New Power

REPORT

APRIL 2017

'Seed investment is not happening and the biggest factor is the planning regime in England'

Philip Bazin, environment team manager, Triodos

SECURE AND PROMOTE

Have three years of measures helped improve market access and liquidity?

BIG AND FAR AWAY VERSUS SMALL AND CLOSE: funding options diverge

FLEXIBILITY PRODUCTS RE-EXAMINED

'There is not much solar left out there that is easy to do. You have to find it, and find it fast.'

Nicola Waters, Push Energy

£45

Capacity market transitional auction result

TRANSMISSION INVESTMENT: major expansion onshore, offshore; and in interconnectors

Expert information for all those invested in the UK's energy future

Gordon Edge sees a new power paradigm – change will move from the edge to the centre, and a new industry will emerge split between large and small

LARGE AND FAR AWAY...

Nearly a year ago, I wrote a piece for *New Power* on the logical future structure of the electricity market, given the imperatives of decarbonisation, affordability and security of supply. In it I argued that, since the wholesale power price becomes increasingly devalued as low-marginal cost power producers come to dominate, the carriers of value would be the investment instruments of the contract for difference (CfD) and the capacity market (CM), plus a much-expanded market for system services, including balancing and frequency response (read **@ Competition on capacity, CfDs and services is the energy market's future. Excluding low-cost renewables will drive up costs**). All this continues to hold true. However, it is becoming increasingly clear to me that this is not the whole story of the future power market. New ideas at the fringes will come to change how we think about electricity.

The structure I set out a year ago holds true for the bulk power market, where power is generated in large quantities, far away, mediated by a centralised wholesale market and with a central system operator (SO) procuring system-wide services.

The majority of people and businesses will get the majority of their power from this arrangement for some time to come, but there will be an increasing move towards generation that is smaller and more local, made possible by the distributed nature of many renewables and by battery storage, which is inherently modular. The coming digitalisation of power will allow fine control of individual parts of the system, with high granularity, with the demand side as an active participant.

Proponents of distributed generation and storage tend to portray the upcoming change to the system as a winner-takes-all battle, with distributed generation (DG) like the small mammals scampering around under the feet of the dinosaurs; when the meteorite of cheap renewables and digitalisation hits, they think the small and nimble will take over the world and the big lumbering beasts will die. The reality will be much more nuanced. Physics rules, in that the power network is a single large machine where the actions in one part of the system affect the whole. And in reality there is generally not enough distributed resource to meet demand, particularly in urban areas.

But physics also gives us another analogy. There is a quantum revolution taking place in the power industry.

In the early 20th century, the world of physics was turned upside down. A well-functioning system – Newtonian physics, which explained the world as we had observed it – started to break down. New information brought by innovation in experimental science was telling us that, at a different scale, the world worked in a different way. Much intellectual ferment led to the new 'settlement', in which classical and quantum physics coexist, each appropriate on its own scale.

OR

The lessons for the power sector are clear. A system organisation that has served us well is being challenged and if we get into the granular ends of the grid, the rules will be different. As with quantum and classical physics, two systems coexist and are appropriate at the right scales.

Working out the *modus vivendi* between these two realms in the power sector is going to be tricky, when they both use the same network and it must remain stable. Where the analogy breaks down is the feedback loop. As the edge of the power system changes radically, the 'classical' power sector will be affected by the coming revolution. On the other hand, it is a useful lesson that existing systems can continue to function well, even as there is a revolution in our understanding. There is a lot of 'intellectual inertia' in the current power system.

Our analogy reveals some implications of this dual vision of the sector. >

...SMALL AND CLOSE BY

Large and far away...

Clearly the real innovation is going to be at the distributed level, because this is where the new technologies are different from what we have now. Storage and demand-side response will to some extent change the way the bulk system will operate – but at the grid edge the change will be revolutionary.

QUALITY NOT QUANTITY

Customers will move away from the mainstream grid, instead using private wire or physical microgrids, with on-site storage. Unless a place is especially blessed with renewable resources it will still draw some power from the grid, but the quality of that interaction will be quite different, and smaller.

...small and close by

Business models at this scale will evolve rapidly to take advantage of new technological opportunities, but will have to interact with a wider wholesale market. That market will evolve, and although its function will primarily be managing dispatch, not providing an investment signal, it should remain recognisably what it is today. This is where the analogy with the interaction of quantum and classical physics may be most instructive: the interaction between the 'new' system and the 'classic' power market is going to be the tricky part, as the behaviour of prosumers at the end of the grid will change as they get new technologies and controls, and start to receive new price signals.

LET'S TALK ABOUT CHARGING

If we are going to see the full flowering of the distributed power model, then we must talk about network charging. Proper cost reflectivity must ensure that users pay for the wires in proportion to the burden they are placing on the system.

If, at any node in the system, users generate, consume and balance electrical energy such that there is no physical flow from the wider system into that part of the network to serve that community of users, why should they have to pay for that wider network? I call this the 'virtual microgrid', because it creates the relationships that exist in a physical microgrid while using the open public power network to mediate it.

On the other hand, if you are physically connected to the wider system as backup or as a means to trade surpluses and deficits, then you have an interest in the existence of the system as a whole, and therefore some kind of fixed charge, perhaps based on the capacity of your connection, is logical.

I suggest users should pay for the network on the basis of a usage charge, strongly connected to the net charging principle, plus a fixed capacity charge. The balance between these would need careful consideration to ensure that the incentives are correct, but it surely must be right that consumers who are taking responsibility for their own energy supply and balancing be relieved of at least some of the costs of the infrastructure and balancing supplies needed for everyone else to get their electricity.

This is why the current Ofgem review of embedded benefits is so pernicious in my view. Rather than deal with the root cause – the structure of demand network charges – the regulator has breached the principle of net charging for certain generators. It argues that the current arrangements are not cost reflective; I would counter that net charging is the only way to ensure that customers pay for the system in proportion to their use of it. If Ofgem confirms its 'minded to' decision to dramatically reduce embedded benefits payments via Triad, it will only be a matter of time before we will have to reverse out of that dead end and reinstate net charging. >

I would extend the net charging principle further, to apply to the levies that suppliers attach to bills to pay for the Renewables Obligation and the CfD. If a virtual microgrid runs on local renewable supply which has not benefited from support through one of these mechanisms, and thus is taking responsibility for its own decarbonisation, then why should it pay for everyone else's? One of the barriers to truly merchant renewable investment is the legacy support mechanisms that place a burden on all power supply. The implicit assumption is that only the RO/CfD is being used to drive investment in renewables. If we want an exit route from our current market structure to one that allows commercial low-carbon generation investment, then I think we have to bite the bullet and adopt a 'pay for service' approach – and if you don't take the RO/CfD service, then you don't pay for it.

> CfD procurement should be divided out not by technology but by scale and geography

It is worth noting the dangers of this approach: if we allow users to defect from network charges or decarbonisation levies, others could jump on the bandwagon leaving a smaller number to pay the same fixed costs. That could simply drive more people to defect – the so-called death spiral of the grid. I think this danger is exaggerated, as defectors must be able to generate all their power on site at a competitive cost, and renewable resources are not distributed in such a way as to allow that. But it is true that equity issues have to be addressed. Those who do not have the ability to defect must not be left with the network and decarbonisation responsibility and cost, and the danger of sudden waves of disruptive defection should be considered. Nobody said revolutions are painless.

SPLIT THE MARKET DIFFERENTLY

How might we expect the wider power market to change in reaction to the revolution at the fringes? I can sketch a future.

The rollout of storage, demand-side response and interconnection will provide a form of cap and collar to the power market. If prices are low, the batteries will charge, demand will move to that time or other markets will take the power; if prices climb, then the batteries discharge, demand moves away from that time or interconnectors import. So although growth in renewable generation drives increasing price volatility, it will be curbed by the new flexibility options. When this 'contained volatility' has a track record, a supplier or pure financial player can be expected to step into the market and sign long-term power purchase agreements (PPAs), in the form of a CfD indexed to the short-run power price, as long as the strike price is comfortably within the range of volatility. The key will be the track record of the market price in this arrangement, alongside the risk appetite and credit rating of the PPA providers.

In this environment, one can even see the way to more radical options, such as the privatisation of the Low Carbon Contracts Company (LCCC).

The vision depends on the risk-reduction characteristics of the CfD, but does not need the counterparty to be a state actor. In government's original conception of the CfD, the counterparty was 'synthetic', taking form from suppliers' requirement to pay the CfD levy. This is merely taking that idea a step further; passing ownership of the LCCC to the collective of suppliers without the need for a legal sanction to underpin it. Suppliers could pool their needs for new low-carbon supply through a mutually owned LCCC, and if they were able to provide for them without the need for the collective CfD, they would be free to go that route.

In this scenario, the system operator would retain control of the capacity market because it is a security-of-supply measure, although working out the procurement volumes would become more difficult as the number of players with distributed storage escalates.

Finally, in the short term there is a good argument that CfD procurement should be divided out not by technology but by scale and geography. Large, far away generators – new nuclear, tidal lagoons, offshore wind and onshore wind on remote islands – can conceivably compete on a technology-neutral basis. Such projects are similar enough in size, lead time and lifetime to allow for meaningful competition. Smaller, closer projects also have similarities, but may have to compete regionally rather than nationally. At this regional level, the market for the CfD could blur into a form of local supply, with the need for collective procurement perhaps disappearing completely if such supplies do not attract decarbonisation levies.

The quantum revolution left physics in a very different place than it was before, and so it will be in the power sector. But there were physicists who resisted: Einstein himself said "God does not play dice". Stephen Hawking's rebuttal – "Yes He does, and sometimes He throws them where they can't be seen" – is a lesson for us.

No-one can accurately forecast what will happen to our industry, because much of the action will happen behind the meter, where it cannot be seen. NP

Dr Gordon Edge is an energy industry expert and director of Inflection Point Energy Consulting

New Power is a specialist monthly report for anyone with an interest in the UK energy industry.

Why subscribe?

New Power is a cost-effective way to keep up to date on shifting UK energy policy and delivery, stay fully briefed on an evolving industry, and have fast access to data you need.

Subscribers benefit from three complementary services tailored for readers with a financial interest – direct or indirect – in power in the UK:

Online Databases of UK power projects and tendered network assets

- Over 2000 projects
- Constantly updated
- Conventional, renewable and unconventional supplies (eg interconnectors, storage)
- In operation and throughout the development pipeline
- Easy to use online
- Filter by type, size, location, developer, status, and more.

M**onthly New Power Report,**

- All the news you need – none that you don't
- Interviews with key industry figures
- Reports on industry issues, political debates and research results
- Regular research into industry opinion
- In depth features on industry issues from expert authors – with the data
- Opinion from the industry's influencers

Weekly New Power Update e-newsletter

- news from the website

Keep in touch with industry events, consultations, and other key dates at www.newpower.info/agenda