BIG

A BRITISH INFRASTRUCTURE GROUP (BIG) REPORT

Electric Shock:

Will the Christmas lights go out next winter?

Chaired by the Rt. Hon. Grant Shapps

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Who is the British Infrastructure Group?

The British Infrastructure Group of MPs (BIG) is led by The Rt. Hon Grant Shapps MP and is dedicated to championing better infrastructure across the United Kingdom (UK). The core purpose of the group is to ensure every opportunity for growth is seized, with bold and thoughtful recommendations, backed by authoritative research and evidence. Each BIG report focuses on a different aspect of national infrastructure, identifying shortcomings and setting out measures for improvement. BIG firmly believes that the UK can and should lead the world in infrastructure, technology and innovation.

This BIG report investigates the UK's current energy woes, focussing on the dangerously small electricity capacity margins that have been left in the wake of a decade of target-led, interventionist energy policy. While nobody questions the noble intentions behind these interventions, it is clear that a perfect coincidence of numerous policies designed to reduce Britain's carbon dioxide emissions has had the unintended effect of hollowing out the reliability of the electricity generating sector. Current projections place the cost of covering potential shortfalls at well over a billion pounds by 2020-21. With top officials suggesting candidly that some measure of energy austerity might be implemented to save costs, British energy policy will soon be, if it is not already, in crisis.

It is in the interests of businesses, consumers and indeed Government to see the UK's economy become more electric. Electrified infrastructure provides many of the answers to our currently high-profile problems of noise pollution, poor air quality and resource overconsumption, especially in our big cities. Reliable, low cost electricity is also a requirement if we are to keep or grow any kind of modern, energy-intensive industries on our shores.

A radical rehabilitation of electricity markets is required to bring both consumer prices and capacity concerns under control in the short term, but in the long term, the Government should work to make it profitable for private companies to invest and innovate in our electricity markets once again.

The Rt. Hon Grant Shapps MP
Chair of the British Infrastructure Group of MPs (BIG)

Executive Summary

This winter, and for the foreseeable future, British consumers will be unwittingly paying millions extra, with permanent bill rises factored in to National Grid's emergency power strategy. With energy mandarins failing to plan for the future, BIG warns that Christmas lights could soon be going out all across the nation.

During the 1990s, the UK electricity market underwent nothing short of a revolution. In an unprecedented break from the past, the Government legislated to break up the national monopoly of power generation in the country, causing prices to come tumbling down for all. Now however, with the revival of Government targets for closing coal power stations and for expanding renewables in order to pursue overly ambitious climate change goals, the UK's electricity generating output has been rapidly reduced, slashing capacity margins and allowing prices to shoot upwards.

This BIG report warns:

- By next winter, the Christmas lights could go out.

- National Grid's safety buffer this winter has shrunk to 0.1%. There is a sustained danger of intermittent blackouts for the foreseeable future, thanks to dwindling base capacity and freak weather events.

- This winter, National Grid will pay around £122.4 million for emergency power. This is 800 times the average wholesale price for 2015 and four times the cost of last year's emergency reserves.

- To plug the capacity gap, mandarins warn of a permanent increase in household energy bills of £10-15 on top of current trends and even some rationing of electricity to ease costs. However BIG estimates that these bill hikes could be as much as £30 extra per year by 2020, twice Government estimates.

- National Grid's measures for coping with peak demand already include restarting old coal power stations and asking factories and hospitals to run emergency diesel generators. Grim future scenarios see electrification of green infrastructure taking a backward step.

- EU plans crackdown on carbon emissions from emergency power, potentially bringing court cases and fines for National Grid's emergency measures in future.

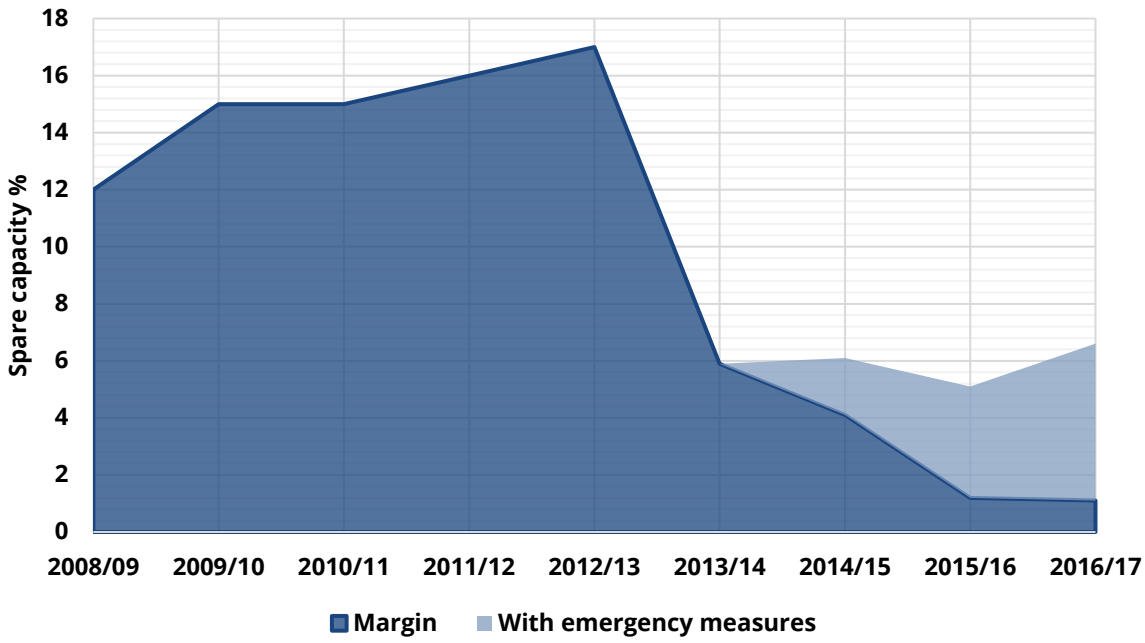
- Comprehensive rehabilitation of electricity markets is required to bring consumer prices and capacity concerns under control.

1. UK electricity capacity margins

During the 1990s, the UK electricity market underwent nothing short of a revolution. In an unprecedented break from the past, the Government legislated to break up the national monopoly of power generation in the country, placing the system in private hands for the very first time.[1] In 1998, households were given the freedom to choose their own suppliers – again a massive change from before and something never before tried in a major economy.[2] Prices were competitive. Three day weeks were, for now, a thing of the distant past. Capacity margins were barely a concern.[3]

More recently, climate change has become a major factor to be considered in energy and electricity policy. Understandably, in order to limit damage to the planet, international agreements have driven advanced economies to take measures to decrease their carbon dioxide emissions. However, the closure of the most polluting coal power stations and expansion of renewable power generation in pursuit of these goals has rapidly reduced the UK's electricity generation output, slashing capacity margins. In the past few winters, this safety margin has fallen from around 17% in winter 2011-12 to 1% this winter (see Figure 1). The full causes of this are discussed later in this paper.

Figure 1: UK electricity capacity safety margin (Winters 2008-2017)[4]



[1] C. Robinson, *The Return of Centralised Energy Planning,* 2013 accessed 07/12/2016 at: <https://iea.org.uk/wp-content/uploads/2016/07/ecaf12040.pdf>
[2] Ibid.
[3] J. Constable, "The Cost of Preventing Blackouts", *B&O,* Winter 2015/16, vol.45, no.4.
[4] National Grid, compilation of Winter Outlook Reports 2008/09-2016/17,, accessed 07/12/2016 at: 2008-09, 2009-10, 2010-11, 2011-12, 2012-13, 2013-14, 2014-15, 2015-16, 2016-17.

Following warnings over these falling capacity margins, National Grid[5] has been authorised by Government to pursue emergency measures to cover peak demand periods and prevent blackouts. In essence, the question the public and business should be asking Government is not whether the Christmas lights will go out this winter, but rather what price consumers will have to pay to keep them on.

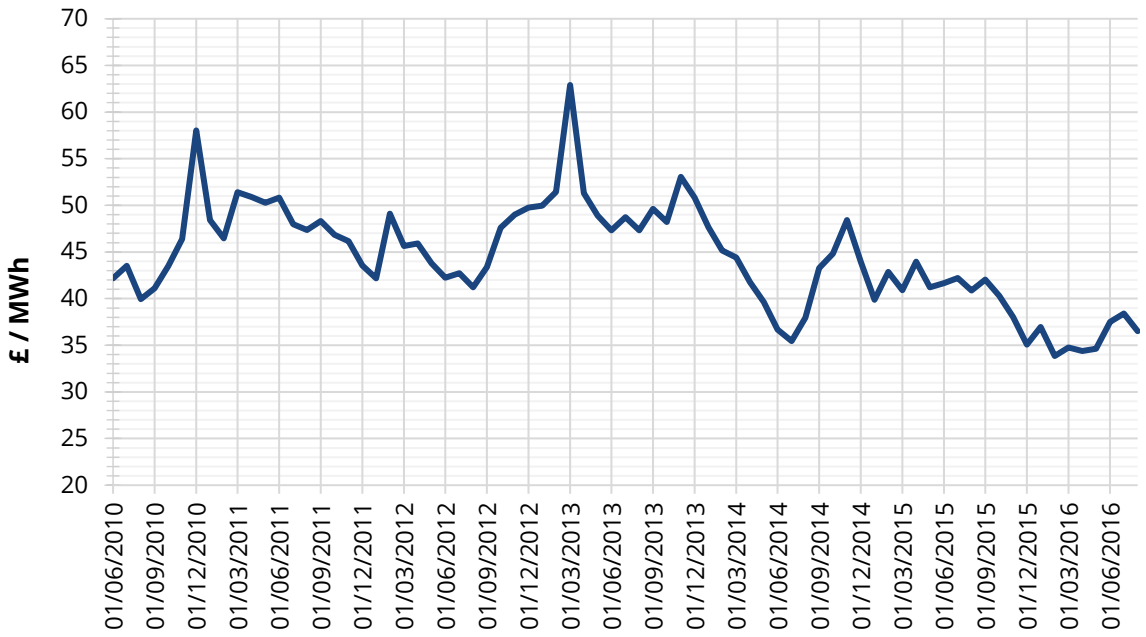
[5] It is important to remember that National Grid is a private company, not a Government body.

2. The costs of emergency power

Government has authorised National Grid to procure emergency power supplies to stop the lights going out. These are, in effect, contracts whereby power stations not trading in the normal energy market are paid an exorbitant sum to be kept in stand-by mode over winter. According to National Grid documentation, such stations can be called upon to start generating just 89 minutes in advance.[6] This system is known in the jargon as the "Supplemental Balancing Reserve".

The average price of this emergency power was estimated at £12,950 per MWh in winter 2015-16 by National Grid documentation.[7] Looked at another way, this is 315 times higher than the average wholesale price of electricity for the year 2015 (see figure 2 below for examples).[8]

Figure 2: Electricity prices: historic monthly average 2010-2016[9]



In total, National Grid paid £33.9million for emergency power in the winter of 2015-16.[10] These costs are eventually spread across the network and picked up by consumers in the form of higher bills.

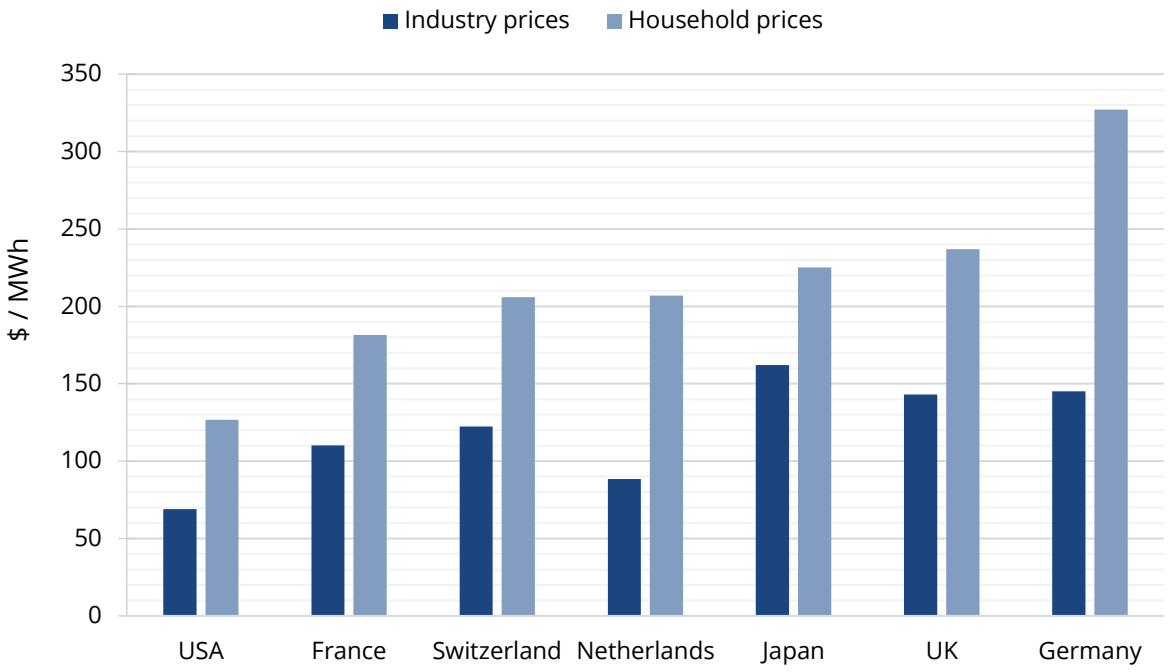
[6] National Grid, *SBR 2016-17 Overview*, 3 November 2016, accessed 07/12/2016 at: <http://www2.nationalgrid.com/WorkArea/DownloadAsset.aspx?id=43675>
[7] National Grid, *SBR Winter 2015-16 TR2 Market Report*, 24 June 2015, page 3, accessed 07/12/2016 at: <http://www2.nationalgrid.com/WorkArea/DownloadAsset.aspx?id=41581>
[8] Ofgem, Electricity prices: Day-ahead baseload contracts – monthly average (GB), accessed 07/12/2016 at: <https://www.ofgem.gov.uk/chart/electricity-prices-day-ahead-baseload-contracts-monthly-average-gb>
[9] Ibid.
[10] National Grid, *SBR Winter 2015-16 TR2 Market Report*, 24 June 2015, page 3, accessed 07/12/2016 at: <http://www2.nationalgrid.com/WorkArea/DownloadAsset.aspx?id=41581>

This coming winter (2016-17), National Grid has planned to pay £122.4 million for emergency power, four times the total during the previous winter.[11] This equates to a planned price of £34,210 per MWh, nearly three times the previous year's price and 800 times higher than the average wholesale electricity price for 2015.[12]

While no precise projection can be made of costs in the future, if this trend were to continue year-on-year, by 2020-21 National Grid estimates that it could be spending nearly one and a half billion pounds procuring emergency power.

Again, these costs are eventually picked up by consumers, both industrial and domestic in the form of higher bills. When considering the implications of this, it is important to remember that electricity in the UK is already more expensive than in many other advanced economies (see figure 3 below).

Figure 3: Comparative electricity prices for selected OECD countries (2016)[13]



A partial three day week?

Another scheme that National Grid has undertaken is what can be colloquially referred to as a partial return to the 1970s-style three day week, at least in national electricity terms.

[11] National Grid, *SBR Market Information - Winter 2016-17,* 18 December 2015, page 4, accessed 07/12/2016 at: <http://www2.nationalgrid.com/WorkArea/DownloadAsset.aspx?id=44323>
[12] Ofgem, Electricity prices: Day-ahead baseload contracts – monthly average (GB), accessed 07/12/2016 at: <https://www.ofgem.gov.uk/chart/electricity-prices-day-ahead-baseload-contracts-monthly-average-gb>
[13] International Energy Agency, *Key World Energy Statistics 2016*, page 44, accessed 07/12/2016 at: <http://www.iea.org/publications/freepublications/publication/KeyWorld2016.pdf#page=44>

Referred to as the "Demand Side Balancing Reserve", contracts involve National Grid paying energy intensive businesses to detach from the electricity network and run their own backup power reserves. These are usually diesel generators, reserved strictly for emergencies thanks to their expense and exhaust fumes. Also rumoured to be included in the 2016/17 scheme were a number of NHS hospitals, raising another controversy about excess pollution so near to patients.[14]

For this "service" in 2015-16, National Grid paid between £50 and £15,000 to contractors for each MWh of extra capacity that was freed up when a request to switch over to backup generators was made. On top of this, National Grid also made standing payments of between £4,000 and £16,000 per MW over the period just to keep those contractors on standby. The switch-over instruction is usually given far in advance, but can occasionally be given with only 2 hours warning, via an SMS-type application installed on tablets, smart phones or other devices.[15]

In total, National Grid paid £3.4m for its three day week in the winter of 2015-16.[16]Again, these costs are spread across the network.

To the relief of critics, the 2016-17 tendering process for the Demand Side Balancing Reserve was cancelled due to favourable forecasts in power capacity over the winter.[17]

Power rationing

Coupled with the plan to take factories and hospitals off the grid, a senior official at the Government's energy department recently suggested the idea of rationing electricity supplies. They claim the "market" is such that in order to conserve capacity, some households will have to go without electricity.[18] Whether households will be compensated for this is unclear, but not providing a reliable, universal power supply demonstrates a clear failure of Government planning.

[14] E. Gosden, "Health warning over plan to use hospital generators to avoid blackouts", *Daily Telegraph,* 21 August 2016, accessed 07/12/2016 at: <http://www.telegraph.co.uk/business/2016/08/21/health-warning-over-plan-to-use-hospital-generators-to-avoid-bla/>
[15] National Grid, *DSBR Factsheet***,** 18 April 2016**, a**ccessed 07/12/2017 at: <http://www2.nationalgrid.com/WorkArea/DownloadAsset.aspx?id=8589934920>
[16] National Grid, *SBR Winter 2015-16 TR2 Market Report*.
[17]National Grid, *DSBR Industry Letter August 2016,* accessed 07/12/2016 at: <http://www2.nationalgrid.com/WorkArea/DownloadAsset.aspx?id=8589936396>
[18] P. Dominiczak, "Britain facing energy crisis that could see families pay extra to keep the lights on while neighbours 'sit in the dark'", *Daily Telegraph*, 12 December 2016, accessed 12/12/2016 at: <http://www.telegraph.co.uk/news/2016/12/11/britain-facing-energy-crisis-could-could-see-families-pay-extra/>

Part-time green targets

Alongside the extreme costs of buying emergency power and of taking energy-intensive users off the grid comes a questioning of the UK's commitment to climate change policy as well as environmental obligations.

To procure emergency power, National Grid restarts old power stations that have been closed. Inevitably these are fossil-fuel plants, some of them burning gas but some are older, coal or oil-burning plants (see Tables 1 and 2 below).

Table 1: Power stations awarded emergency power (SBR) contracts for 2015-16[19]

Unit	Owner	Capability (MW)
Peterhead CCGT (2 x 375MW)	SSE	675
Killingholme CCGT (1 x 660MW)	Centrica	660
Deeside CCGT (Additional 250MW)	GdF Suez	250
Uskmouth (1 x 100MW Coal Unit)	Uskmouth Power	90
Fiddlers Ferry GTs (2 x 17MW)	SSE	32
Ferrybridge GTs (2 x 16MW)	SSE	30
Rugeley GT (1 x 25MW)	GdF Suez	25
Keadby GT (1 x 23MW)	SSE	22
Total		**1,784**

Table2: Power stations awarded emergency power (SBR) contracts for 2016-17[20]

Unit	Owner	Capability (MW)
Eggborough Coal (775MW)	Eggborough	681
South Humber CCGT (750MW)	Centrica	654
Peterhead CCGT (additional 2 x 375MW)	SSE	646
Killingholme CCGT (600MW)	Uniper	523
Fiddlers Ferry Coal (480MW)	SSE	422
Deeside CCGT (additional 250MW)	Engie	218
Corby CCGT (353MW)	ESBi	308
Fiddlers Ferry GTs (2 x 17MW)	SSE	32
Keadby GT (23MW)	SSE	22
South Humber CCGT (20MW headroom)	Centrica	17
Total		**1,784**

Since these are emergency power supplies, some of this might be forgiven as necessity. Yet, Government policy has led to a now-annual scenario whereby environmental

[19] National Grid, *SBR Winter 2015-16 TR2 Market Report*, page 3.
[20] National Grid, *SBR Market Information - Winter 2016-17.*

pledges forcibly close heavily-polluting power stations only for National Grid to re-open them temporarily at astronomical cost when emergency electricity capacity is required.

In addition to this, the diesel generators used by most businesses to power their emergency electricity during their National Grid-sanctioned three day week are severely damaging for air quality around their buildings. As mentioned, some of those energy-intensive users contracted for this service are hospitals.[21]

To make matters worse, the European Union has started taking notice of this practice. Early proposals from the EU's energy department aim to place stricter limits on emissions of carbon dioxide from emergency power reserves.[22] While it seems unlikely the EU will be able to force the UK to stop using emergency power outright, it will inevitably drive up costs to consumers through fines and court cases if an alternative solution is not found.

Formalised emergency power

The National Grid's programme of purchasing emergency power and factory shutdowns is planned to run until 2017-18. From then, the programme is planned to switch to the "Capacity Mechanism". However, this is merely a formalised version of the current system and, though auctioned competitively much further in advance, is still inherently costly. National Grid estimates that this plan will cost £600 million for winter 2018-19, rising to £1.1 billion in 2019-20.[23] By contrast, Departmental answers to Parliamentary Questions on this same subject indicate ambiguity over these figures, estimating instead a cost of £980 million for 2018-19 and £830 million in 2019-20.[24] (see table 3 and figure 4).

Departmental statistics claim that these costs will only add £10-15 per year to the energy bill of the average household. However, a separate estimation, taking in these costs and dividing by the number of households predicted to be in the UK by 2020 indicates this estimate could be a generous one.

At the Department's overall cost of £830 million and accounting for population increases by 2020, household bills could be hit by a permanent £25 hike.[25] Using

[21] Gosden, "Health warning over plan to use hospital generators to avoid blackouts".
[22] A. de Carbonne,l "EU to attach CO2 limits to power reserve subsidies", *Reuters*, 28 November 2016, accessed 07/12/2016 at: <http://www.reuters.com/article/us-eu-energy-powerstation-exclusive-idUSKBN13N1AM?utm_campaign=trueAnthem:+Trending+Content&utm_content=583c409904d30135a036d163&utm_medium=trueAnthem&utm_source=twitter>
[23] Same as below (Constable)
[24] Written Parliamentary Question No.55548 answered by Department of Business, Energy and Industrial Strategy, asked by the Rt. Hon Grant Shapps MP, 6 December 2016.
[25] Office for National Statistics, National Population Projections: 2014-based Statistical Bulletin, 29 October 2015, accessed 07/12/2016 at: <http://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/bulletins/nationalpopulationprojections/2015-10-29>

National Grid's estimates of a £1.1 billion annual cost, the average bill would be increased by £30.

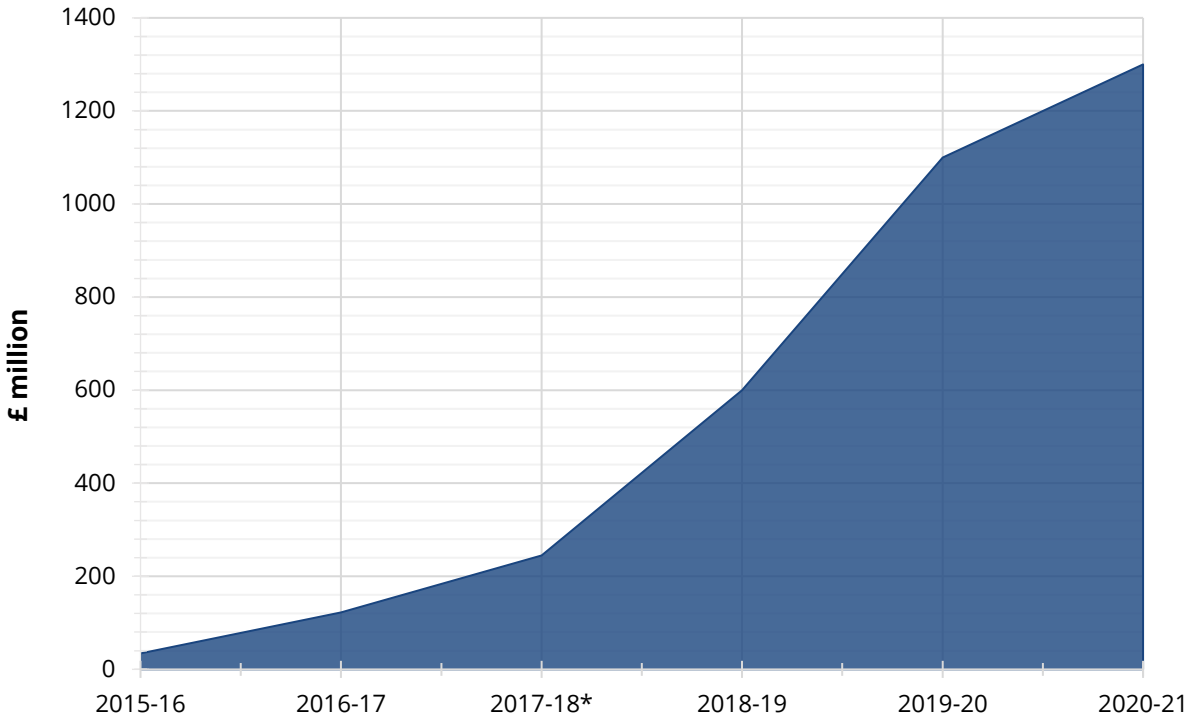
Using household population figures, it is possible to estimate that these costs spread across the UK will permanently add at least£10 to the energy bill of the average household by 2020. The Department statistics agree with this assessment, though they claim it will be "significantly offset when reduced wholesale price spikes are taken into account".[26]

Table 3: Estimated costs of emergency power (SBR and CM) up to 2020[27]

	Supplementary Balancing Reserve			Capacity Mechanism		
	2015-16	2016-17	2017-18*	2018-19	2019-20	2020-21
National Grid	33.9	122.4	244.7	600	1100	1300
DBEIS	-	-	-	980	830	-

*Estimated from 2016-17 figures

Figure 4: Estimated costs of emergency power (SBR and CM) up to 2020[28]



[26] Parliamentary Question No.55548.
[27] National Grid, *SBR Market Information - Winter 2016-17.*
Constable, "The Cost of Preventing Blackouts".
Parliamentary Question No.55548.
[28] Ibid (all).

Interconnectors: a precarious alternative to native power

National Grid (which is a private company listed on the FTSE), is driven by market conditions to seek the cheapest power available for its consumers. Britain's energy sector is so beset by market distortions that this is usually sourced outside the UK. Imports of energy have risen over 30% in the last two years (see table 4 below).[29]

Table 4: Net imports of electricity via interconnectors (2013-2015)[30]

TWh	France -UK	Ireland-N. Ireland	Netherlands-UK	Ireland -Wales	Total
2013	10.3	0	6.3	-2.2	14.4
2014	15	0.1	7.9	-2.4	20.5
2015	13.8	0.2	8	-1.1	20.9

Generally speaking, importing power at low cost via undersea interconnectors with the continent makes commercial and public service sense in lowering bills for UK consumers. France, for instance, enjoys some of the lowest bills in the EU thanks to its pervasive, (albeit state-directed) nuclear industry. However, this ignores the wider policy implications, especially that of energy security.

Numerous incidents in the last few months have shown how unpredictable the interconnector supply can be, especially when the weather becomes involved. On the positive side, the disruption of the East-West interconnector that exports power to Ireland has meant the UK's capacity margin has ostensibly slightly improved.[31] However, storm damage to one of the UK's electricity interconnectors with the European continent has reduced imports by 1GW, slimming the National Grid's safety margin again below 1%.[32]Earlier in the year, an unplanned shutdown of French nuclear power stations at a time of unusually high consumption and low output in the UK also caused an expensive price spike.[33]

Unless Government acts to improve the attractiveness of UK energy markets, National Grid is increasingly likely to rely on the precarious interconnector between France and the UK for value for money and expose the UK to risks of blackout and very high emergency power costs.

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[29] Written Parliamentary Question No.37066 answered by Department for Energy and Climate Change, asked by Sir William Cash MP, 25 May 2016, accessed 07/12/2016 at: <http://www.parliament.uk/business/publications/written-questions-answers-statements/written-questions-answers/?house=commons%2clords&max=20&member=288&page=2&questiontype=AllQuestions>

[30] Written Parliamentary Question No.37066.

[31] National Grid, *Winter Outlook Report 2016-17*.

[32] E. Gosden, "Winter power crunch fears as UK-France cables severed during storm", *Daily Telegraph*, 29 November 2016, accessed 07/12/2016 at: <http://www.telegraph.co.uk/business/2016/11/29/winter-power-crunch-fears-uk-france-cables-severed-storm/>

[33] E. Gosden, "Power price surges to record high on supply shortage fears", *Daily Telegraph*, 14 September 2016, accessed 07/12/2016 at: <http://www.telegraph.co.uk/business/2016/09/14/power-price-surges-to-record-high-on-supply-shortage-fears/>

3. Electrification of the modern economy

Electrification of the economy is straightforwardly desirable and necessary for numerous reasons:

- It is far more versatile than traditional fuel, able to be transformed into a wide range of energy forms at the point of consumption, including heat, light and mechanical energy, to say nothing of its necessity in computer systems and running complex software.

- It can be transmitted across huge distances quickly, relatively cheaply and at high density.

- It does not, unlike gas, oil and other energy sources, create environmental pollution or present other health hazards at the point of consumption.[34]

It makes sense to improve the UK's economy via electrification. Indeed, given its traditional benefits, the process is likely to happen spontaneously via the population's free choice if the costs are low enough because, simply put, cheap and readily available electricity improves quality of life. However, projections of electricity capacity under current policy put this ambition at risk. Electrification over the past few years has markedly stalled. Maximum power capacity has fallen dramatically, with old power stations closing and none being opened to replace them, creating a drastically smaller capacity margin for the National Grid.

Emergency power measures mean these power stations are re-opened at short notice, but the costs to consumers are huge. The cost of providing electricity is now so great that National Grid deems it reasonable to detach major factories and hospitals from the network and have them run emergency diesel generators in order to reduce demand at peak times. Major projects such as the electrification of railway lines that create smoother, less polluting services, are put on hold thanks to the rising costs of electricity.[35] Energy intensive industries are forced to move overseas and household bills keep rising.[36] Policymakers back electric vehicles, high speed electric trains and manufacturing, but the economy as a whole, even with efficiency measures, is unable to make the step into full electrification because it simply doesn't have the capacity to do so.

In fact, if this crisis continues, electrification may even start going backwards. A recent candid interview with a senior official at the Government's energy department

[34] Constable, "The Cost of Preventing Blackouts".
[35]M. Wilkinson, "£3bn plans to electrify Great Western rail route to be delayed by six years", *Daily Telegraph*, 8 November 2016, accessed 08/12/2016 at: < http://www.telegraph.co.uk/news/2016/11/08/tories-accused-of-another-broken-promise-as-electrification-of-g/>
[36]Business for Britain, Energy Policy and the EU, accessed 08/12/2016 at: <http://tcpresearch.weebly.com/uploads/2/1/7/1/21715546/bfbenergypaper.pdf#page=16>

suggested that the price of power in the near future is predicted to be so high that some households may have to go without electricity altogether.[37]In such a scenario, facing ever-increasing bills for keeping even a minimum of power flowing to their homes, families may find it less expensive and less effort to start heating and powering their homes independently of the National Grid via their own diesel generators or even rehabilitated coal fireplaces in some instances. Combined with the expansion of the use of such generators for factories, this would be a catastrophic failure by successive Governments to appropriately manage the power supplies of a modern nation. Without doubt, this eventuality would have disastrous consequences, not just for localised pollution levels and for the wider economy, but for overall quality of life of people living in the UK.

BIG's position is that the Government should try to make the voluntary transition to an electric economy as easy and as smooth as possible. For this, some radical changes are needed to the UK's electricity network to ensure it has the capacity to grow as required and accommodate greater electrification without burdening consumers with higher costs.

[37] Dominiczak, "Britain facing energy crisis that could see families pay extra to keep the lights on while neighbours 'sit in the dark'"

4. Proposals

Energy efficiency

Saving on electricity through efficiency reaches the top of this list simply because it is one of the easiest and least costly areas to improve. By improving efficiency and wasting less, we consolidate our current electricity capacity, easing the pressure during peak demand periods. It also makes sense for the population to act on voluntarily since they end up saving money on their bills. For example, LED lights save 60% plus energy and related costs, while other measures such as automated building management systems, air conditioning and insulation deliver savings that cover the costs of implementation in three to five years.[38]

Accompanying a general efficiency drive should come a decentralisation and relaxation of Government rules (such as planning permission and consultation) around constructing combined heat and power plants on industrial sites or large complexes. Decentralised projects can deliver more than 20%higher efficiency through shorter electric transmission distances and through better use of heat that would ordinarily be wasted in large power stations. Via local consultations, it seems logical that contractors and local residents would be able to come to an agreement: many stand to benefit from cheaper electricity and heating from local sources.

However, an efficiency drive alone is not going to solve this problem in the long-term. For a modern economy to grow, it will always require additional capacity to grow into.

Restore the market

In November 2015, then-Energy Minister Amber Rudd announced in a speech that not even a gas-fired power station can be built in the UK without Government assistance.[39]This situation must be overturned if Britain is to succeed in the dual goals of providing adequate electricity capacity for the future economy and maintaining a low price for consumers to use that electricity. Given the revolutionary changes the world is currently witnessing in the realm of technology, it simply isn't feasible for any civil servant or government minister to be able to predict and plan the electricity capacity needed to accommodate it.

The best approach is to make it financially worthwhile for private investors to respond to demand as it approaches, as the current economy does with food supplies, with

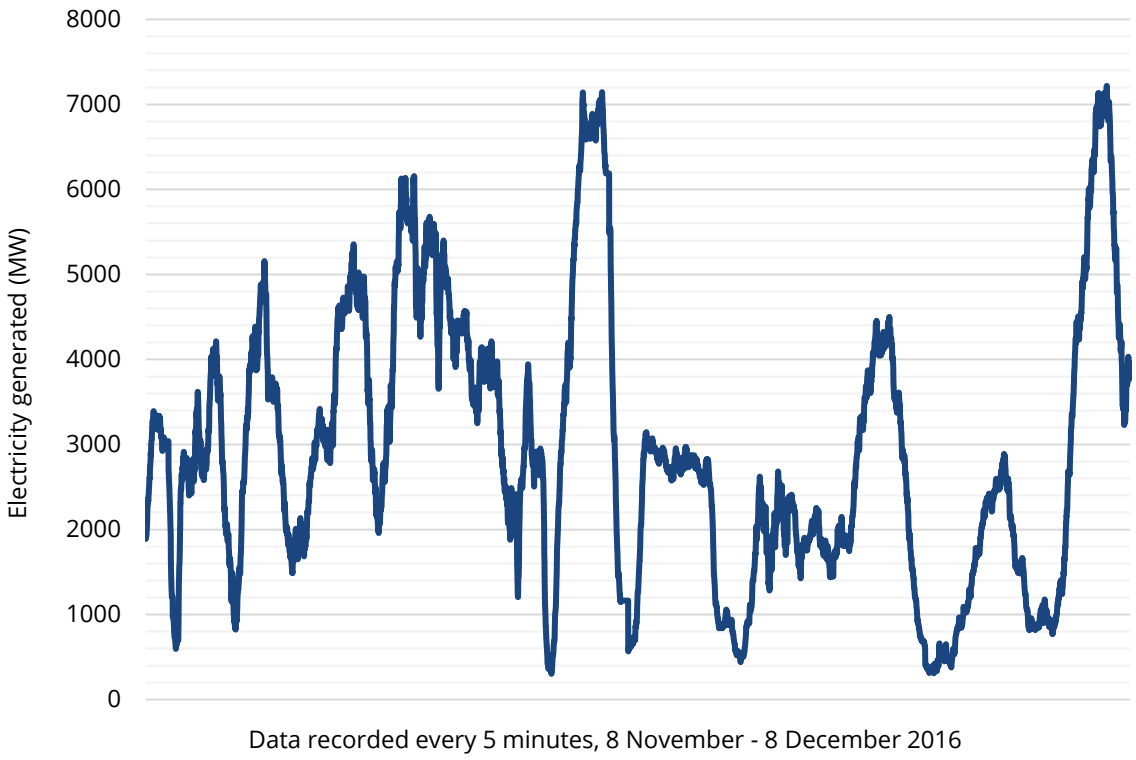
[38] Jonathan Maxwell, "Less Energy, More Power: the fundamental transition of the UK energy market", *New Statesman*, 30 November 2015, accessed 07/12/2017 also at:<http://www.sdcl-ib.com/less-energy-more-power-the-fundamental-transition-of-the-uk-energy-market/>

[39]HM Government, Amber Rudd's speech on a new direction for UK energy policy, 18 November 2015, accessed 08/12/2016 at: <https://www.gov.uk/government/speeches/amber-rudds-speech-on-a-new-direction-for-uk-energy-policy>

clothing or with the supply of any other consumer product. Currently, the market is heavily distorted by Government programmes.

In this regard, the Government must urgently review policy with regard to Renewables Obligation Certificates and targets for the energy sector (be it renewables, carbon price floors or the premature closure of coal power stations) in general. Given the inherent inability of solar and wind renewables to respond to market demand, the Government should also be wary of exposing consumers to further irregular capacity (see Figure 5 below). Some estimates claim that nearly 80% of renewables installations built since 2002 has been unable to contribute reliably to capacity margins.[40]

Figure 5: Variable output of UK wind power (8 November – 8 December 2016)[41]



Without storage technology sufficient to counterbalance instances of very low supply such as those mentioned in September 2014, as well as over cold, windless winter evenings, expensive emergency measures have to back up the shortfall.[42] As such, forcing the network to expand into renewables without sufficient storage for downtime is very expensive for consumers and (given that many emergency stations are coal-fired) environmentally counterproductive.

[40] Constable, "The Cost of Preventing Blackouts".
[41] G.B. National Grid Status, accessed 08/12/2016 at: <http://www.gridwatch.templar.co.uk/index.php>
[42] Gosden, "Power price surges to record high on supply shortage fears", *Daily Telegraph*.

The re-establishing of an undistorted market would allow the best solution to emerge, but in the meantime, BIG's position is for combining efficient gas and nuclear in the medium term until the technical problems of storing renewable electricity are overcome or an alternative is found. This would provide a robust and diversified base capacity margin. Gas power stations are quick to build, while nuclear power stations deliver huge amounts of output for their fuel intake and are relatively low-carbon. Further comments on the merits of these two approaches will follow in later research.

Again, until the right technology can be perfected, National Grid should also be more cautious of interconnectors. For other European countries, such connections are commonplace and probably effective in widening competition and driving down consumer prices. For Britain, the task of importing energy is made difficult by geography. An overreliance on a precarious connection across the Channel that ends up damaged by storms or by other freak events (as occurred earlier this year) could be disastrous for UK energy security and for electricity bills.

Infrastructure costs

The UK Government and National Grid working together need to examine closely the present policy of socialising infrastructure costs across the electricity network. Infrastructure here refers to the cables, interconnectors and other aspects of the electricity grid that is required to bring power from generating stations to the consumer. It is no secret that different types of electricity generators impose different costs on the system infrastructure, but it cannot be right that risks are always passed on to consumers.

The Department of Business, Energy and Industrial Strategy is currently working on a report that will set out in detail these different costs (known as "Whole System Costs") which is likely to be published in early 2017.[43]Until these figures are released however, some evidence suggests that the cost of maintaining the system infrastructure is a standing charge of some £100 million a year.[44]The renewables sector must take some share of the blame for these rising costs. One former Power Network Director of National Grid has stated that the capital cost of offshore wind has increased at 17%annually for the last 16 years and that the capital costs of onshore wind have increased at 4% per year in the same period.[45]In essence, while the levelised cost of generating electricity from wind may be falling (i.e. their efficiency is increasing), the costs of maintaining the network and the turbines themselves are not.[46] This is especially true since renewables' output is so variable (as mentioned before).[47]Regardless, a debate should be had when the Department has assessed all the available evidence.

One Carbon tax

A single tier carbon tax, similar to the EU Emissions Trading Scheme, creates a market-based cost to electricity generators levied per tonne of carbon dioxide their produce. Priced at the equivalent social cost of carbon emissions ($85 per tonne according to the authoritative Stern Review on the Economics of Climate Change), this would provide all the incentive required to cut pollutants effectively and economically in an otherwise free market, allowing the most efficient, carbon-free solutions to rewarded.[48]

[43]Written Parliamentary Question No. 55686 answered by Department for Energy and Climate Change, asked by the Rt Hon Grant Shapps MP, 5 Dec 2016.
[44] Constable, "The Cost of Preventing Blackouts".
[45] C. Gibson, "Time we faced fact wind and solar power costly [sic]", The Scientific Alliance, accessed 07/12/2016 at: <http://www.scientific-alliance.org/scotland/Colin-Gibson-Time-we-faced-fact-wind-and-solar-power-costly>
[46] A. Evans-Pritchard, "Cut-throat competition is slashing offshore wind costs to unthinkable levels", *Daily Telegraph,* 2 October 2016, accessed 07/12/2016 at: <http://www.telegraph.co.uk/business/2016/10/02/cut-throat-competition-is-slashing-offshore-wind-costs-to-unthin/>
[47]G.B. National Grid Status, accessed 08/12/2016 at: <http://www.gridwatch.templar.co.uk/index.php>
[48]*Stern Review: The Economics of Climate Change*, accessed 08/12/2016 at: <http://mudancasclimaticas.cptec.inpe.br/~rmclima/pdfs/destaques/sternreview_report_complete.pdf#page=26>

5. Conclusions

As mentioned earlier in this report, BIG's position is that the Government should try to make the voluntary transition to an electric economy as easy and as smooth as possible. For this, some radical changes are needed to the UK's electricity network to ensure it has the capacity to grow as required and accommodate greater electrification without burdening consumers with higher costs.

Currently, the British electricity network is going backwards. Capacity margins are so tight that National Grid's emergency power deals have become the norm. Consumers, both domestic and business, having once reaped the benefits of tumbling prices after the 1990smarket reforms, are now resigned to paying ever-higher electricity bills. Some households may even face the prospect of power being rationed and returning to a three day week. Some businesses already have. This is surely a failure of any nationally-directed power strategy.

This paper has suggested some solutions, gesturing towards ways to boost output and increase efficiency of distributing benefits and responsibilities in the short term, but pointing ultimately towards restoring an efficient market in the long term. Regardless of the detail, if the goal of policymakers is for Britain to make the shift to the cleaner, electrically powered economy of the future, its electricity generating sector must be able to provide cheap electricity in abundance, respond rapidly to new demands and shoulder its own risks and rewards, just as the food, clothing and other consumer goods sectors currently do every day.

Quotes in support of Electric Shock

Daniel Mahoney, Head of Economic Research, Centre for Policy Studies said:

"It is very welcome that the British Infrastructure Group is highlighting concerns about the UK's energy security. Mismanagement of energy policy – both from the European Union and the UK Government – has left the UK with desperately narrow capacity margins."

"In her first major campaign speech, Theresa May made a welcome declaration that she wanted to see an energy policy that promotes the reliability of supply and lower costs for users. This report re-emphasises the need for this commitment to be delivered."