



Energy sector
regulation
- designing a
sustainable
and resilient
energy system
of the future



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Roundtable

The ongoing energy and cost of living crisis has highlighted just some of the challenges global power providers face in periods of uncertainty and transition — ones that will only increase as they look to meet net zero targets and embrace a low carbon future.

The role of regulatory market design for achieving the energy transition and lessons from the energy crisis

Designing a sustainable and resilient energy system of the future





Introduction

The ongoing energy and cost of living crisis has highlighted just some of the challenges global power providers face in periods of uncertainty and transition — ones that will only increase as they look to meet net zero targets and embrace a low carbon future.

Central to the discussion is the role of energy policy and regulation in shaping how power markets function around the world — and how state and private organisations work together. This will involve industry leaders, investors, regulators, policymakers and societies forming alliances to find new ways to fuel our future. It will mean accelerating the race to net zero, powering up renewables at an unprecedented rate to create strong, sustainable infrastructure and going beyond wind and solar to develop and scale more innovative sources of power. Doing so will create sustainable and transparent change that radically accelerates decarbonisation while driving greater value intersecting industries and growing new ecosystems.

A wave of deregulation, liberalisation and the introduction of competition from non-traditional power providers is already shaking up the status quo. However, at the same time, the ongoing shift towards renewables and the energy transition in general has exposed shortcomings in the way prices are determined in wholesale markets, the way grids are regulated, and the way end-user costs are calculated.

To meet the challenges, power providers now realise they need to increase investments in infrastructure and production, as well as rethink how they supply power and how and when it should best be consumed by business and the public.

To better understand all the issues shaping the current and future power landscape, PwC recently convened a global roundtable in Amsterdam to share ideas and discuss pathways that can help accelerate the energy transition while simultaneously maintaining security of supply and demand.

The role of regulatory market design for achieving the energy transition and lessons from the energy crisis

– Prof. Dr. Michael Pollitt, Professor of Business Economics at the Judge Business School, Cambridge University

Five key takeaways

- UK retail electricity prices are at levels not seen since the start of mass electrification and wholesale electricity prices are higher than they would be to achieve net zero
- The scale of fiscal intervention in European energy markets has been massive — 758 billion euros from September 2021 to January 2023
- There has been pressure to intervene directly on market prices. However, in the long term we need to rethink and remodel our systems to meet the challenges of net zero
- The energy transition is about accelerating the right investment
- Market design on its own is not enough. There needs to be a supportive and consistent policy environment to deliver net zero

Designing a sustainable and resilient energy system of the future

– David Peters, Chief Transition Officer of Stedin Group

Five key takeaways

- Uptake of solar, wind, charging, EV, large-scale batteries, electrification in industry and heat pumps all are on the rise in the Netherlands and beyond all forecasts
- The energy system is changing and requires new rules of the game
- Major challenges include: rising demand for transmission capacity, funding and feasibility of future investments, sufficient space (permits), supply chains, labor force and new rules of the game
- To meet the challenges, Stedin needs to build, optimise and manage the grid
- Digitalisation is a key part of the focus of Stedin, e.g. to forecast customer demand, profiles (electricity peaks), new technical solutions, congestion management and flexibility



The first panel discussion took a detailed look at current regulatory developments around the world while considering what is required from regulators and network operators. It is namely with them to navigate the current uncertain energy landscape and shape a vision to transition to a low carbon future.

Network regulation will be a key driver of the energy transition, but it has traditionally focused on cost efficiency and ensuring the lowest possible tariffs for end-users. Clearly, as we move from a stable state grid and witness massive increases in investment, the current regulatory framework needs to be revisited and reinvented.

Tanya Hedley, Director of Networks at the Northern Ireland Utility Regulator, set the tone by emphasising that 'regulators are there to protect customers, not companies'. Those people want secure and stable access to power, and regulators have a responsibility to make sure the companies that supply those services are doing so in a sustainable and reliable way. But regulation is also crucial for investment explained Hedley, adding: 'It gives confidence to investors'.

Is current regulation fit for purpose?

The question that all regulators need to be asking is: how can regulation facilitate investments, but also ensure that the right investments are made at the right time?

In many parts of the world the regulatory framework is not structured to enable the sort of investment that is urgently needed for the energy transformation. This is especially true where power providers are starting to transition to renewable forms of energy and there is a shift in the location of power generation and transmission networks.

However, as Hedley explained, smart regulation can 'take the political element out of the equation and give confidence to investors'. The challenge for the rapidly evolving energy landscape is to make regulation more flexible while retaining the consistency and dependability that it has been designed to ensure.

Part of the challenge is bridging the gap between the expectations and the reality of how quickly the energy transition can be achieved. Regulators at international, national and regional level are setting different goals leaving both investors and operators confused. 'Either we adjust expectations or we have to really speed up the transition. And if we want that, then we need to have the right regulatory measures', notes Ingo Schmidt, Director Regulatory Affairs at TenneT, a leading Transmission Systems Operator (TSO).

Getting the balance right

Part of the issue is that power providers and regulators must juggle short-term concerns over increased efficiency of the grid and networks with the mid- and long-term need to decarbonise.

In this respect, regulators are having to weigh investment decisions based on future demand scenarios (particularly in the electricity sector) that they have never encountered before at a time when, in certain parts of the world, network capacity is already approaching its maximum capability. In short, regulators are being asked to make decisions at a scale and pace unlike anything they have done before. This can create a perceived delay in investment approval that then leads to a bottleneck in building energy transition infrastructure.

So, could it be that it is time for the regulators to step aside and just leave it to the markets to set the standards and drive growth? Or should there be more direct government intervention to jumpstart the transition?

The issue is not necessarily the regulator itself but the role it plays in the process said Ingo Schmidt. 'What we need is transparency in how the rules are. We need what I like to call a principles-based approach', he said. Noting that this will deliver long-term stability for investors and entrepreneurs. 'You should agree on some rules and then let the market and the market players play by them.'

Network regulation as a key driver for energy transition

Regulators need to think big

Whatever the merits of government versus free market leadership, the panel agreed that regulators need to start thinking differently if we are to transition our energy infrastructure and systems in a just and effective way.

They noted that while regulators are always concerned about overinvestment, they are not necessarily best qualified to evaluate potential game-changing innovations such as the digitisation of energy infrastructure and systems through Big Data analytics, machine learning and cloud computing.

Likewise, the actions of regulators now can help encourage business and academia to nurture the next generation energy talent and so prevent future work+ force shortages.

'We are a company of 1,700 people, but we have some 600 open positions right now', said Dirk Biermann, Chief Markets and System Operations Officer at 50Hertz, a German TSO whose power distribution is already made up of 60% renewable energy with a goal of reaching 100% by 2032.

The lack of trained personnel is a real hindrance not just for 50Hertz but for power providers all over the world.

'You have to start really early to get people on board. You have to start at universities, schools even. And you have to run very coordinated and very elaborated programmes to attract people', he said.

Perhaps, despite the many current challenges, regulators can act as effective stewards for the consumer while also providing a fair environment for business.

'Regulation is put in place by government so you do not get the short-termism that you would get with political decisions,' Tanya Hedley argued, adding: 'And the whole point is a long-term decision that means the companies look after consumers, both in the short, medium and long-term. Net zero is something regulators are taking into account, irrespective of whether it is been legally put in their duties, because we need to do that for consumers.'



Since the early days of mass electrification, the grid has served as a predictable framework for power providers. Not anymore. The combination of increased intermittency on the network using renewable sources, more electrification, and the scaling up of prosumers, means that managing the power system will become increasingly complicated at both the transmission and distribution level.

This will require not only more infrastructure to accommodate increased loads and load variation, but also new ways to unlock flexibility in the system to increase resilience and to mitigate or minimise new investments.

The second panel focused on the ways that business and regulators can unlock flexibility in the power generation and distribution ecosystem, incentivise end-users to play their part in balancing the grid and embrace emerging business models that will help deliver infrastructure and services that are fit for the future.

New funding models needed

A central part of enabling greater flexibility and fast-tracking infrastructure is getting the funding right. Most power systems are being financed based on historical pricing and planning from the last century. Now though, the transition will require hundreds of billions in investments to build completely new systems of generation and distribution — ones that do not necessarily adhere to the historical dual Distribution Network Operator (DSO) and Transmission System Operator (TSO) framework.

As will bridging the flexibility in capacity that is currently being provided by natural gas believes Dave Rhéaume, VP Integrated Energy Needs Planning and Risk Management at Hydro Québec. '[At present] if you were trying to make a business case for capacity investments or reliability investments, inertia, voltage support, it's not there.'

He explained that currently, the gas market provides a reliability safety net and gas is cheap today. '[The problem is that] there is no business case to develop reliability services based on renewable technologies. So, in the US and Canada, we are decarbonising significantly the energy market. But when it comes to [ensuring] flexibility, it's just not the current reality.'

How tech can help

Plenty of hurdles remain in bridging the renewable energy flexibility gap. Better battery storage technology will need to play a big part as will educating new ways of consumption and production behaviour for both the residential and business sectors. Central to this transformation will be role of technology in the form of automation and digitisation.

'Everything hinges on the smart use of data', argued Raaijmakers. 'Data provides insights. Insights provide behavioural change and that provides flexibility.'

Encouraging behaviour change

An important part of ensuring the flexibility of our new clean energy systems needs to come from changing behaviours both in terms of supply and demand. David Peters highlighted how companies like Octopus Energy have piloted a scheme where they pay customers to reduce their energy usage during 'saving sessions' — relieving pressure on grid at critical times.

But, as René Raaijmakers, CEO of Groendus, points out, changing renewable customer behaviour will be just as important, especially when companies will likely be generating their own power. 'You need to find an incentive for the customers to follow the production cycles of sun and wind', he said.

Groendus is a new energy services company in the Netherlands helping businesses maximise their own renewable energy consumption and production. Raaijmakers highlighted a conversation he had with one of the companies that uses his platform. 'I have one big shipbuilder in the Netherlands, and we are trying to convert fully to solar and renewable energy', he told the panel. 'I said to them, 'you have all this solar power generation on top of your roofs, but your workers are taking a lunch break between 12pm and 1.30pm.' Reconfiguring the working day around the optimum capacity of renewable energy could save the company money and build resilience.



3 Market regulation in the EU

For over 20 years, the EU has had an efficient, well-integrated electricity market, allowing consumers to reap the economic benefits of a single energy market, ensuring security of supply and stimulating the decarbonisation process. However, the current energy crisis spurred by Russia's invasion of Ukraine has underlined the need to quickly adapt the electricity market to better support the green transition and offer energy consumers, both households and businesses, widespread access to affordable renewable and non-fossil electricity.

In mid-March 2023, the EU Commission proposed a reform of the EU electricity market design to boost renewables, better protect consumers from future price spikes and potential market manipulation and enhance industrial competitiveness.

This roundtable considered the role of market regulation in an era where power generation is transitioning away from fossil fuels to renewable dominated framework.

Don't change the rules of the game

Two years of energy disruption across Europe has created tensions among consumers, power providers and investors over pricing, affordability and resilience of energy supplies. These may just be a preview of the issues the power markets will face in the coming decades.

Reflecting on the experience of the last few years, Julio Castro, CEO of Iberdrola Renewables Europe said, 'There must be legal certainty for investors and consumers always [to maintain and build confidence throughout the sector].'

'There's a legal framework and we have to respect that, and we have to maintain a climate of confidence on financial markets. That should be done by keeping the short-term market as it is and taking care of customers through a political entrepreneurial approach – but one that sends a market signal that keeps the lights on.'

Trust the market but be adaptable to change

When considering the lessons of government interventions during the cost-of-living crisis, Michael Pollitt said: 'This was an extreme market test which revealed there's no real alternative to the market.'

He pointed out that the power market is evolving too quickly and widely for direct state control to be effective. 'We're going to see an exponential increase in the number of players in the energy system [including customers and investors]. So, it's not just going to be about energy companies in a traditional sense.'

What will new markets look like?

'Are we thinking too linear?' That is the question posed by Maxine Tillij, Director of Energy System Strategy at the Dutch Ministry of Economic Affairs & Climate.

'I hear a lot about the electricity market today, but I'm trying to design a fully integrated energy system and how does market regulation help in that system?'

Tillij believes that new regulation must balance three core elements – sustainability, affordability and reliability. But to achieve that, she points out that new markets will need to be established for emerging technologies like hydrogen. Most power sector regulation has been developed over the past decades – often prompted by monopoly markets being liberalised. 'Now we're in the situation where we have to create markets. So how are we going to deal with this?'

Don't go it alone

Most countries in Europe have ambitious net zero strategies but are they too focused on their own activities? Michael Pollitt argued that nations need to work together to achieve their own targets.

'Every country is thinking that we need to be self-sufficient in energy but that is the wrong approach. What we need is to extend the European single market. You need to include the UK, you need to include Morocco, need to include Iceland, you need to include Ukraine, you need to include everybody you can gather', he said.

A wider collaboration on net zero will add price complications and require more regulation, he acknowledged. Ultimately though, it will be good news for consumers and every nation that you include.

Market regulation in the EU

Getting the finance right

Net zero needs financial backing. Bringing new technologies online and investing in the infrastructure needed to build sufficient renewable capacity is an undertaking most governments are only starting to grasp. How then can market regulation facilitate investment at the speed required?

'If you look at the development of new technologies for decarbonisation of the industry, we see that hedging is really important', remarked Tillij. 'I always say it's the sum of energy and of investments. We need to make a lot of investments and I think that the energy price is one of the biggest insecurities that most of most companies have. That's where hedging comes in.'

Credit worthiness — particularly in terms of Power Purchase Agreements (PPAs) — is a key consideration for Iberdrola said Castro. 'The finance world has to learn that PPA belongs to the way of doing things correctly and they are safe for companies.' He said the same is true for Contracts for Difference (CfD), noting the company has had good experience entering into them with governments in Germany and the UK.

'You are talking about a state that has a budget and it's signing a security contract with you for 25 or 35 years. This attracts investment if it is well designed across the time. You can extract the value from the technology and from the different counterparties, so that you are fair with citizens because you are lowering the costs of technology.'

Pollitt cautioned against getting too fixated on one financing solution and hence create common terms for every contract in every country. He argued for a diversity of contract positions as that will better protect end consumers in the long run.

'It's clearly the case that having some long-term contracting if you're an energy customer is a good thing. But it's [also] clearly a matter of preference. I'm not sure as an individual energy company customer that I want to sign a 20-year contract for my residential electricity. I think it's good idea to cover some of it, but do I want to lock in all of my consumption for the next 20 years at a fixed price, which might turn out to be very high?'

Who owns the air?

One of the big unknowns as we create new clean energy markets and finance the infrastructure for its success is how will the revenue be recouped? As Tillij explained: '[One of the principal issues that governments are grappling with is] how to establish a system where everybody benefits fully from the investment that we make as a state?'

At the heart of this debate is ownership of the natural resource. As Pollitt explained, 'We are going to have to adjust how we capture rents in the system.' Currently, two-way CfDs through government auctions is one method to capture renewable rents but harnessing the power of different forms of energy are going to require different approaches.

'I think in the longer run we are going to need smarter ways [such as] auctioning the seabed or taxing the seabed', he said.

It's a conundrum that surely will only get more complicated as new technologies such as floating wind farms become mainstream. The challenge for regulators will be to create a system that is sustainable, resilient and equitable for companies, investors and consumers alike.



Market regulation in the EU

What regulators and industry can do now to best prepare for the power transition

Understand the limitations of existing electricity infrastructure and invest in new generation and transmission capabilities

Explore a mix of blended finance to boost renewable capacity

Shape new regulation that takes into account the fast changing make up of power supply and demand

Balance the drive for efficiency with the rate of investment and not lose sight of consumer interests financially, but also account for the broader interests of decarbonisation

Agree that the decarbonisation goal is fixed and inflexible, but allow the way to get there to be flexible and adaptable

Build regional and national power partnerships to strengthen domestic initiatives

Employ new technology to increase efficiencies and improve knowledge of the grid

Invest in a new generation of talent that can help execute the long-term vision of energy transition





The global energy market is in a period of rapid but challenging transition from fossil fuels to renewables. This transition has to happen at pace, but it must also protect consumers while boosting innovation and industry competitiveness.

During the discussions at this roundtable, a number of important themes emerged that can help drive that transition. It quickly became clear that new thinking around network regulation is needed at a time when countries and regions are moving away from central legacy grids and embracing more fluid power generation frameworks with multiple, often new suppliers. Regulators also have to balance investment needs that will meet mid- to long-term decarbonisation goals with the short-term concerns of maximising efficiencies in existing grids and networks.

The roundtable participants agreed that new funding models are needed to meet these challenges. Technology in the form of automation and digitisation will play an important role in facilitating the transition but success will also depend on changing supplier and consumer behaviour.

To meet these changes and challenges, market regulation has to keep pace and evolve. The speakers at the roundtable expressed the importance of keeping faith with market forces and avoiding being overly prescriptive in terms of new regulation. At the same time, regulators should be open to new types of markets that balance sustainability, affordability and reliability. Reassuringly, the conversations showed that regulators have similar ambitions – particularly across the breadth of EU countries. By learning from each other and collaborating, energy markets across the globe can accelerate towards reaching net zero while also ensuring a just transition for both business and citizens.



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