

## **Power cuts and how to avoid them**

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Whatever the approximate causes of the particular power cuts in mid-August this year, the very idea that the electricity system could be brought to its knees just because a couple of power stations dropped off at short notice should send alarm bells ringing in BEIS and the Treasury.

National Grid is correct in pointing out this was a rare event. The power cut lasted for less than an hour. There were failures by the multiple parties that are jointly providing and distributing the power. National Grid got the system back up and running very quickly, and appears to have been extremely professional in its responses. Whilst all this of course matters, and will be the subject to the various inquests into the details of this unfortunate episode, the key point is that the power cut should never have happened in the first place. If power cuts can happen when just 2 power generators drop off, then something fundamental has gone wrong.

### **Three lessons**

There are three lessons from this power cut. First, what happened in that hour reveals a central truth about our economy, and that is that security of supply is much more valuable now than even a couple of years ago. The economy is digitalising, and almost everything digital is electric. All our main infrastructures now depend upon a reliable supply of electricity. They all depend upon the communications networks, and they need electricity. When the trains ground to a halt, the transport dependency was stark. When the lights went out, so did all the digital devices in houses and commercial buildings. Even the traffic lights failed. We need a higher level of security of supply than ever before, and as we complete the transition to a digital economy (and net zero) we will need ever more security. What was good enough a couple of years ago is not now. What we need in the next decade is a lot more security.

Second, the power cut revealed just how fragile the system is becoming as it relies on more and more intermittent renewables generation. This may not have caused the power cuts, even if a wind farm drops off, the intermittency of the capacity on the system makes it harder to secure supplies. It is just a fact that a power system with lots of intermittent renewables is harder to manage, and need a lot more extra capacity to absorb and manage both anticipated and unanticipated events. Most renewables power is not firm power. More renewables mandated, by the net zero legal requirement, mean more equivalent firm power.

Third, the power cuts also revealed the exposure of the networks themselves and their resilience. It took out not just one part of the networks but several. This matters, as Ofgem is currently determining how much investment, and therefore resilience, the networks will be allowed to build in after the periodic reviews. More resilience means more investment and capital maintenance cost, something Ofgem will have to consider (along with how far the network companies have been doing sufficiently in the past).

### **Making sure the system is more resilient in future**

There is now a BEIS-driven review, as well as one by OFGEM. The former really matters, whilst the latter is inevitably about whether National Grid and the other parties fulfilled their licence function. For the BEIS review, it should do a quick analysis of the costs of extra firm and flexible capacity, and compare these costs to those the economy experienced from this short sharp shock. It would be surprising if this sort of calculation produced any other result than that extra spare capacity is a bargain. The costs of too much capacity are trivial compared with too little – and will become more so as the economy digitalises.

Once the review has established the obvious conclusion about the need for a bigger capacity margin and the flexibility to go with it, the really important questions can be addressed. These were all set out in the [Cost of Energy Review](#) (Helm, 2017). Amongst the recommendations, two stand out: separating out the system operator functions and placing these in the public and not private domains; and integrating and normalising the

renewables into a single market framework, focussed in an Equivalent Firm Power auction market.

The National System Operator (NSO) deals with the public system interest, not those of shareholders. Security of supply is a public good. There is an inherent conflict of interest between the transmission owner and operator and the NSO. This is readily acknowledged in the byzantine contortions that form the ring fence internally separating out the SO in National Grid. None of these would be necessary if the conflict did not exist. It is time to stop pretending and to create clear blue water between the two.

This is not only in the public interest, but arguably also in National Grid's interests too. There is little upside to its shareholders from owning the SO, and lots of risk, especially reputationally, as the recent power cut has revealed. National Grid finds itself in the firing line for things which really are not its business to determine. Who knows what National Grid has been telling BEIS about the security of supply issues, including the consequences of more intermittency and the dropping off of coal and soon old nuclear and gas from the systems? This should all be public, between a public authority and the government, not a private company. Added to this is the convenience for government to blame National Grid for when things go wrong. National Grid's shareholders will no doubt recognise this blame incentive risk.

The *Cost of Energy Review* recommended that the SO functions be split off into an NSO in the public and not the private domain. It also recommended that Regional System Operators (RSOs) be set up to coordinate the regional decentralised electricity systems that are emerging. It urged the government to be pro-active in doing this and not to repeat the mistake it made in leaving the SO with National Grid, by letting the distribution companies (DNOs) set up their own Distribution System Operators.

It is perhaps even more important to separate out the RSOs, because of the competition between active demand management, local renewables in the distribution networks, batteries and storage, as against network investments and expansion. The conflict of interest in the DNOs is even deeper than that in National Grid.

If the government fails to spilt out the NSO and the RSOs, then it should not be surprised by the consequences that flow. The recent power cut may turn out to be but one of a very painful cascade of difficulties in the years ahead, as the system moves from existing baseload nuclear, coal and gas to one which relies overwhelmingly on smaller scale intermittent renewables and perhaps new nuclear, all zero marginal cost.

In the process, the new and emerging technologies will be hamstrung by the interests of the DNOs, and hence the crucial technical changes will happen more slowly if at all. Net zero adds an urgency. Failing to implement these recommendations does and will have consequences. Ministers can duck the decisions, but they cannot duck the consequences. There has now been a nasty wake up call. There will probably be more to come.

As the importance of security of supply rises, with the rising costs in a digital economy of interruptions in supply, the overall capacity margin should be correspondingly rise, and the flexibility elements should be bigger too, and all should be brought within the ambit of an Equivalent Firm Power auctions, proposed in the *Cost of Energy Review*. Security of supply is a public not a private good, and will not be optimally provided by the market. It needs to be set and managed by the public NSO and RSOs.

### **Normalising renewables**

The *Cost of Energy Review* recommended that a central aim of policy should be to normalise the renewables. Instead of having a large centralised and firm power set of coal, gas and nuclear power stations, the future is probably one of small-scale renewables, and these in turn raise the fundamental system question of how to handle their decentralised position in the networks and their intermittency. This should be the central focus of the new energy markets, with the residual fossil-fuel power stations as add-ons. All this should be set in the context of whatever nuclear capacity emerges (more on this below).

A market which normalises renewables should have an Equivalent Firm Power (EFP) capacity auction at its core. It is *firm* power, because we want to know we have enough capacity available to keep the lights on. No system can ignore the central firm power

requirement. The new problem is that not all power is firm, and for two reasons. The first is that some of it is intermittent. To have a wind farm on the system adds to security, but not as much as would be the case for a baseload conventional plant. Intermittency causes system costs. These will not go away by pretending that the wind farm does not impose them. So, it has to be de-rated in working out the total firm capacity required. This is what already happens by default as part of the National Grid's operations. In an EFP auction, which is really the capacity auction expanded to take account of the intermittency and one that integrates the renewables, the wind farm bids less, and gets less money through the capacity payments. It can of course rectify this, by side contracting with other supplies of back-up power - for example batteries, other forms of storage, demand-side responders and even small gas generators - to improve its firmness and hence be de-rated less.

The EFP auctions positively incentivise the renewables to foster and grow the technologies which mitigate their intermittency. For solar, it is about storing power to use at night, and for very overcast days and of course for the winter loss of generating hours. It is a market-based approach, which avoids the need to plan the system, pick winners (or, as so often, losers) and thereby avoids the huge lobbying pressure that state planning brings, and indeed is already evident in the differential subsidies that each renewable technology has been able to persuade the government to grant. The EFP auctions, run by independent NSO and RSOs, identify the most competitive options available.

There is one further reason why the EFP auctions approach is getting urgent. Most of the renewables are zero marginal cost. That means that there is little long-term future in the wholesale electricity market (which is supposed to reflect marginal costs). Electricity generation is becoming a capacity provider, rather than an energy-only provider. It is more like fibre and broadband, and less and less based on the twentieth century fossil-fuel driven wholesale markets. It is increasingly absurd to pay for electricity on the basis of the marginal coal or gas plant, when so much of the costs have nothing whatsoever to do with their marginal costs.

## Baseload and nuclear capacity

In looking ahead through the next decade, the coal is going and going fast (and from a climate perspective this exit is the cheapest option to bring down emissions in the short run). The zero marginal cost renewables, subsidised through direct contracts, are wreaking havoc on the economics of existing gas power stations. As the renewables grow there will be increasing times when the wholesale price is zero or even less than zero. The gas power stations can only make money when the wind does not blow and the sun does not shine enough to cover the total market demand.

The result is not only that there is little or no incentive to build new gas power stations. Indeed, none were successful in the existing capacity auctions, and are unlikely to be so in the EFP version. The existing gas stations will get mothballed and closed earlier too. Baseload is no longer going to be a feature on the system.

Does the system need baseload? The answer is unclear: the system could get by without any baseload, but it would then need a lot of flexibility through storage, demand side and so on. If there is to be no baseload, then the NSO and RSOs will need to really push on with increasing dramatically the availability of ways to make the renewables into firm power. This may happen, but it is unclear what the timeframes will be.

In such circumstances, it might be considered appropriate to have the insurance of *some* baseload, just in case. However, all the conventional baseload is carbon emitting, and with the new net zero target, there is not much room for even large gas stations by the latter part of the next decade. And if there is going to be a gas power station cut-off (or the much higher costs of applying CCS to existing gas) then this will be taken into account by the current owners of these plants. As with coal, as the end date closes in, some of the power stations tend to go earlier. This will be all the more the case as the renewables' zero marginal costs undermines their revenues.

It is in this context that the nuclear question raises its head, as the only large low carbon baseload contender. Some claim that decarbonisation cannot be done without nuclear. This is not true as a matter of principle. It can be done without it. But it is not really

about the theoretical possibilities: it is about practically getting net zero at as low a cost as possible.

The government has committed itself to a nuclear future. The trouble is that having committed itself, it has pursued one of the worst strategies available. Unsure of how to proceed, its policy has been try three different technologies and three different financial packages to see which works. It is already pretty clear that this involves a colossal waste of time and very high costs. Two of the three options have already been abandoned, and the third (at Hinkley) is unlikely to be replicated.

If the government really wants to do nuclear, then it has to come up with a better model. It could do this like the CEGB (and EDF in France) have done it in the past. It could treat these as state projects and use state monies to pay for building them. Most nuclear in the world is explicitly or implicitly carried out through state-supported businesses. Indeed, Hinkley is being built by a Chinese state-owned nuclear business and an 85% state-owned EDF.

The alternative option is the RAB model, and this is subject to consultation. My views on this model are set out in [The Nuclear RAB Model](#) (Helm, 2018).

### **The White Paper and the Energy Bill**

The *Cost of Energy Review* added a number of additional recommendations. It made recommendations about the future regulation of the networks and how to move away from the periodic reviews. It proposed significant simplifications of the licences, and a thorough overview of the multiple carbon prices in the economy.

BEIS and the Treasury have sat on the *Cost of Energy Review* for almost 2 years, while working towards a White Paper. Partly because of BREXIT, but also because of the lobbying by vested interests who make money out of the existing inefficient energy policies, this White Paper has yet to see the light of day. With the government the effective customer for almost all new generation, and OFGEM effectively determining

investment in the networks, it is not surprising that electricity has become like agriculture – a market for capturing economic rents from the government contracts.

The two years of inaction have had a price. It is to allow the electricity systems to come closer and closer to the edge of the capacity and flexibility margins, and to have much more cost than they need to. This is a price that customers are paying as the legacy costs pile up on their bills. It is now aggravated by the lack of security and resilience in the system that the power cut revealed.

The optimistic take on recent events is that the power cuts will be a wakeup call to BEIS and the government to get on with the White Paper and the legislation that will be required to implement the evolutionary changes now urgently required if the economy is to continue to be able to rely on secure supplies and the innovations that are coming are to be grasped. The recommendations in the *Cost of Energy Review* are all on ministers' desks. They just have to get on with it, or face the inevitable consequences of indecision and delay. That is the choice, and it matters not just for the security of supply but also to credibly march along the path to net zero to which the government is now legally committed to.