

Mark Copley
Associate Partner, Wholesale Markets
Ofgem

24th May 2016

Dear Mark

Notice of an Income Adjusting Event, submitted under Part E1 of Special Condition 4C (Balancing Services Activity Revenue Restriction on External Costs) of National Grid Electricity Transmission plc's Electricity Transmission Licence

In February 2016, a number of thermal power stations announced their intention to either close or mothball due to unfavourable market conditions. Ensuring we have an efficient and reliable electricity system is core to National Grid Electricity Transmission's (NGET) role as the GB System Operator (GBSO). Therefore, following these announcements, the GBSO thoroughly analysed the potential impact of closures on the National Electricity Transmission System (NETS), concluding that a minimum of two units were required in the North-East and / or North-West to ensure we could maintain the existing GB Black Start capability.

In the unlikely event that the electricity transmission system becomes de-energised, Black Start capable¹ stations are required to assist the GBSO in the restoration of the transmission system. A review of the Black Start process by the Electricity Supply Industry through E3C² concluded that there is an industry expectation that the NETS should be energised within 12 hours of a total system shutdown. NGET's strategy in the event of a Black Start situation is designed to achieve a restoration of the skeleton network within the industry expected 12 hour period.

For the purposes of Black Start, the country is split into six zones. In order to achieve restoration of the skeleton network within 12 hours, 2 units per zone are required to Black Start simultaneously. National Grid's policy states that 3 units should be contracted in each zone in order to provide resilience in the event that one of the required 2 units is unavailable, providing that this is economic and efficient for consumers compared to the counterfactual of the capability not being available.

Black Start has been reviewed under our System Operability Framework. With a reduction in warm thermal generation it is considered that an alternative approach to restoration should be investigated. In 2015 we commissioned two reports to review the potential for diverse technologies and different restoration techniques³. These reports support our current strategy of focusing in the medium term on CCGTs and Interconnectors as the technology types best suited to system

¹ The power plants' ability to start up and provide electricity to the NETS without the use of an external power supply.

² The Energy Emergencies Executive (E3) and its Committee (E3C) are the principal fora for identifying both the risks and mitigating processes and actions necessary to manage the impact of emergencies affecting the supply of gas and/or electricity to consumers in GB

³ Alternative service provision will require an element of testing to determine its capability. Any testing of this service will be carried out with consideration of minimising the impacts on the wider energy market.

restoration. The reports also highlighted that renewables, batteries, Nuclear and smaller plant should also be considered in the longer term.

National Grid is taking forward four workstreams to develop our longer term strategy for Black Start in the areas of Technology, Restoration, Frameworks and Procurement.

- Technology - Developing sustainable services from new and existing technologies
- Restoration - Developing new and innovative network restoration strategies
- Frameworks - Review of obligations and frameworks
- Procurement - Developing procurement strategies to signal future requirements and remove possible barriers to entry.

In the short-term, however, there is a necessity to continue to contract with the existing Black Start capable plant, where it is cost efficient for consumers to do so. On the 25th February 2016, NGET published a letter⁴ requesting final expressions of interest for Black Start services in the North West or North East of England. Following this, we entered into bi-lateral discussions with a number of potential Black Start providers to further explore the options available and have since signed contracts for the provision of Black Start capability from Drax and Fiddlers Ferry at a combined cost of £113m.

The costs associated with these contracts are in excess of the current Balancing Services Incentive Scheme (BSIS) target⁵ for Black Start and therefore I am writing to request that the target is adjusted.

Notice of Income Adjusting Event pursuant to Part E1 of Special Condition 4C (Balancing Services Activity Revenue Restriction on External Costs) of NGET's Electricity Transmission Licence ("Licence")

This letter constitutes a notice of an Income Adjusting Event arising from the announcement of the potential closure or mothballing of thermal generation plant. This has led to balancing service costs being incurred by NGET in excess of the value envisaged in the current Black Start element of the BSIS target, in order for NGET to maintain GB Black Start capability that provides an appropriate level of efficient and economic protection to consumers.

Under Part E1 paragraph 4C.10 of Special Condition 4C this notice is required to contain the following information:

- **the event to which the notice relates and the reason(s) why the person giving the notice considers this event to be an income adjusting event;**

The event for the purpose of this notice is the announcement of the potential closure or mothballing of a number of thermal generating plant, which has led to balancing service costs being incurred in excess of the current Black Start element of the BSIS target in order to maintain an efficient and economic level of Black Start capability.

The Licence sets out those events or circumstances which constitute an Income Adjusting Event. These events or circumstances include those which are not explicitly listed in the

⁴ <http://www2.nationalgrid.com/WorkArea/DownloadAsset.aspx?id=45483>

⁵ The Black Start cost target for 2016/17 is a maximum of £33.74m.

Licence but which meet certain criteria. These criteria are listed below along with an assessment of how the event meets those criteria:

- (a) **The event must be unforeseen.** The Black Start Cost incentive target is set at the end of the preceding formula year (in this case, 31st March 2016 for Formula Year April 2016 to March 2017), prior to which NGET is obliged to make a submission to Ofgem by 31st December (in this case 31st December 2015) setting out any proposed changes to the target specified in the Licence. Announcements in February 2016⁶ regarding the potential closure/mothballing of generators earlier than expected under our Future Energy Scenarios (developed under consultation with industry) were therefore unforeseen at the time that adjustments to the target were proposed.
- (b) **The associated costs must increase or decrease the cost of balancing services on which NGET is incentivised by more than £10m in a Relevant Year.** These new contracts awarded for Black Start services will incur a maximum cost of £113m in the Relevant Year.
- (c) **The unforeseen event or circumstance must lead to consequences beyond the reasonable control of the licensee.** The extent to which the unfavourable market conditions would lead to plant closure or mothballing decisions for 2016/17 was unforeseen. Decisions taken by the boards of power stations on the future of those power stations, taking into account both projected income and expenditure, are outside the control of NGET in its role as GBSO. NGET has an obligation under the Grid Code (CC6.3.5)⁷ to ensure that the NETS can be re-energised in the event of a total or partial system shutdown and therefore the obligation to contract with such stations for Black Start cannot be avoided.
- **the amount of any change in costs and/or expenses that can be demonstrated by the person giving the notice to have been caused or saved by the event and how the amount of these costs and/or expenses has been calculated;**

Contracts have been signed for the provision of Black Start services at Fiddlers Ferry and Drax. The combined maximum value of these contracts is £113m. A competitive process was followed in order to achieve the lowest possible contract value and ensure the costs are economic and efficient. Mechanisms have been put in place to return money to consumers where the contracted unit generates in excess of the level required to keep warm under the Black Start contract. This will also reduce any potential for out-of-merit running of the two Black Start units, which could distort the energy market.

The combined total value of the contracts will result in a maximum of £1.43 on the average domestic consumer bill, with the contractual mechanisms negotiated meaning that money

⁶ SSE announced the potential closure of Fiddlers Ferry on 3rd February 2016, Engie announced the potential closure of Rugeley on 8th February 2016 and Drax Power announced the potential mothball of the Drax coal units on 23rd February 2016.

⁷ **Grid Code CC6.3.5.** It is an essential requirement that the National Electricity Transmission System must incorporate a Black Start Capability. This will be achieved by agreeing a Black Start Capability at a number of strategically located Power Stations. For each Power Station NGET will state in the Bilateral Agreement whether or not a Black Start Capability is required.

will be passed back to consumers in the event that the Black Start units run in the market in excess of the level required to keep warm.

- **the amount of any allowed income adjustment proposed as a consequence of that event and how this allowed income adjustment has been calculated; and**

NGET proposes that the full value of the two contracts is accounted for in the adjustment of the BSIS target. Although these costs are in excess of the level normally incurred in procuring Black Start services, the change in market conditions means that historical costs offer no meaningful benchmark when assessing them. The costs for these services should therefore be assessed on their own merits in current market conditions and whether they prove to be cost effective for consumers.

For all tenders received, a technical assessment was made of the contribution that plant would make to our Black Start capability. This was then used to compare the cost to the consumer of contracting the service as opposed to the counterfactual of not contracting the service and accepting longer restoration times in a Black Start event.⁸

In order to assess the cost benefit to consumers, we referred to the London Economics paper on Value of Lost Load (VoLL)⁹, which was produced in July 2013, using the VoLL figure as a proxy for consumers' willingness to accept longer restoration times. This paper recommends a headline number of £17,000/MWh for VoLL for a one hour outage, with the value in £/MWh being four times higher for a four hour outage. We therefore used a VoLL of £67,780 in our cost benefit analysis. For Fiddlers Ferry this calculation leads to a consumer benefit of £950m to £1.4bn. For Drax this calculation leads to a consumer benefit of £400m to £1bn.

- **any other analysis or information which the person submitting the notice considers to be sufficient to enable the Authority and the relevant parties to fully assess the event to which the notice relates.**

An appendix is attached to this letter which sets out:

- A) NGET's Black Start Policy – *an overview of the Grid Code Black Start requirement, the industry expectation of how that requirement should be interpreted and how the NGET Black Start Policy has been designed to meet the industry expected restoration timescales.*
- B) How System Restoration is achieved in the event of de-energisation - *a description of how regional and national energisation is carried out.*
- C) Current Black Start capability - *an overview of the Black Start capable stations currently contracted in each zone and potential new services where discussions are ongoing.*
- D) The procurement process followed in relation to the Black Start need detailed in this notice - *a description of the assessment process followed in relation to expressions of interest received in providing the required capability.*

⁸ This assessment was made on the basis of the contribution to regional restoration times in a Black Start event. There will also be a contribution to national restoration times but this is more difficult to quantify and so was not included in the analysis.

⁹ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/224028/value_lost_load_electricity_gb.pdf

- E) An assessment of the contribution of Fiddlers Ferry to Black Start – *a description of the contribution of Fiddler’s Ferry to the technical requirements of Black Start in the required regions, the cost of providing the service and the potential impact on the market.*
- F) An assessment of the contribution of Drax to Black Start - *a description of the contribution of Drax to the technical requirements of Black Start in the required regions, the cost of providing the service and the potential impact on the market.*
- G) An assessment of the consumer benefit of these contracts – *an assessment of the consumer benefit, utilising a representative Value of Lost Load Figure to compare the cost of contracting the service to the counterfactual of accepting longer restoration times.*
- H) Alternative options considered - *an overview of other contracts being pursued in the identified zones and why these are not considered full replacements for the Fiddlers Ferry and Drax services at this point in time.*
- I) Forward Black Start strategy - *an overview of the work that is being undertaken to develop a long term sustainable Black Start strategy.*

Black Start contracts are negotiated bi-laterally and details are not published due to commercial sensitivity and potential security implications. However, due to the level of cost associated with these contracts exceeding the current BSIS target for Black Start, we are disclosing the necessary details relating to the contracts in this letter. We do not intend to publicly disclose any further information on our Black Start capability for the aforementioned reasons and therefore request that the appendix attached to this letter is not published.

Normally Black Start contract costs are recovered through Balancing Services Use of System (BSUoS) Charges in the month they are incurred. We have, however, excluded these costs from BSUoS recovery at this point in time until the Authority has made a determination in respect of the Income Adjusting Event in order to be able to provide industry with foresight of the potential charging changes.

We look forward to receiving the Authority’s determination in relation to this notice of Income Adjusting Event in accordance with Part E2 of Special Condition 4C of NGET’s Licence.

If you have any questions, please do not hesitate to contact myself or Audrey Ramsay.

Yours sincerely



Cathy McClay
Head of Commercial, Electricity

Notice of an Income Adjusting Event, submitted under Part E1 of Special Condition 4C of National Grid's Electricity Transmission Licence

Supplementary Information

1. Executive Summary

In February, announcements of potential closure or mothballing of thermal power stations led NGET to review its Black Start capability. This revealed that a minimum of two units were required in the North East and / or North West zones to maintain existing capability. Following a competitive process, contracts have been signed for one unit at Fiddlers Ferry and one unit at Drax to provide Black Start services only for a 12 month period. The rationale for this decision is as follows:

- A Black Start service at Fiddlers Ferry restores 3.5GW 4-6 hours earlier than would otherwise be the case
- A Black Start service at Drax restores 2-4GW 3-4 hours earlier than would otherwise be the case, provides stability in the establishment of the North East power island and also helps accelerate the restoration of the wider network.
- If Drax and Fiddlers Ferry are not available and reasonable assumptions are made regarding the availability of other Black Start stations, restoration times of the skeleton National Electricity Transmission System []
- []
- A simplified cost benefit analysis has been carried out using VoLL to assess the cost to consumers of contracting this service. This indicates that consumers benefit from contracting the service rather than accepting longer restoration times.
- Alternative Black Start options have been explored but, at this stage, these are not mature enough to provide a viable alternative to the services provided by conventional thermal plant.
- NGET's priority will be to continue progressing longer term solutions with these alternative providers.

2. NGET's Black Start Policy

NGET has an obligation under the Grid Code (CC6.3.5)¹⁰ to ensure that the National Electricity Transmission System (NETS) can be re-energised in the event of a total or partial system shutdown. Such re-energisation is known as Black Start. The likelihood of a total or partial system shutdown occurring is considered remote due to the security standards employed by NGET to ensure system safety and reliability. However, it is the case that should a total or partial system shut-down occur anywhere on the NETS, contingency arrangements must be in place to enable a timely and orderly restoration of supplies and this capability is therefore maintained 24/7.

The Black Start requirement is met through the procurement of Black Start service capability at a number of strategically located power stations across Great Britain and is agreed via bilateral contracts between NGET and the relevant power station. In accordance with its licence conditions,

¹⁰ **Grid Code CC6.3.5.** It is an essential requirement that the National Electricity Transmission System must incorporate a Black Start Capability. This will be achieved by agreeing a Black Start Capability at a number of strategically located Power Stations. For each Power Station NGET will state in the Bilateral Agreement whether or not a Black Start Capability is required.

NGET aims to procure an economic and efficient Black Start service on an ongoing basis. Increasing the number of power stations contracted for Black Start enlarges the number of system restoration options available. This improves the resilience at any given time to unavailability or failures of Black Start stations. However, not all power stations will be capable of meeting the technical requirements for Black Start and a balance is also required in terms of service level and the cost associated with such service provision.

The Black Start service relies on contracted power stations being warm enough to respond within the prescribed time frame. Historically this has not been challenging as the Black Start stations ran regularly in the market therefore keeping themselves 'warm'. In current market conditions, with coal fired power stations being running less at certain times of the year due to the economic conditions, coal plant is not maintaining the warmth without specific instruction from NGET.

A review of the Black Start process by the Electricity Supply Industry through E3C was carried out in 2006. The Energy Emergencies Executive (E3) and its Committee (E3C) are the principal fora for identifying both the risks and mitigating processes and actions necessary to manage the impact of emergencies affecting the supply of gas and/or electricity to consumers in GB.

The review referred to above concluded that there was an industry expectation that the skeleton NETS should be energised within 12 hours of a total system shutdown. The skeleton network enables approximately [] of GB demand to be restored and is defined by each grid supply point and power station having a live connection to the energised network by at least one circuit.

A meeting of the E3C Electricity Task Group meeting in May 2008 endorsed a probabilistic modelling project, led by National Grid, to examine the relationship between network resilience levels and system restoration performance under total shutdown conditions. A probabilistic model was developed, using @Risk software, and the model's mathematical formulation and computational robustness was reviewed by an independent expert specialising in statistical modelling¹¹. The paper attached in Appendix A reports the results and findings of this modelling work, as presented to, reviewed and endorsed by, the associated E3C Task Group in September 2008.

The probabilistic analysis highlighted the following:

- []
- []

NGET's strategy in the event of a Black Start situation is designed to achieve a restoration of the skeleton network within the industry expected 12 hour period. In order to achieve this, 2 units per zone are required to Black Start simultaneously. This is corroborated by the probabilistic modelling results. National Grid's policy states that 3 units should be contracted in each zone in order to provide resilience in the event that one of the required 2 units is unavailable. This policy was approved by Ofgem, pursuant to Special Condition AA5J of NGET's Licence in 2012.

3. System Restoration

The skeleton NETS has a minimum number (assuming no network damage) of circuits to be restored to return supplies to all generators located on the NETS. Establishing the skeleton requires approximately [] of national demand to be restored. This demand is provided by DNOs. Following

¹¹ NGET is in the process of updating and redeveloping the probabilistic model to take account of current and future market conditions

on from this, more demand would only be able to be restored if more generation is made available.

[]

[].

The concept of regional restoration relies on 1 or more Local Joint Restoration Plans (LJRP) being enacted and joined together to form power islands. Within this process, each LJRP requires a period of time for:

- Start-up of the Black Start unit, transmission network configuration and distribution network configuration to provide block loads. These 3 activities can be carried out in parallel, however each activity may encounter its own issues such as plant failing to start or network issues occurring requiring further reconfiguration.
- Energising the network once the Black Start unit and both transmission and distribution networks have been prepared.
- Block loading the Black Start unit with DNO demand along pre-agreed routes (within the LJRP or as agreed on the day).
- Expanding the network, using the Black Start unit to provide reactive compensation for route energisation and to restore auxiliary supplies to non-Black Start power stations.

If, for example, [] is the only available Black Start unit in the [] zone, the steps above must be completed before the [] unit can begin to energise further parts of the NETS and provide supplies to additional generation. If a [] unit is contractually available then this LJRP could be initiated in parallel with the [], thus accelerating NETS restoration.

The Black Start contracting zones are not rigid boundaries. If a particular zone has only 1 Black Start station available then it is acceptable to consider a Black Start station located in an adjacent zone. This should only be considered if it results in the lending zone achieving a capability of at least 2 Black Start stations and the Black Start station can meet the general requirements in the zone it is now supporting.

4. Contracted Black Start Capability

There are 6 defined zones – Scotland, North East, North West, Midlands, South East and South West. The current contracted position is as follows:

Scotland	North East	North West	Midlands	South East	South West
[]	[]	[]	[]	[]	[]
[] ¹²	[]	[]	[]	[]	[] ¹³

Services currently under discussion at varying stages of development

¹² []

¹³ []

	Scotland	North East	North West	Midlands	South East	South West
Ongoing discussions	[]	[]	[]	[]	[]	[]
Feasibility	[]	[]	[]	[]	[]	[]
Contracting	[]	[]	[]	[]	[]	[]

[]

[]. Taking all of this in to account, it is highly likely that restoration timescales for the skeleton NETS would extend [] for long periods throughout the year, hence the requirement to contract with Drax and Fiddlers Ferry and consideration of paying already contracted stations 'warming' payments.

5. Procurement Process

In February 2016, announcements were made that [] were considering closing or mothballing in Spring 2016. NGET reviewed the impact of these closures on the NETS, concluding that the closures would lead to an inability to maintain the industry-expected GB restoration times in the event of a total system shutdown. NGET identified that a minimum of 2 units were required to be contracted for Black Start purposes in the North East and / or North West region to maintain capability.

Discussions were held with both traditional Black Start providers and potential new providers to establish the availability of services to be contracted from 1 April 2016. On 25 February 2016 NGET issued a letter¹⁴ highlighting the requirement for these services and asking for final expressions of interest from potential service providers. Our priority in this process was to maintain our Black Start capability at a cost efficient level for consumers. [].

The submissions were assessed against a number of criteria:

- 2 / 4 hour restoration service being offered.
- Ability to restore supplies to additional generation.
- Policy impact on number of stations contracted within zone.
- Policy impact on number of stations contracted in other zones.
- Locational impact – network resilience to damage.
- Impact on GB NETS restoration timescales.
- Impact on DNO resources.

Each station was scored accordingly using these criteria. This assessment showed a technical preference for contracts to be put in place with one Fiddlers Ferry unit and one Drax unit. The full assessment can be found in Appendix B.

As a result of this assessment, Fiddlers Ferry and Drax were identified as the preferred providers and discussions commenced with each on the technicalities of their service provision. A summary of each is included below.

6. Fiddlers Ferry assessment

¹⁴ <http://www2.nationalgrid.com/WorkArea/DownloadAsset.aspx?id=45483>

There was a considerable amount of progress in negotiations with SSE, with their offer being refined over the course of the discussions.

Proposition	Benefits/Issues	Costs
[]	[]	[]
[]	[]	[]
[]	[]	[]
1 unit Black start with 4 hour synchronisation. []. Claw back on running	<p>1 unit contributing to Black Start</p> <p>No requirement to export MWs so less distortion</p> <p>Slower restoration time</p> <p>Proportion of availability and warming fee clawed back in the event the Black Start unit runs in the market</p>	Max £[]m

Technical Contribution:

- Secures policy in North West zone (in conjunction with [])
- Provides an additional power island in the North West
- Allows circa 3.5GW of demand to be restored 4 - 6 hours earlier than if it was not available
- []

Cost Considerations:

- A maximum of £[]m for one Black Start unit
- Equates to a maximum of around []p on the average domestic bill
- A claw back scheme has been agreed whereby part of the availability fee paid will be returned to consumers in the event that the Black Start unit generates

Market Impact:

A slightly inferior technical service has been agreed with Fiddlers Ferry, compared to their previous Black Start contract, which would lead to them synchronising in 4 hours rather than 2 hours. In order to provide the technical requirements of Black Start, Fiddlers Ferry must be warmed on a daily basis but does not need to export MWs on to the system to do this. As this warming would reduce the short run marginal cost of the unit (by minimising start costs) a rebate is recovered if the unit exports MW.

The intent is to preserve the natural merit order as far as possible in order to avoid other MWs being displaced in the market. Whilst there is a claw back mechanism in place, the rebate is set at a level which does not entirely remove the prospect of the unit running during tight days. This provides a wider degree of natural protection to the end consumer as a greater proportion of the fixed costs are recovered [].

7. Drax assessment

There was a considerable amount of progress in negotiations with Drax, with their offer being refined over the course of the discussions.

Proposition	Benefits/Issues	Costs
[]	[]	[]
[]	[]	[]
[]	[]	[]
1 Black Start Unit	2 hour service, exporting a minimum load of []MWs on to the system, with a profit sharing scheme agreed	£[]m

Technical Considerations:

- Secures two units in North East zone, with [] also contracted
- []
- Allows circa 2-4GW of demand to be restored 3-4 hours earlier than if it was not available
- Allows power islands to be built quickly but []
- Contributes to restoration of skeleton NETS and provides a route north to Scotland

[]

Cost Considerations:

- A cost of £[]m for one Black Start unit
- Equates to a maximum of around []p on the average domestic bill
- A profit share scheme has been agreed whereby part of any profit made when generating is passed back to consumers

Market Impact:

In order to provide the technical requirements one coal unit at Drax must export MW onto the system. Whilst understanding that this export will cause some market distortion (in particular for the summer months where current prices indicate the unit would not run), the contract has been structured to minimise this effect. In recognition of the fact that covering a proportion of the coal stations' fixed costs means the station could make significant additional profit if winter prices rally, a financial profit share has been put in place covering the period 1st September to 31st March.

This one-way contractual mechanism (in the end consumers' favour) recovers []% of the profit []. In this way the station on the system will still dispatch in merit order. This approach was favoured over a rebate which, if incorrectly structured, could have provided a disincentive for Drax to run in merit (thereby inflating market prices).

Consumer Benefit:

Drax is a [] and therefore this service []. Power Islands are relatively unstable in the early development stages as 1 unit is relied upon initially to accept DNO block loading while maintaining the frequency and target voltage levels. Significant step changes within the power island could result in the frequency being outside the unit's tolerances and lead to the unit tripping. A power island is more stable with additional units running as the ability to react to step changes and the associated impact is shared. Units with a [], are required for power island development in order to provide reactive power support in both the early and later stages of restoration.

8. Consumer Benefit

In order to assess the cost benefit to consumers, we referred to the London Economics paper on Value of Lost Load (VoLL)¹⁵, which was produced in July 2013, using the VoLL figure as a proxy for consumers' willingness to accept longer restoration times. This uses a stated preference choice experiment to estimate VoLL in terms of the willingness to accept payment for an outage and willingness to pay to avoid an outage. Economic estimation and standard statistical techniques are then used to convert the results into £/MWh VoLL figures.

In order to calculate a headline figure for VoLL this uses the willingness to accept choice experiment results, as a load-share weighted average across domestic and SME users for the winter peak weekday figure. This results in a VoLL figure of £17,000/MWh. The same paper suggests that the analysis shows that the VoLL in £/MWh is four times higher for a four hour outage. We therefore used this figure in our analysis.

- 1 hour figure is £16,940
- 4 hour figure is £67,760

Fiddlers Ferry, on a regional basis, restores around 3.5GW demand 4 - 6 hours earlier than would otherwise be the case. This leads to a consumer benefit of £950m to £1.4bn.

Drax, on a regional basis, restores 2 - 4GW demand 3 - 4 hours earlier than would otherwise be the case. This leads to a consumer benefit of £400m to £1bn.

Both units will also contribute to the restoration of the skeleton NETS, and thus restoration of GB demand. The technical assessment carried out considered each unit's impact on national as well as regional restoration.

It may be tempting to attempt to assign a probability to the occurrence of a Black Start and compare the probability adjusted cost of a Black Start event to the contract costs to determine whether the contracts are value for money. However, a Black Start event is a relatively low probability, extremely high impact event. It is very difficult to assess the probability of such low-frequency events and not all potential impacts are captured by the VoLL measure. It is therefore more appropriate to assess the cost of contracts in the context of the Black Start Policy as an insurance premium which reduces restoration times.

Alternative VoLL numbers were not analysed as the London Economics report itself analysed a number of different options in order to identify the most appropriate singular VoLL number. Whilst the London Economics report is 3 years old, there is no evidence to show that the VoLL number has lowered. If anything, it is likely that impacts of protracted outages may even be increasing as people

¹⁵https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/224028/value_lost_load_electricty_gb.pdf

become ever reliant on power supplies for what are increasingly considered every day needs (internet access etc.). One downfall of the VoLL analysis is that it will not fully capture the reputational impacts for UK plc and future investment decisions. This however would also only serve to increase the VoLL number if fully considered.

9. Alternative options

A Black Start service has been contracted with [] in the North East zone. If any power station is cold (i.e. not active in the market and currently not generating) then auxiliary supplies need to be restored to the station to enable them to begin their start-up process. []

[]

[]

Alternative Black Start options are under discussion with a range of other providers, however they are not considered capable of providing a full replacement for the legacy Black Start services at this point in time.

10. Looking Forward

We have been considering how we can continue to procure services for restoration in a rapidly changing market and discussing the provision of Black Start with a broad range of potential providers. In the medium term this strategy is based on the existing process for restoration but looking further into the future we are also looking at alternative approaches for restoration and how this could open up the range of stations able to offer a Black Start service.

With the current restoration process based on large generators and the limited numbers of these connecting, in the medium term the strategy is based on extending existing services by retrofitting Black Start capability at existing stations and procuring services from interconnectors¹⁶. In order to retrofit the service the main unit must be able to deliver the technical requirements for restoration and often an auxiliary generator must be installed to facilitate the start-up of the main unit. We have also approached potential newly connecting generation and interconnectors to encourage Black Start to be included as part of the initial design of the unit. This would mean that when these new units are built they will have inherent Black Start capability which can be commissioned at the same time as the unit connects.

Looking further into the future, Black Start has been reviewed under our System Operability Framework and with a reduction in warm thermal generation it is considered that an alternative approach to restoration should be investigated. We have started this work by commissioning two reports to review the potential for diverse technologies and different restoration techniques¹⁷.

These reports support our current strategy of focusing in the medium term on CCGTs and Interconnectors as the technology types best suited to system restoration. The reports also considered that renewables/batteries, nuclear and smaller plants should also be considered in the longer term. Following these reports we are taking forward four work streams to develop our longer term strategy in the areas of Technology, Restoration Strategy, Commercial Frameworks and

¹⁶ []

¹⁷ <http://www.smarternetworks.org/Project.aspx?ProjectID=1653#project-details>

Procurement Strategy. Whilst these medium and longer term strategies are progressed, there will be a need to continue to contract legacy services from existing plant.

Notice of an Income Adjusting Event, submitted under Part E1 of Special Condition 4C of National Grid's Electricity Transmission Licence

Supplementary Information

Appendix A – Results of E3C Modelling Work

[]

Appendix B – Results of technical assessment of potential Black Start service providers

[]