charging of electric cars."

PwC viewpoint: developing future capabilities

"The shift to more distributed generation means that both TSOs and DSOs will need to revisit the capabilities and skills required from their staff. We expect to see an increased emphasis on data analysis and technology specialists over time."

Paul Nillesen, Market Design Leader, PwC Netherlands

Demand management challenges

Panek stressed the difficult nature of the demand management issues that are resulting: "We can balance this if we can have greater flexibility in end use, shifting consumption to times where it helps the grid. But we can't impose this. We have to create a system where people are incentivised to exploit the flexibility in their consumption." Delivering this goes to the heart of the business model: "It needs a very intensive exchange of real-time data and new business models that merge the utility business with IT and telecommunications," said Panek. But he questioned why change was not happening: "We see synergies and we have talked about it for some years and yet the sea change is still not sufficiently visible despite the evident opportunities being there."

New roles for DSOs

The roll-out of smart meters is one of the developments relevant to the future of DSOs. Panek observed: "By and large this is foreseen to be the task of DSOs, although some countries see it as that of suppliers and some envisage data going into a central hub. If the DSO is actually the entity that meters the data and manages it, this puts the DSO in a position of possible advantage. How do we stay true to the concept of the DSO as facilitator?"

A study commissioned by the Directorate General for Energy has looked at new types of services that have the character of natural monopoly and therefore could be conducted by DSOs in a smart grid environment. It outlines five possible service areas – flexibility services; infrastructure provision for electric vehicles; energy efficiency services; ownership and management of smart meters; and services for handling the data from smart meters. "All of these are very important for thinking about the evolution of the DSO business," observed Panek.

1 Ecorys/ECN, The role of DSOs in a smart grid environment, 23 April 2014.

“But if we ask DSOs to do new tasks, we have to incentivise and reward them appropriately,” said Panek. The Commission is currently carrying out a critical review of member states’ tariff systems, looking at factors such as successful and motivating features in existing tariffs, the potential of each tariff system to facilitate DSOs’ transition to new goals and objectives and best-practice tariff structures incentivising efficiency and innovation.

Gas networks – a new transition

In the second keynote address to the roundtable, Jean Lemaistre, Executive Vice President, Direction Générale, GrDF, outlined the potential for new gases, new uses for gas and new ways to operate the grid to play an important role in energy transformation. GrDF is a gas DSO with a 196,000km-long network supplying 9,500 municipalities, accounting for 77% of the French population and 11 million final customers. “Gas distribution provides a history of transitions – from town gas to natural gas in the last century and, looking ahead, from natural gas to renewable. We are now beginning a new transition,” observed Lemaistre.

“An affordable future will come from the complementarities of energies, uses and networks,” said Lemaistre. A study of the French market anticipates that by 2050, in a scenario of high penetration of intermittent renewable capacity and ambitious efficiency targets, the excess of renewable electricity production could reach up to 75TWh (5000 to 6000h) or nearly 15% of the current production of the French fleet and require massive storage capacities.²

“Potentially there is a massive future electricity storage need and the gas grid can be used. The processes are very well known and some demonstrators are being built in Europe,” said Lemaistre. He sees ‘power-to-gas’ as an important part of the future and being the ‘fourth generation’ of ‘new gas’ following on from the first three generations in the form of waste methanisation, biomass gasification and microalgae.

The latter is at the research stage but the first two are advancing fast. Lemaistre reported that: “Green gas generation is already a reality for GrDF with six injecting sites and more than 380 projects in the pipeline.” He also stressed the future importance of bio-methane produced with biomass: “It’s a very efficient biofuel and in France we expect 10% of green gas in 2030 and more than 50% by 2050.”

Operating the gas grid

GrDF’s smart meter programme, GAZPAR, is in its construction phase and is scheduled to enter full-scale deployment from 2017 onwards. But Lemaistre emphasised that the benefits are not for the DSO: “It’s a project driven by the customers. It is a profitable project for the customer but the savings for the DSO are not enough to balance the investment cost and operating costs. It’s only when you add in the energy efficiency and customer empowerment that the overall business case is positive.”

Lemaistre also highlighted new ways to operate the gas grid, involving data, nanotechnology, drones, remote monitoring and control as well as smart meters. GrDF is rolling out a smart pipes project that will provide remote monitoring, remote control and dynamic SCADA (supervisory control and data acquisition) and, eventually, biogas injection monitoring and control. “Today the different underground networks are not connected,” he said. “In 2030 they will be, enabling better optimisation and safety, decentralised electricity, waste to electricity and many more elements in an integrated system.”

Q&A

The Commission would like us all to be smarter but the same commission is questioning whether the DSO should do more when it is a monopoly?

Jan Panek, Directorate General for Energy, European Commission: We do not ask DSOs to be smart no matter what; we seek to promote a discussion where it becomes obvious to what extent it pays off for the DSOs to become smart. We certainly need a model where the grid stays secure and reliable while enabling new services for consumers, who should not pay more than necessary. I am not convinced that this would require a mixed model where DSOs extend their activities beyond natural monopolies.

I think we will see some of the IT players come into this space but isn’t it pretty pointless until the consumer can really see the benefit?

Panek: I agree, and it shows the importance of a consumer focus in smart meters. We have recommended ten minimum functionalities which smart meters should have – for example, it should allow direct access for consumers to the data and, subject to a consumer’s agreement, the provision of this data to third parties according to the consumer’s preference. But in the analysis of rollout plans which we have conducted, we see that 50% of the rollout plans in Member States do not follow the full ten recommended functionalities. This merits further analysis and discussion of whether a large part of the rollouts may not fulfil the full potential of smart meters for consumer benefits.

2 E-Cube/GRT gaz, Analyse du rôle du transport de gaz naturel dans l’économie de l’hydrogène en France, March 2013.

DSOs & TSOs – intertwined in the new market structure

Energy transformation is changing the dynamics of DSO and TSO roles and relationships. Dr Erik Landeck, Managing Director, Strategy, at DSO Stromnetz Berlin, told the roundtable: “We now have 80GW renewables connected to the grid in Germany and the load is 80GW. So we really do have an ‘Energiewende’³!” The impact on DSOs and TSOs is considerable: “In the eastern part of Germany most of the DSOs supply more than 80% of their load by dispersed generation so the TSO is no longer the one who is pushing the load flow from up to down, but vice versa. There are many times in the year where the substations have reverse load flow.”

Integrating new energy sources

There are also different roles among DSOs, as Landeck explained: “DSOs with a lot of energy in-feed have to transport it to the TSO. Urban DSOs (with relatively little distributed generation from wind turbines and solar panels) have to take all the renewable in-feed, either from their neighbours or from the TSO, and organise smart usage of that in-feed. All this is very easy to describe but is very difficult to do because of different market rules and regulatory regimes that are definitely against that. With the additional network tariffs that the consumer who uses that surplus of energy has to pay, most of the business case will not fly.”

UK Power Networks is one of the largest DSOs in the UK. It covers London, the south east and east of England, serving a population of about 20 million people. Ben Wilson, UK Power’s Director of Strategy and Regulation and CFO, reported on the changes that are happening: “We’re on the receiving end of a disruptive wave of distributed generation connecting to our networks. The rate of change is enormous and it’s concentrated mainly for us in the east of England where there is 6GW of peak demand and 2GW of solar and other distributed generation either connected or with a connection agreement. It’s not on the scale of Germany but we’re getting quite close now to being a net exporter to the national grid at times of high sunlight and low demand.”

Snapshot: Low Carbon London

Working with 11 partners, plus specialist suppliers, UK Power Networks’ Low Carbon London project is investigating how ‘smart grid’ technologies can be used to help meet the increased demand for electricity. It includes:

- the first British trial of day-ahead electricity prices
- one of the largest electric vehicle monitoring trials in the country
- responsive demand contracts reducing electricity use and supporting the network at peak times
- monitoring of electricity use from more than 6,000 smart meters
- active network management to connect more low-carbon electricity generation.

Source: innovation.ukpowernetworks.co.uk

3 Energiewende – the name given to the German energy transition.

Q&A

I have two questions from an African perspective. What are the key opportunities to try and learn from some of the mistakes that perhaps have been made in the more advanced economies and are there leap-frogging opportunities?

Ben Wilson, Director of Strategy and Regulation and CFO, UK Power Networks: A big wave of electrification is still to come in Africa. Africa has an opportunity to do that rollout on a distributed basis. That's a pretty obvious point but there are also some very interesting financing implications from that. Rolling out distributed generation is a much more diversified risk with much shorter payback and a much wider range of credit risk compared with large-scale centralised systems. So there's quite a neat financing angle there to benefit from.

Dr Frank-Peter Hansen, Senior Manager, Corporate Regulation, TenneT TSO GmbH: I think it is wise to discuss and be clear about what should come from a central system and what from a decentralised system. I would stress the need to have a well-designed coordination process from the start.

Dr Erik Landeck, Managing Director, Strategy, Stromnetz Berlin: We all know about the defects of central planning in the past but, particularly with a decentralised system, make sure there is a well-designed coordination process between the different parties. You need to cover that from the start, particularly if at some point in time the thing takes off.

Håvard Vaggen Malvik, Head of Public Affairs, Nordics, Corporate Public Affairs, Statkraft: In some parts of Africa, it is perfectly possible to see that we can skip some of the developments that have taken place in Europe. Maybe the grid should not be built everywhere and it is enough that you have a local system that is functioning with the generation resources that are available locally.

More innovation

In the current environment, innovation is becoming an important priority for DSOs and something that is receiving encouragement from the UK regulator, the Office of Gas and Electricity Markets (Ofgem). "Ofgem has been very proactive in incentivising innovation in distribution," said Wilson. "There's a carrot and stick approach which is really driving a change in behaviour. The 'carrot' is a £500m innovation fund that's been available to the distributors over the last five years. The 'stick' is the new RIIO (revenue = incentives + innovation + outputs) model for the next price control period, 2015–2023, in which the regulator is requiring all the companies to include savings from smart grids in the plans."

One of the innovation projects being proposed by UK Power Networks is Kent Area System Management (KASM). "It's very important to optimise the grid so that distribution and transmission work together," said Wilson. "This is primarily a software project, but it will build a link between the National Grid control room and our control room and include a lot of sophisticated contingency analysis software." The project is in a part of the UK where there are complicated transmission constraints as well as increasing amounts of distributed generation and the forthcoming Nemo 1,000MW high-voltage direct current (HVDC) link between the British and Belgian transmission systems.

Smart at the start

A key challenge for UK Power Networks in London is a constant stream of new connection applications for very high single-point loads of 20 to 30MW. Wilson explained: "We have to innovate to connect those loads. Smart meters have been talked about. I do think that smart meters will be an enabler for an additional revolution in energy in the way that we've seen in telecoms. That's going to impact and complicate our interface with the customer on issues such as what the distributor does and what the retailer does. That's another area of disruptive change."

Wilson observed that we've barely started the journey from old grid to smart grid: "We're still in the very early stages. We have limited visibility over our network, better at higher voltages, poor at lower voltages. We have limited control and we do really no system balancing at all, so we're still a very long way from the end stage of this transition."

PwC viewpoint: addressing the challenges

A TSO perspective

Dr Frank-Peter Hansen, Senior Manager, Corporate Regulation, TenneT TSO GmbH, brought a TSO perspective to the roundtable. TenneT transmits electricity via the high-voltage grid in the Netherlands and large parts of Germany. “The TSO/DSO relationship isn’t the classical top-to-bottom one anymore. It’s moving the other way around and it’s difficult to forecast when this is going to happen. So, we need improved coordination among TSOs and DSOs.”

The problem of coordination is all the greater with the very high number of DSOs in Germany, many of them very small. “We’re talking about several hundred,” observed Hansen. “It’s a huge coordination issue and not all of the DSOs are of the same opinion on how things are to be dealt with. So, even coordinating among the DSOs on certain topics is an issue and can become a very lengthy process. We need better coordination, particularly exchange of online data of all kinds between TSOs and DSOs, not only upwards from the DSOs but also downwards from the TSO to the DSO.”

Coordination could be even more crucial if market design evolves to provide greater flexibility in the energy-only market for conventional generation. Hansen explained: “At TenneT we believe that the energy-only market should be strengthened in a way that means we do not necessarily require a capacity market to keep the large conventional generators connected to the grid. But if such a system is to work, coordination among the different parties becomes even more pronounced because of the need to steer all that.”

As well as coordination, Hansen stressed the importance of clear separation of roles: “We do see a problem of DSOs trying, at least in financial terms, to push their congestion problems up to the TSO. There needs to be a clear separation between TSOs and DSOs, with the DSO responsible for their internal congestion.

“We have two ways of dealing with the issues presented by these changes. We can out-build the problem by adding network capacity or we can find new ways of managing the existing networks more effectively, allowing them to cope with the new demands. We should be trying to follow the second approach but it will not be easy. Not only do we need to deploy new technologies but also new commercial and market models that will allow DSOs, TSOs, retailers, customers and new market participants to interact in new ways and trade in new products such as flexibility.”

Steve Mullins, Global Smart Energy Leader, PwC UK

Snapshot: EcoGrid EU

The EcoGrid EU project is a large-scale demonstration of consumer participation in the balancing of renewable electricity generation by active demand response to real-time price signals. The hope is that it will provide preparation for a fast-track towards European real-time market operation of renewable energy sources and demand response.

Torben Glar Nielsen, Executive Vice President, CTO, Energinet.dk*, outlined some of the project’s main features to the roundtable. “We have different groups of people participating in this experiment on the Danish island of Bornholm in the Baltic Sea. We send out a price signal every five minutes direct to the consumers so that we can see how they react.”

“We are creating a new market here. Traditionally it is the TSO taking imbalances out of the system,” said Nielsen. “What we want is that the customers do it themselves by reacting to market-based price signals.” Bornholm provides a unique test environment, as it has a high variety of low-carbon energy sources with 50% of its generation from renewable sources and several demand and stationary storage options.

The project has 2,000 participants in total. Some are reacting to the price signals manually while others have automatic control systems installed. “The first results are expected in spring 2015,” reported Nielsen. “We expect that customers can save 10–15% on their energy bill. In a future world, where electricity is a main supply source for electric cars, heat pumps and so on, that is a significant incentive.”

** Energinet.dk is the Danish national transmission system operator for electricity and natural gas.*

Q&A

Is there scope for moving the boundary between TSOs and DSOs down the voltage levels and would that address some of these problems? In the US, for example, it is 66KV, which is much lower than in Europe.

Dr Frank-Peter Hansen, Senior Manager, Corporate Regulation, TenneT TSO GmbH: From our perspective, yes, because at the boundaries it is very difficult to differentiate. The boundary may be too artificial. There are a number of regulatory issues to be addressed but that is something we are thinking about.

Dr Erik Landeck, Managing Director, Strategy, Stromnetz Berlin: There are a lot of countries with DSOs at the 110KV level. Sometimes the 110KV network serves as a transporting network, but it is the exception not the rule. So most of the DSOs have an integrated planning role for the medium voltage and for high voltage and, because of that integrated planning, they can organise it in a cheaper way. If you changed the boundaries that would mean that you have to optimise between companies and this makes life definitely more difficult. I think in Germany this is not really a discussion.

Ben Wilson, Director of Strategy and Regulation and CFO, UK Power Networks: In England and Wales, 132KV sits with the distributors and in Scotland it sits with transmission but since Scotland is vertically integrated it's a bit of a moot point. If it changed, we'd be left with the 33KV and the 11KV levels, most of which are not connected to each other. So it would be very difficult for us to make the rest of the network smart and to deal in a flexible way with the connection of distributed generation which tends to play now across all the voltage levels. My hunch is that the disadvantages outweigh the benefits.

Do you have a view on the role of national energy markets going forward? Are we still going to see national energy markets in the future or do you think we might see a fragmentation and localised markets starting to be set up and operated within each of the DSOs or within various micro-grids?

Wilson: I think there must be local markets which will develop together with the local distribution but I don't see the national market disappearing any time soon. We're effectively going to have two generation systems and the conventional one still needs to be there for when the renewable one isn't running. As long as you have that need to connect in large point generation, you're going to have a national energy market.

Hansen: We put a lot of effort into deeper integration of energy markets at the European level. Nevertheless, for the time being much of the framework is determined at the national level, for example regarding regulatory affairs. While balancing energy in small unities – for example balancing micro-grids – is an interesting concept, I do not believe that localised balancing will be an efficient concept for the foreseeable future. Actually, right now we are trying hard to avoid the breakup of the German bidding zone by building new lines as quickly as possible.

Landeck: As long as we have a function for the TSO with one area able to help out another area at times of high or low demand, we will have a national or large market. As long as that is true, balancing should be a TSO role and not a DSO role. Once regions split off from the transmission grid, they would certainly have a need for balancing their individual island, but that's not what I see. What I can see is decentralised storage and by this reducing the need for central balancing. We very much try to go in the direction of keeping the German pricing zone as long as possible and even to enlarge it in the long run.

The challenge of integrating renewables

The experience of Spain provides a good insight into the challenge of integrating renewables. Iberdrola Renewables is a leading renewable energy company with a presence in 14 countries, including 5,735MW in its home country Spain. Plácido Ostos, Iberdrola Renewable's Market Analyst, Prospective and Technology, told the roundtable: "Wind energy growth has been very fast in Spain – from just 3.1% of demand coverage in 2000 to 21% in 2013, the largest single generation technology. Instantaneous demand coverage of wind can reach 60% or more."

But unlike many other European countries, Spain has little opportunity to gain flexibility from neighbouring systems: "We are an electric island – even a real island, the UK, has more interconnection capacity than Spain," Ostos remarked. TSO/DSO transparency is one of the factors that Ostos identified as key to successful integration of Spain's windpower: "It's important to know how the system is going to react and behave and how the system will want the renewable generator to behave." All Iberdrola's wind facilities are connected to the company's renewable energy operations centre (CORE), which in turn is connected in real time with the TSO Red Eléctrica de España's (REE) own control centre for renewable energy (CECRE).

PwC viewpoint: flexible use of renewables

"The flexibility of renewable energies in coordination with the TSOs in a transparent manner will result in better integration and management of the electricity system, and help lead to the provision of different services to end consumers."

Iñaki Goirienea, Partner, PwC Spain

Maximising flexibility

Iberdrola has been working with REE to study the feasibility of voltage control and secondary reserve generation control using a cluster of 15 wind farms (~400 MW), as part of the EU-funded TWENTIES project.⁴ This has established that wind farms can provide wide-area voltage control and secondary frequency control services to the system. Looking to the future, Ostos foresees that wind farms will have the technical capability to take part in ancillary services, at least under certain circumstances.

The ability of windpower to respond to system requirements was illustrated in very real terms during the Easter weekend of 2013. It was a period of low demand but high wind generation and very high hydro generation. Ostos explained: "Due to physical security reasons, following heavy rains the hydro could not be stopped, some thermal generation had to stay connected to the grid for technical reasons and we had nuclear and CHP which is not flexible." So the requirement for responsiveness to demand fell to windpower. "Wind helped the system. We increased and decreased the output from wind in line with TSO orders. Wind proved its capability to help the system in this situation."

The rise of renewables was a theme that was also picked up by Håvard Vaggen Malvik, Head of Public Affairs, Nordics, Corporate Public Affairs, Statkraft: "I believe the move to more renewables is quite unstoppable. There will be more renewables in the future whatever we do. The question is, how do we transform the market quickly enough and how do we make sure the companies that have invested over recent decades get their money back? And the next question is what will actually happen to the utility companies in Europe?"

⁴ 'Transmission system operation with a large penetration of wind and other renewable electricity sources in electricity networks using innovative tools and integrated energy solutions'

A different market landscape

Malvik reflected on how different the competitive landscape looks compared to a decade or so ago when the debate was about which company would be taking over another: “Maybe we are in a new discussion of who’s eating whom. Maybe this is the revenge of the consumers. Will prosumers consume the producers? How do companies make money in the future when customers are perhaps defecting from the grid? How can the market be organised so that we will actually be there in the future?”

The future will be one where companies need to rethink how they address the market, said Malvik: “At the moment the market is structured from generation, through transmission and distribution to retail. I think we have to think differently in the future. Let me give you an example from telecoms. Not so long ago I was delighted to cut the cord on my landline phone and move to internet-based telephony. But now of course, I am paying more money to the same company but for a different service. And that is what we have to do – provide different services.”

New products and services

“We need to come up with new products and serve the consumer in a new way. I don’t think the companies that don’t want to transform and think in a more cloud-based way will survive 10–15 years from now,” said Malvik. He went on to outline some of the ways in which Statkraft is looking at new ways of interacting with and providing services to customers as well as being a producer, for example: “Statkraft is looking at virtual power plants; we are grouping together lots of small consumers – PV and wind – and selling together into the day-ahead market and now 25% of the wind production in Germany is handled by Statkraft.”

Incumbent companies are well placed to provide these new services to customers. Malvik pointed out: “We know the market and when to sell into it. We employ a lot of data and weather models and, together, there is profit for the small producers and us. Statkraft is also active in distributed energy and biofuels as well as constructing a site in Germany where we are looking at how solar, battery, wind and hydropower can be used together.”

Q&A

When the TSO curtails your wind generation, are you paid for the electricity that is not put into the grid?

Plácido Ostos, Market Analyst, Prospective and Technology, Iberdrola Renewables: Regular facilities are able to take part in ancillary services like the tertiary reserve, where an offer to decrease production can be made. If a facility’s output is decreased due to real time constraints, payments will be in line with the offer in the tertiary reserve if there is one, or related to the market price if not. Wind is not allowed to take part in tertiary reserve; payments are related to the market price (15%), which is not very much, especially because the price in the market is very low when curtailments are needed. We are working now with policy-makers to allow windpower and renewable facilities to take part in ancillary services like the tertiary reserve, so this might change in the future.

Can you tell us a little bit more about the data and confidentiality periods?

Ostos: In Spain, and it’s something I’m really proud of, everything is public after three months, even the bids to the market of any facility. So that gives a lot of transparency to everyone, not only to the regulator to review but also for others to understand how everything is working.

What do all these changes mean for you as a company when it comes to skills and making sure you are different from others?

Håvard Vaggen Malvik, Head of Public Affairs, Nordics, Corporate Public Affairs, Statkraft: We are still building big projects, wind and hydro power, in parts of the world where the demand is growing, so we still need those skills. In Europe, there is a transformation taking place and we have to think in new ways about how to interact with the consumers. But we will also have to take that thinking outside Europe, to countries like India for instance. Of course, other companies are looking at the same things, so we have to see who wins the race in a few years from now.

The future of DSO regulation

The future of regulation will be shaped in part by the future course of technological change. One is more uncertain than the other. “Thankfully, predicting what regulation will look like in the future is easier than predicting what technology will look like,” observed Dr Michael Pollitt, Assistant Director, Energy Policy Research Group, University of Cambridge. “I think we can see some near-term things that regulators are likely to be interested in and things that they’re already thinking about, which I think can be extended.”

Pollitt introduced some visions of the future UK power grid taken from a study undertaken for the UK regulator Ofgem.⁵ At one extreme is a grid perhaps three times the size that it is now in terms of length and size of assets and, at the other extreme, an alternative vision where the transmission system is smaller than it is today. In between are scenarios such as the energy service company vision where everything is going to be managed by third party IT-driven companies; the distributed system operator vision in which DSOs are going to do the things that TSOs do at the moment but at the DSO level; and then there’s a multi-network vision with a patchwork of different things going on across the network from micro-grids at one end to transmission grids at the other.

PwC viewpoint: coherent market design

“A coherent energy market design is crucial for Europe. Network regulation has to support the energy market by addressing key areas adequately. As DSOs will play a more important role in future, the regulatory framework will be reshaped and sharpened. Since stability is key for the industry, we should share best practices on the European level, but give leeway to the national regulators to decide on the specific framework and rules for the DSOs.”

Jan Zöckler, Director, Regulation, PwC Germany

Competing visions

“It’s clear that these visions are fighting one another,” said Pollitt. “I think it’s important to say that we should keep options open. But we don’t really know which of those visions is best. The development of photovoltaics, batteries and IT all have the potential to totally disrupt the existing electricity system but it remains unclear the extent to which they’ll do that.”

A number of principles are clear, including the presumption of engagement between players and use of competitive mechanisms where possible. “Unbundling is a genie that’s now out of a bottle in Europe and we will be thinking about who owns what, both vertically along the supply chain and horizontally as well. It’s not clear that the current distribution of ownership is going to be the one that will interest regulators going forward,” observed Pollitt. “Nor is it clear that the trend towards larger distribution companies will continue. We might increasingly see carve-outs of distribution networks to integrate local resources with the actual local wires.”

Pollitt highlighted the launch by the New York State regulator of its Reforming the Energy Vision (REV) initiative, in which the six state utilities are to become ‘distribution system platform providers’ (DSPs). “The aim is to set up an intelligent network platform to facilitate more DG and more demand-side management. What’s interesting about it is it’s going to market-based and it’s deliberately designed to encourage new entrants to come in to the market, identifying projects which will use distributed energy resources to reduce costs and serve the needs of the distribution system.”

⁵ Ault et al., Long Term Electricity Network Scenarios, 2008.’

“DSOs will move from something like a night watchman to the centre stage. They will need a bigger and a more sophisticated toolbox.”

Behavioural and social considerations

Pollitt poured a splash of cold water on some elements of future thinking. “Engineers are very fond of talking about the internet of things but to an economist it sounds very expensive. Who is it for except for engineers to play with? And it does have some pretty serious cybersecurity and privacy issues,” Pollitt remarked. He pointed out that economic incentives have to be meaningful to change behaviour: “I’m not going to bother having my dishwasher switch on and off in the middle of the night if all I save is one euro a year.”

There are also social considerations arising from the way in which the energy transformation is unfolding. There’s a danger that it’s better-off people who can afford technologies such as solar but lower-income people face the extra costs, either those arising from a direct subsidy, such as a beneficial feed-in tariff, or through increased grid charges as the better-off customers’ use of the grid declines. Pollitt picked up on this issue: “We need to think about the distributional issue of who is going to benefit from the smart grid because at the moment it sounds like only people with a heated swimming pool or lots of solar panels.”

DSOs at centre stage

Susanne Nies, Head of DSO Unit, Eurelectric, sees a smarter distribution network as key to the future: “DSOs will need to actively manage a smarter grid, rather than just ‘burying copper in the ground’.” Nies foresees that DSOs will keep their role as system operators and as neutral market facilitators, ensuring diversity and reliability of supply.

But with an active grid and active customers, she says “DSOs will move from something like a night watchman to the centre stage. They will need a bigger and a more sophisticated toolbox. Active system management will be important for maintaining the reliability and quality of service. DSOs will also need to manage increasing amounts of data.”

Moving onto market design, Nies said: “We believe that the best way to hedge costs is a regional approach. There needs to be a regional generation and accuracy assessment and compatibility between different market designs in order to make sure all the benefits of the internal energy market aren’t offset by national strategies on capacity markets. The current situation in Europe is a national patchwork of capacity remuneration mechanisms, RES support and even CO2 regimes, which is not the way and is detrimental to integration efforts.”

Nies went on: “There is a need to go away from KW-hours-only approach and look also at capacity. For example, someone who has panels on the roof is using the reliability of the system but not paying anything for it because he doesn’t receive any electricity other than in emergency situations. This kind of service has a price and it needs to be charged in the regulatory framework for this. But again this needs to be done in a European framework and we need to avoid national approaches to these kinds of things.”

Clarity of roles

Andrew Burgess, Associate Partner, Transmission and Distribution Policy, Ofgem, emphasised the importance of clear roles in a future when the number of stakeholders interacting with the system will be much greater: “It’s not just about the network companies anymore, it’s about a much wider range of people. As the world becomes more complicated, the information flows need to be better and there needs to be clarity about who is responsible for what. I can see the potential in having independent bodies balancing the system at distribution level but I think the more people you have involved in balancing the system, the more you need some sort of framework to make sure the overall system fits together.”

Burgess also emphasised the importance of a new approach to regulation: “The regulatory framework needs to facilitate change and enable the companies to change and, in some cases, have strong incentives and penalties to make sure that change happens.” Ofgem has introduced a new framework for network company price control – RIIO (revenue = incentives + innovation + outputs). Burgess commented: “In the new framework we have an eight-year control period and over eight years for electricity distribution there must be savings from new technology. I think it’s fair to say that some of the distribution networks aren’t particularly happy with our assumptions on the level of savings and are challenging us but we do think it’s fair to assume some benefits over the next eight years.”

Other elements of the framework include an innovation stimulus, flexibility in allowing companies to deliver outputs in the best way possible at the best time, and broadly a 50/50 sharing factor of any outperformance. “The other option which we’re looking at is how you give third parties a greater role in delivery, so how do you introduce competition into traditional monopoly areas? We’ve already got competition in distribution connections and we’re reviewing the extent of competition at the moment, but we’re also exploring how you might introduce competition in extending the electricity transmission networks.”

Stability vs flexibility

Dr Salvatore Lanza, Advisor to Board of the Italian Electricity Authority for Electricity Gas and Water, highlighted a key dilemma facing regulators: “We have to reduce the risk of investors by creating stable rules. However, the world is changing so there is another requirement which is flexibility and this is another magic word. Now everything has to be flexible. So, we have to put together stability and flexibility and, of course, it’s not always easy to conjugate stability and flexibility.”

Lanza emphasised the importance of output-based regulation and also a real-life learning approach. An example of the latter is a public consultation in Italy on the design of a mechanism to redefine the balancing market. Lanza explained: “We want to receive ideas and comments on the three models being proposed. One is more or less the standard model with a central dispatching system based on the TSO where both conventional and renewable generators can submit offers to the TSO in order to balance the system.

“Another model is a more innovative model with an important role played by the DSO. The DSO becomes a sort of aggregator of services, so it is a single buyer of ancillary services and then it offers the service to the TSO. In this case, there is a strong interaction between the TSO and the DSO and the DSO is an active market player in the balancing market. Then there is a third model which is in between the first two, an intermediate model, where the DSO is a local dispatcher but without directly participating in the global dispatching market, simply committing itself to a zero balance load profile.”

Lanza concluded by saying that many market design questions remain unresolved: “We don’t know if it is correct to have a single market for traditional generation and the renewable generation. Probably it could be better to have different markets but we need to understand whether this is true from an empirical point of view. Also, we probably have to shift from the model of ‘energy only’ to a hybrid model with capacity remuneration not only for the energy but also for the grids.” He also highlighted a number of other questions that are exercising market participants and regulators in most countries (see panel).

Snapshot: Open issues for a possible new regulation in Italy

- Two distinct regulations, one for RES and one for the traditional sources
- Shift from energy to capacity market
- Negative prices in the Day Ahead Market
- Change in regulation of grids and tariffs following the shift to capacity market (i.e. capacity component much higher than commodity one)
- Degressive tariffs able to push demand and to shift consumption of electricity from other fuels (like gas)
- Incentive for medium-/long-term contracts at retail level, transforming energy markets in markets for services (appliances, heating, etc.)
- Dual markets, price discrimination, product differentiation, etc.

Source: Italian Electricity Authority for Electricity Gas and Water.

Q&A

What suggestions would you make to regulators trying to avoid heading towards the European situation and an increasing bill for renewables?

Dr Michael Pollitt, Assistant Director, Energy Policy Research Group, University of Cambridge: I think the key thing is that you do need to get the prices right. A stream of work is to clearly price the services which a DSO provides and ensure those prices are reflected on to distributed generation and on to demand-side management customers. If the prices aren't right, then there are going to be big mistakes. The issue in Germany was that it was fine for the government to decide to fund lots of distributed generation but it wasn't exposed to its true cost of connection. If it had been, it would have been put in in more sensible places. You wouldn't necessarily have had less in aggregate but you would have had it more sensibly distributed.

Could you explain more about the New York initiative, as my understanding is that it is not all that unique compared with Europe?

Pollitt: As I understand the New York intention, it is to try to put some of the incentives that you see in the transmission grid down to the distribution grid. The transmission grid in the US has very sophisticated markets for capacity, ancillary services and energy that can vary by time and location. They can vary every five minutes and there is nodal pricing. So they've made huge progress at the transmission level and we're way behind in Europe on that. Of course New York is interesting because it has big areas of congestion so you can imagine that there are many load pockets within distribution grids across New York State, where setting up these nodal incentives could really help.

Do you think that economic regulation is going to get more complicated in the future because there are all these potential futures out there and, if so, what should regulators do about that?

Andrew Burgess, Associate Partner, Transmission and Distribution Policy, Ofgem: It's already at times quite complicated and I think one of the challenges is to keep it simple. Actually there are some simple principles around

what we do. It can get very complicated once you get into modelling, benchmarking and everything else, but the principles should probably remain the same. One of the challenges is new ways of doing things or new entities being created who have to come up against a system of codes and licence obligations and everything else which were built for another world. There's the question of the extent to which new parties should be regulated, particularly to protect the vulnerable. That's quite a challenge because if the regulator gets it wrong it could be that the markets don't develop. But equally if you don't have any obligations where they're needed, then you could get failures which mean that the market gets killed because no-one has any confidence in it.

Dr Salvatore Lanza, Advisor to Board, Italian Electricity Authority for Electricity Gas and Water: I agree with Andrew. I think also we have to bear in mind that we are harmonising our regulation in Europe. So if we want to have a single market we have to simplify, otherwise 28 countries will not agree on the same rules if they are too complex. I think that merging our national regulations will be simplifying regulations and probably it is a good thing. In a converged multi-service market, we have to analyse many more sectors. So the work of regulators will probably become more complex – not the final product but the analysis. It's a challenge, but it's also interesting, and we will require more skills and more knowledge.

Do you see DSOs as ready for big data and for all the tasks from smart grids and smart metering, or do we have to face new market entrants from the world of data and online technology?

Susanne Nies, Head of DSO Unit, Eurelectric: Yes we are definitely ready for this. We can bridge the world of private and public. DSOs are acting in the public interest like TSOs and, if you put this into private hands, I think there is a risk for the privacy of the data. We see ourselves as 'neutral market facilitators' on which others can build their business and should build their business because, indeed, there are lots of areas where DSOs are absolutely uncompetitive and shouldn't be competitive with the Googles of this world.

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