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EXTENSION TO EXISTING RESERVE ELECTRICITY GENERATING FACILITY COMPRISING 3 GAS ENGINES WITHIN 2 CONTAINERS AND ANCILLARY WORKS

LAND EAST OF SPALDING DROVE, CLAY LAKE

PLANNING STATEMENT

ON BEHALF OF ABBEY POWER SOLUTIONS

TOWN & COUNTRY PLANNING ACT 1990 (AS AMENDED)
PLANNING AND COMPULSORY PURCHASE ACT 2004

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1.0 EXECUTIVE SUMMARY

1.1 This Planning Statement accompanies the planning application for an extension to the existing reserve electricity facility at land east of Spalding Drove, Clay Lake. The existing facility has a total installed capacity of 20MW.

1.2 The proposed extension comprises 3 no. gas fuelled engines within 2 no. containers, one of which includes a control room. Switchgear comprising 3 no. transformers is proposed to be located adjacent to the containers. The additional plant will be accommodated by an extension to the existing perimeter fencing and acoustic fence, with the inclusion of a sealed gated section to the acoustic fence to permit access.

1.3 The planning permission for the existing facility (H16-0372-12) includes conditions preventing use as a base load generation plan (cond. 3), restricting daily and annual operation times under normal circumstances (conds. 4 and 5), and setting noise impact restrictions at the nearest residential boundary (cond. 6). The proposed extension will comply with all existing conditions.

1.4 Since the facility became operational in late 2012 utilisation calls from the National Grid have been minimal and running of the engines has largely been for the purposes of testing and maintenance.

1.5 Notwithstanding this, the availability of reserve electricity plant remains a central component of National Grid's balancing service and the facility at Clay Lake forms an essential part of this precautionary system. The National Grid has announced urgent requirements for additional reserve plant, and existing facilities provide an opportunity to deliver this with minimal impact as existing switchgear and grid connections can be utilised. This application is therefore made in response to National Grid requirements.

1.6 The proposed gas engines represent best available technology and are lower in impact when compared to diesel engines in terms of both pollutant and noise emissions. This application is accompanied by statements confirming that the proposed extension will be acceptable in terms of emissions impacts both in isolation and cumulatively with the existing facility.

2.0 ENVIRONMENTAL IMPACT ASSESSMENT

2.1 Due to its relatively small scale it is not considered that the development will trigger a requirement for Environmental Impact Assessment. However, to provide certainty of this, the proposal has been assessed against the criteria set out in the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 2011 ("the 2011 Regulations").

2.2 As set out on the accompanying plans, the area of the proposed extension amounts to approximately 400 sq m in footprint. Cumulatively with the existing facility footprint of 1,370 sq m the facility as extended will amount to approximately 1,770 sq m or 0.177 ha.

2.3 The proposed development does not fall within the scope of any description set out under Schedule 1 of the 2011 Regulations.

2.4 Where development may constitute Schedule 2 development under the 2011 Regulations, it is necessary to consider whether EIA is required with reference to the criteria at Schedule 3. These include the size, resource demand, waste production, emissions and safety implications of the scheme. They also include the location (e.g. in reference to sensitive areas) and characteristics of impacts including the extent of the impact, its magnitude and complexity, probability, duration, frequency and reversibility.

2.5 Section 3 to Schedule 2 sets out energy industry related developments which may require EIA. It includes *"industrial installations for the production of electricity."* The threshold for classifying such a development as Schedule 2 development is an area exceeding 0.5 ha.

2.6 Given the cumulative footprint of the facility, taking into account the proposed extension, at 0.177 hectares, the proposal falls considerably below the relevant threshold for Schedule 2 development.

2.7 Furthermore, given the small scale and infrequent nature of the electricity generating operation proposed, it is considered that the development as extended would not be likely to have a significant effect on the environment. As such the development should clearly not be considered to be EIA development and therefore a screening opinion is not required.

3.0 APPLICATION SITE AND RELEVANT PLANNING HISTORY

3.1 The application site is outlined in red on the accompanying site location drawing. The site comprises an area adjoining to the east the existing reserve electricity facility on land to the east of Spalding Drove. The land on which the extension is proposed amounts to approximately 400 sq m in area.

3.2 The proposed extension area is located immediately to the east of the existing facility, which is shown on the Existing Site Layout drawing (ref: 0012/GA/002). The existing facility comprises 40 no. raised and containerised diesel engines along with a switchgear/transformer compound and fuel tank enclosed by a 2.4m perimeter palisade fence. An acoustic fence runs along the northern boundary of the site extending to approximately 3.7 metres in height from typical site ground level.

3.3 The immediate site context consists of industrial units to the north and south, vacant scrubland to the east and Spalding Drove to the west. A proposed cycle route runs along the southern boundary of the site and will remain unaffected by the current proposals.

3.4 The nearest neighbouring building is located approximately 15m to the northwest and houses a distribution substation. A number of residential properties are situated further to the north of the substation building. Approximately 100m to the south beyond an area of industrial development is a switching substation which provides connection for the facility to the national grid.

3.5 The application site is outside of the defined settlement boundary for Spalding and is therefore classed as open countryside for the purposes of planning policy.

3.6 The existing facility is served by a previously existing access track leading from Spalding Drove. The same access track continues along the northern boundary of the facility and therefore provides access to the area of the proposed extension. Due to the low frequency of maintenance visits required, it is not necessary for the track to be upgraded, but a short section of new access will be created to connect to the site.

3.7 Spalding Drove provides wider transport access via the junction with the A16 approximately 1km to the south, part of a major arterial route through the East of England.

3.8 No listed buildings, conservation areas or scheduled ancient monuments have been identified in the vicinity of the site. The nearest significant ecological designation is the Site of Special Scientific Interest at Cowbit Wash (reference 1006843). This 9.06 hectare site lies at approximately 2.25km to the southwest of the application site and is designated chiefly for geological interest. The SSSI is not considered to be affected by the development proposed at this location.

3.9 The Environment Agency interactive flood mapping service demonstrates that the site lies within an area at risk of flooding from rivers or sea, which affects a large proportion of the local authority area. Accordingly a Flood Risk Assessment accompanies this application and the requirements of the National Planning Policy Framework in respect of flood risk are addressed at Chapter 6 of this report.

Relevant Planning History

3.10 The following planning history is considered to be of relevance to the current proposals:

- Application H16-0902-11 dated 17th November 2011 for the siting of a reserve electricity generation facility with ancillary equipment – approved.
- Application H16 -0372-12 dated 8th May 2012 for the removal and variation of conditions relating to permit revised layout and modified operating hours – approved.
- Application H16-0796-12 dated 26th September 2012 for a variation of approved scheme H16-0902-11 to permit revised acoustic fence details – approved.

4.0 DESCRIPTION OF PROPOSED DEVELOPMENT

4.1 The proposal consists of an extension to the existing facility located along its eastern boundary, as shown on the accompanying Proposed Site Layout drawing (ref: 0012/GA/003). The following drawings and documents are included with the application to define the proposed development:

- Site Location Plan ref: 2388.D.001
- Existing Site Layout Plan ref: 0012/GA/002
- Site Details and Elevations Plan ref: 2388.D.002
- Proposed Site Layout Plan ref: 0012/GA/003
- Container Design and Elevations ref: S10510-02B
- Engine Specification ref: JMS 420 GS-B.LC
- Flood Risk Assessment ref: 800175r1
- Air Quality Screening Assessment ref: PB/5686.S
- Noise Statement ref: QT-2014-5539-DP

4.2 The extension comprises 3 no. Jenbacher gas engines with a combined electrical capacity of 3MW. The specification for the engines is provided with this application (ref: JMS 420 GS-B.LC). The engines will be housed within two containers, one of which will also serve as a control room. Transformers are proposed to be located adjacent to each container.

4.3 The proposed engines represent best available technology in gas fuelled generators which minimise pollutant and noise emissions. The application is accompanied by a Noise Statement (prepared by Environmental Noise Solutions) and Air Quality Screening Assessment (prepared by Phlorum Ltd) which address these matters.

4.4 As is the case for the existing facility, visits to the site will be highly infrequent and largely for the purposes of maintenance, as the site will respond remotely to requests from the National Grid. The proposed engines will be subject to maintenance and refuelling visits on the same schedule as the existing facility and any change to the intensity of vehicle movements to and from the site will be negligible.

4.5 The existing 2.4m high site perimeter palisade fencing will be extended to accommodate the proposals. The existing acoustic fence along the northern boundary of the site will be extended to maximise the mitigation of noise emissions for residential properties to the north. This will include a gated section to allow intermittent maintenance access to the site.

4.6 Access to the site is provided by an existing access track leading from Spalding Drove to the west. This consists of a rough track which does not require upgrading given the intermittent and infrequent nature of vehicular visits required. A short section of access will be created extending from the site access to connect to the existing track.

4.7 The proposed extension will operate on the same basis as the existing facility in terms of the remote utilisation arrangement with the National Grid. As such the following conditions which deal with the function and operating hours of the facility are considered appropriate to be attached to any planning permission for the current proposal, to ensure that local amenity is preserved and the plant operates within identified limits:

- *3 The development hereby approved shall be used for short term operational reserve back up generation and shall not be used as a base load generation plant.*

- *4 The generators hereby approved shall not be operated:*

  (i) for more than 6 hours in any 24 hour period save where this is necessary in order to comply with an instruction from the operator of the electricity transmission system for England and Wales to provide short term operational reserve back up generation.
  (ii) in any event for more than 12 hours and 20 minutes in any 24 hour period or between the hours of 23:00 and 06:00.

- *5 The generators hereby approved shall not be operated for more than 330 hours in any calendar year (running from 1st April to 31st March) save for exceptional circumstances where this is necessary in order to comply with an instruction from the operator of the electricity transmission system for England and Wales to provide operational reserve back up generation.*

4.8 In respect of noise, condition 6 attached to the planning permission for the existing facility requires that *"noise from fixed plant/machinery shall not exceed +5dBA LAeq 15mins above background noise levels when measured at a height of 1.5m on any residential boundary outside the applicants control."* It is confirmed that the proposed extension will comply with this condition, having the benefit of containerised engines and an appropriate extension to the existing acoustic fence.

5.0 RELEVANT PLANNING POLICY

Legislative background

5.1 Section 38(6) of the Planning and Compulsory Purchase Act 2004 requires that applications for planning permission must be determined in accordance with the development plan, unless material considerations indicate otherwise.

5.2 The local planning authority South Holland District Council is currently in the course of preparing replacement Local Plan jointly with Boston Borough Council and Lincolnshire County Council (the South East Lincolnshire Local Plan). At present the emerging plan is at a relatively early stage of development and no draft policies are available. The adopted development plan continues to comprise the saved policies of the 2006 South Holland Local Plan.

South Holland Local Plan (adopted July 2006) ("the Local Plan")

5.3 This assessment considers the application proposals against those development policies contained within the adopted Local Plan which were saved beyond July 18th 2009 by direction of the Secretary of State.

5.4 **Policy SG1** is a general policy dealing with sustainable development, and states that permission will be granted for schemes where the quality of life for residents is unimpaired, measures are taken to conserve energy and natural resources, and the character of the locality and environment will not be damaged.

5.5 Local Plan **policy SG4** deals with development in the countryside, and states that development should be essential in its proposed location in order for permission to be granted, with more stringent requirements where proposals would result in unacceptable impacts on the landscape character of the area.

5.6 **Policy SG13** states that planning permission will only be permitted for development proposals where the scheme would not cause unacceptable levels of pollution by noise, light, offensive odour, airborne pollutants or the release of waste products.

5.7 Local Plan **policy SG14** sets out detailed recommendations for the design and layout of new development. Apart from the general requirement for new development to make a positive contribution to the quality of its surroundings, several of the specific points are considered to be of relevance to this application. In particular, the policy requires that the development take into account matters of the relationship to local character and the scale and form of nearby buildings, the effect of the development on local amenity (in terms of noise, smell and other considerations), the layout of the site for access purposes, and measures to reduce the potential for crime.

5.8 **Policy SG15** refers to general vehicular and pedestrian access matters, stating that new development shall provide safe access for motor vehicles, cycles and pedestrians, while respecting local character.

5.9 **Policy EC3** deals with existing employment areas, stating that new development within existing employment curtilages will be permitted *"provided they are acceptable in terms of environmental impact, the level of traffic movement and intrusion into the open countryside."*

The National Planning Policy Framework ("the Framework")

5.10 The NPPF sets out a broad framework for plan making and decision taking at the local level. It must be taken into account in the preparation of local and neighbourhood plans and is a key material consideration in planning decisions.

5.11 The NPPF states that the purpose of the planning system is to contribute to the achievement of sustainable development in its three dimensions; economic, social and environmental. Central to the NPPF is a presumption in favour of sustainable development, *"which should be seen as the golden thread running through both plan-making and decision-taking".* For decision taking this means (paragraph 14):

Approving proposals that accord with the development plan without delay; and

Where the development plan is absent, silent or relevant policies are out of date, granting permission unless;

- *any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in the NPPF; or*
- *specific policies in the framework indicate development should be restricted.*

5.12 Paragraph 17 of the NPPF sets out the core principles of national policy. Of relevance to this application, it states that planning should *"proactively drive and support sustainable economic development"* in order to meet the country's development needs, including infrastructure.

5.13 The principles state that planning decisions should *"always seek to secure high quality design and a good standard of amenity"* for existing and future users, respect the varying character of different areas, and promote the vitality of urban centres.

5.14 Paragraph 17 goes on to state that planning decisions should seek to reduce pollution, reuse previously developed land, protect heritage assets and *"support the transition to a low carbon future."*

5.15 Paragraph 97 establishes support for the transition to a low carbon economy and the delivery of renewable energy generation capacity, including the infrastructure required to support that delivery.

5.16 Paragraph 120 states that *"to prevent unacceptable risks from pollution…planning policies and decisions should ensure that new development is appropriate to its location."* Paragraph 123 sets out aims for planning decisions to avoid *"significant adverse"* impacts on health and quality and life as a result of noise and other adverse impacts, and seek to mitigate such impacts through the use of planning conditions.

6.0 THE NEED FOR RESERVE ELECTRICITY DEVELOPMENT

6.1 A basic introduction to the role of National Grid balancing mechanisms including Short-Term Operating Reserve (STOR) is provided at Appendix 1 to this statement. The document sets out the role of balancing services in ensuring that national electricity supply can continue to match demand alongside economic growth and the transition to a low carbon energy supply system. This chapter provides a summary of national guidance relating to reserve electricity development and the relevance of balancing requirements as a key material consideration.

6.2 In July 2011 the Department for Energy and Climate Change (DECC) released the Electricity Market Reform White Paper Planning our electric future: a White Paper for secure, affordable and low-carbon electricity. The White Paper sets out the challenge of ensuring that electricity capacity keeps pace with the changing landscape of technologies and demand. Regarding STOR plant, it states the following:

> *"The System Operator (SO), National Grid, is responsible for maintaining the stability of the electricity system by ensuring that supply and demand are in balance at all times. Although individual market participants will have planned ahead of time for the expected demand in each half hour, there will be times when demand is greater than forecast … National Grid makes an assessment of how much reserve capacity is required to manage these uncertainties in the period about four hours ahead of real time. This requirement is about 4 GW, and is largely met by the Short-Term Operating Reserve (STOR), whereby National Grid contracts reserve capacity to be made available on demand.*
>
> *As greater amounts of wind generation are added to the system, National Grid expects that the level of required reserve will increase, due to the need to cope with real time unexpected changes in wind generation in addition to existing challenges; this can be both the wind dropping off or blowing too hard causing generation to drop rapidly."* (p.64)

6.3 The White Paper identifies a key barrier to more secure capacity as being the *"potentially limited routes to market for some independent generation"* (p.66). This market failure is due in part to the permitted development rights which allow historical statutory undertakers to install reserve plant under prior notification, while new developers are required to undertake the full planning process.

6.4 Increasing the amount of standing reserve plant across the country under the National Grid STOR programme is identified as a key solution to the growing demand balancing problem, along with Demand Side Response (DSR), new storage technology and other innovations. The White Paper sets out two options for developing a more comprehensive and secure market for meeting the capacity

challenge – the Strategic Reserve and Capacity Market models – both of which would depend on a large increase in the availability of STOR generation plant.

6.5 Taking into account the challenges facing the electricity market and the forecast closures of base-load coal and power generation plant over the next decade, National Grid have estimated that by 2019/20 the amount of STOR reserve generation will need to be almost double from 2009 (National Grid Future Balancing Requirements: Response 2009).

Critical infrastructure for renewable energy development

6.6 In response to the EU Renewable Energy Directive 2009/28/EC - which set a legally binding target of 15% renewables share in the energy portfolio by 2020 – a series of high level Government documents (including the UK Renewable Energy Strategy of 2009 and the UK Low Carbon Transition Plan of 2009) and White Papers have been published to ensure that this target is met. The National Planning Policy Framework lends weight in favour of the delivery of renewable energy generating capacity and supporting infrastructure.

6.7 While it involves electricity generation from fossil fuels, the installation of new STOR plant allows the overall proportion of electricity produced from renewable sources of energy to be increased nationally, for the reasons described in the 2011 White Paper quoted above. The considerable increase in renewable electricity production demanded by the most recent national planning policies – seeking to meet the challenge of climate change - will require a proportional increase in the availability of reserve generation plant if reliability is to be maintained, and rolling blackouts avoided.

6.8 National policy requires that planning proactively drives and supports sustainable economic to deliver the country's development needs, including infrastructure needs. There is a strong public interest in the delivery of further STOR capacity given the risks faced by the national electricity supply system, which represents a significant material consideration in favour of STOR development.

7.0 ASSESSMENT OF PROPOSED DEVELOPMENT

Principle of Development

7.1 The proposed extension to the existing reserve electricity facility at Spalding Drove represents an increase of approximately 30% (370 sq m) to the existing footprint (1290 sq m).

7.2 Given the scale of the existing facility and the immediate site context of large-scale industrial development, this is considered to be a modest extension to a use established by virtue of the planning history set out at Chapter 3 to this report. As an extension, the principle of development in this location is considered to be acceptable.

Visual Amenity

7.3 The proposal will not exceed the limits of the existing facility in respect of the height of the enclosure nor in respect of proximity to residential properties. The extension is located at the eastern end of the site towards neighbouring industrial development and vacant scrub land. The extension will benefit from the natural and built screening which serves the existing facility effectively.

7.4 It is therefore not considered that the proposed development will result in any unacceptable visual impacts upon the amenity of neighbours, nor any harm to the character of the surrounding area or immediate landscape context.

7.5 For these reasons the proposal is found to accord with the requirements of Local Plan policies SG1, SG14 and SG15 and the aims of the Framework in this respect.

Noise, Air Quality and Residential Amenity

7.6 Specialist statements dealing with the noise and air quality effects of the proposed extension accompany this statement, and conclude that no unacceptable impacts will result from the proposal. The proposed gas generators represent best available technology and perform well in respect of preserving acceptable levels of noise and air quality. The proposed containers exhaust vertically in order to maximise dispersion. The proposal also incorporates the extension of the existing acoustic fence along the northern boundary to retain further noise mitigation for the benefit of neighbouring occupants.

7.7 For these reasons it is considered that no unacceptable amenity impacts will result from the proposal, which is therefore found to accord with the relevant requirements of Local Plan policy SG13 and SG14 and the aims of the Framework in this respect.

Access Considerations

7.8 As set out at Chapter 4 of this report, the proposed development will benefit from use of the existing informal access track running along the northern boundary which provides connection directly to Spalding Drove and the wider transport network. Due to the infrequency of visits to the site required, the access does not require to be upgraded and only a short section of new access will be created to connect to the proposed site entrance.

7.9 The construction phase for the proposed development is straightforward and following this, due to the remotely operated nature of the generating facility, vehicular movements to and from the site will be infrequent for maintenance and refuelling purposes, and in any event will be aligned with maintenance visits to the existing facility.

7.10 For these reasons it is considered that the proposals will not result in any change in impacts relating to access and highways, and are therefore fully compliant with the relevant Local Plan policy SG15 and the provisions of the National Planning Policy Framework.

Flood Risk

7.11 A site-specific Flood Risk Assessment accompanies this application and confirms the acceptability of the development in terms of flood risk subject to measures which are incorporated into the design, and that the proposal will not increase the risk of flooding elsewhere. The National Planning Policy Framework also requires that proposals in areas of flood risk address the Sequential Test and, if required, the Exceptions Test.

7.12 The basis of the Sequential Test is that development should not be permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding. In this case the proposed location is essential to the proposed development, both inherent to its nature as an extension to an existing facility, and in respect of its requirement to utilise the existing grid connection at the site. It should also be noted that the substantial majority of the local authority area is subject to the same probability of flooding which severely constrains the availability of lower risk sites for all uses.

7.13 The proposed development is considered to comprise essential infrastructure which is of very low vulnerability to flooding due to mitigation measures which are incorporated into the design. The development brings wider sustainability benefits in the form of its contribution to national electricity infrastructure essential to support economic growth and the transition to a low carbon energy portfolio. As set out above, the proposal is also supported by a site-specific Flood Risk Assessment. The Exceptions Test is therefore passed and the development is found to be acceptable in this location in respect of flood risk and the associated requirements of national policy.

Utilities

7.14 An existing connection to the national grid is in place at the site which will serve the proposed extension and avoid the need for further cable laying in the area. The proposal will also benefit from the site's existing switchgear, maintenance and security facilities which permits the level of development required to be minimised. This is a consideration in favour of the development at this location.

Contribution to National Infrastructure Requirements

7.15 The existing facility at Spalding Drove has been utilised well within its operational time limits during its first year of operation, and this underlines the nature of the development as emergency supply infrastructure. Nonetheless the facility plays a crucial role in ensuring that the National Grid's capability to respond to unexpected falls in baseload electricity supply remains intact.

7.16 In order to keep pace with economic growth and to provide sufficient flexibility to accommodate the growth in the contribution of renewable energy to the national energy portfolio, National Grid has identified additional requirements for reserve electricity capacity, and this application is made in response to these requirements.

7.17 The proposal for a modest extension to an existing facility permits the use of existing on-site operational and grid connection infrastructure which in turn minimises the scale of development required. The contribution to national requirements for reserve electricity capacity is a significant material consideration in favour of the proposed development.

8.0 CONCLUSIONS

8.1 This report has provided an assessment of the proposed development against the relevant extant policies of the development plan and the provision of national planning policy. The assessment has demonstrated that:

- The principle of development is established as the scheme represents an extension to an existing facility in an acceptable location;
- The proposals will be inconspicuous in the context of adjacent development, will benefit from natural and built screening in the locality and as a result will not give rise to any unacceptable harm to local visual amenity, character or landscape interest;
- The effects of the proposed extension, both in isolation and cumulatively with the existing facility, will be acceptable in respect of noise and emissions and will fully preserve the amenity of neighbouring occupants. The conditions attached to the original planning permission for the facility are considered to be appropriate to be attached to the current scheme in the interests of preserving local amenity;
- Access to the proposed extensions for the purposes of maintenance and refuelling will be aligned with visits to the existing facility, and the scheme will therefore result in negligible change in effects upon access and local highways safety;
- The proposal will make use of existing maintenance and security features allowing the scale of development required to be minimised, and the existing grid connection will be utilised, avoiding any disturbance in this respect; and
- The proposal will make a meaningful contribution to ongoing national requirements for reserve electricity infrastructure in an effective and efficient manner through the extension of an existing facility. This is a significant consideration in favour of the proposals.

8.2 This assessment has demonstrated that the proposed development will be in accordance with all relevant policies and the development plan and with the provisions of the National Planning Policy Framework. Material considerations have also been identified which lend further weight in favour of the scheme. In these circumstances the Framework directs that proposals should be approved without delay.

APPENDIX 1 National Grid Future Balancing Services Requirements

Future Balancing Services Requirements: Response

National Grid wishes to highlight to participants its current and future requirement for response services. This document illustrates the diurnal and seasonal shape of the requirement and how requirements are anticipated to change over the coming years.

If you would like to know more about providing services of this kind please contact Andy Walden (+44 (0)1926 655087, andy.walden@uk.ngrid.com) or look here: http://www.nationalgrid.com/uk/Electricity/Balancing/services/frequencyresponse/

Gone Green Scenario

The analysis presented in this document is based on an updated version of the 'Gone Green' scenario used in the 2020 initial consultation[1]. The background to this scenario is as follows:

The UK Government is required to reduce greenhouse gas emissions by 80% by 2050 under the Climate Change Act. The draft UK Renewable Energy Strategy is aimed at supplying 15% of energy from renewable sources by 2020.

Prior to these dates, implementation of the Large Combustion Plant Directive will mean that 12GW of generation capacity in use today will need to stop generating before 2016. We may see further early generation closures driven by the proposed Industrial Emissions Directive.

Additionally, to facilitate the connection of larger generating units, the System Security and Quality of Supply Standards is likely[2] to be modified to increase the normal infeed loss risk from 1000MW to 1320MW and the infrequent infeed loss risk from 1320MW to 1800MW. This change is expected to effect National Grid from 2019/20, but it may be accelerated to allow for earlier connections.

We believe that the 'Gone Green' scenario illustrates a set of plausible outcomes for 2020 and beyond which are useful in illustrating the challenges we face, even though other scenarios are equally plausible and consistent with relevant policy objectives.

Frequency Response

System frequency is a continuously changing variable that is determined and controlled by the second-by-second (real time) balance between system demand and total generation. If demand is greater than generation, the frequency falls – if generation is greater than demand, the frequency rises.

[1] http://www.nationalgrid.com/uk/Electricity/Operating+in+2020/
[2] Subject to Authority approval of SQSS review GSR007

After a demand or generation fault there is a significant difference between generation and demand, and therefore system frequency changes. National Grid runs the system in such a way that:

- The maximum deviation of frequency after a normal loss is no greater than 0.5Hz.
- The maximum deviation of frequency after an infrequent loss is no greater than 0.8Hz.
- Any deviations outside 49.5Hz and 50.5Hz do not exceed 60 seconds.

National Grid achieves this by using one of three response services, which are defined below. The requirement for these frequency response services is set to the lowest amount that is required in order to meet the obligations outlined above.

Primary and secondary response is an automatic increase in generation (or reduction of demand) when the frequency is below 50Hz. Primary response is delivered within 10 seconds, while secondary response is delivered within 30 seconds.

High response is an automatic reduction in generation (or increase in demand) when frequency is above 50Hz. High response, like primary, is delivered within 10 seconds.

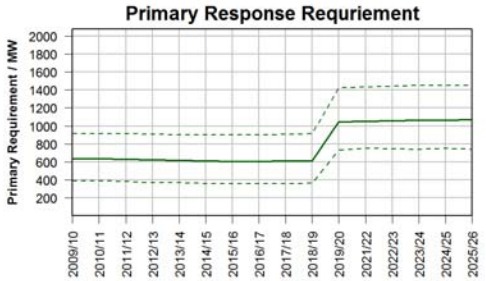
Response Requirements Per Year – Gone Green Scenario

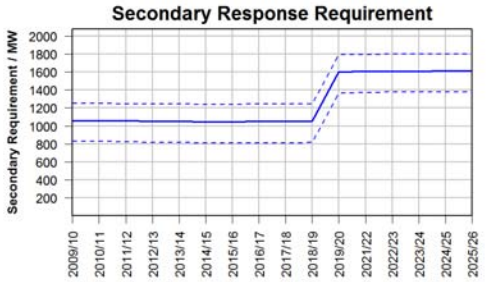
The table and graphs below details the average[3] values of the various Frequency Response requirements under our 'Gone Green' scenario:

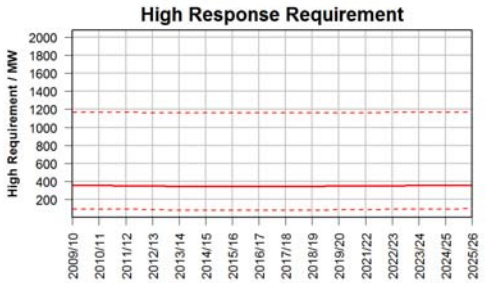
Year	Installed Capacity / MW					Demand / MW	Response Requirement / MW		
	Wind	Nuclear	Coal	Gas	Other		Primary	Secondary	High
2009/10	2,228	10,894	28,166	27,181	10,539	58,400	636	1,060	354
2010/11	3,802	9,679	28,166	28,074	9,383	56,700	634	1,060	354
2011/12	5,795	9,444	28,166	29,364	9,383	55,900	628	1,058	352
2012/13	7,677	9,444	28,166	29,799	9,431	56,100	619	1,052	347
2013/14	9,086	9,444	22,428	31,034	9,946	55,900	614	1,051	346
2014/15	10,681	9,444	22,060	32,234	10,176	56,700	608	1,048	344
2015/16	12,198	9,444	20,120	35,231	7,796	56,800	604	1,048	344
2016/17	14,888	9,444	20,970	34,331	8,346	57,000	606	1,049	345
2017/18	17,378	9,444	21,720	33,437	8,746	57,200	608	1,050	346
2018/19	19,928	8,363	21,720	33,912	9,196	57,700	609	1,051	346
2019/20	22,258	10,033	21,679	32,706	9,645	57,900	1,045	1,604	347
2020/21	24,599	11,233	17,745	31,918	9,939	57,600	1,051	1,606	349
2021/22	26,799	10,548	17,745	31,918	9,999	57,200	1,054	1,608	351
2022/23	28,130	11,748	17,745	31,918	10,264	57,100	1,058	1,609	352
2023/24	28,955	13,418	14,461	33,158	10,280	57,100	1,063	1,611	353
2024/25	29,530	11,008	14,461	32,366	10,380	57,000	1,065	1,612	354
2025/26	30,605	12,658	14,461	32,999	10,770	57,000	1,070	1,613	355

[3] A time-weighted mean

In addition to the average requirement over the year, one can also calculate the minimum and maximum requirement. These figures are included on the graphs as dotted lines.







Circuit outages can raise the credible level of instantaneous demand loss and therefore increase the requirement. When calculating the requirements (both average and range) an intact system has been assumed.

With the currently planned arrival of larger generation units in 2019, the largest credible generation loss increases from 1320MW to 1800MW. This increases the primary and secondary response requirements significantly[4] at that time, from 630MW to 1080MW and from 1020MW to 1570MW respectively.

As the largest demand loss is unchanged into the future, the High requirement is largely unchanged.

[4] SQSS review GSR007 contains a detailed study of this effect. Broadly, one would expect an increase in the requirements by almost the increase in largest loss. The full document can be found here:
http://www.nationalgrid.com/uk/Electricity/Codes/gbsqsscode/reviews/index.htm

Each year more wind connects, and therefore generates and displaces conventional power stations. This reduces system inertia slightly, and therefore increases the primary and high frequency response requirements. As one can see from the graphs this effect is minor compared with the largest loss effect.

As the range of wind output increases, so does the range of inertia. This causes the range of possible values for the primary requirements to increase[5].

The maximum response requirement is caused by a combination of low demand and high wind. That is a low inertia system, with little demand side response. Conversely, the minimum requirement is caused by high demand and low wind.

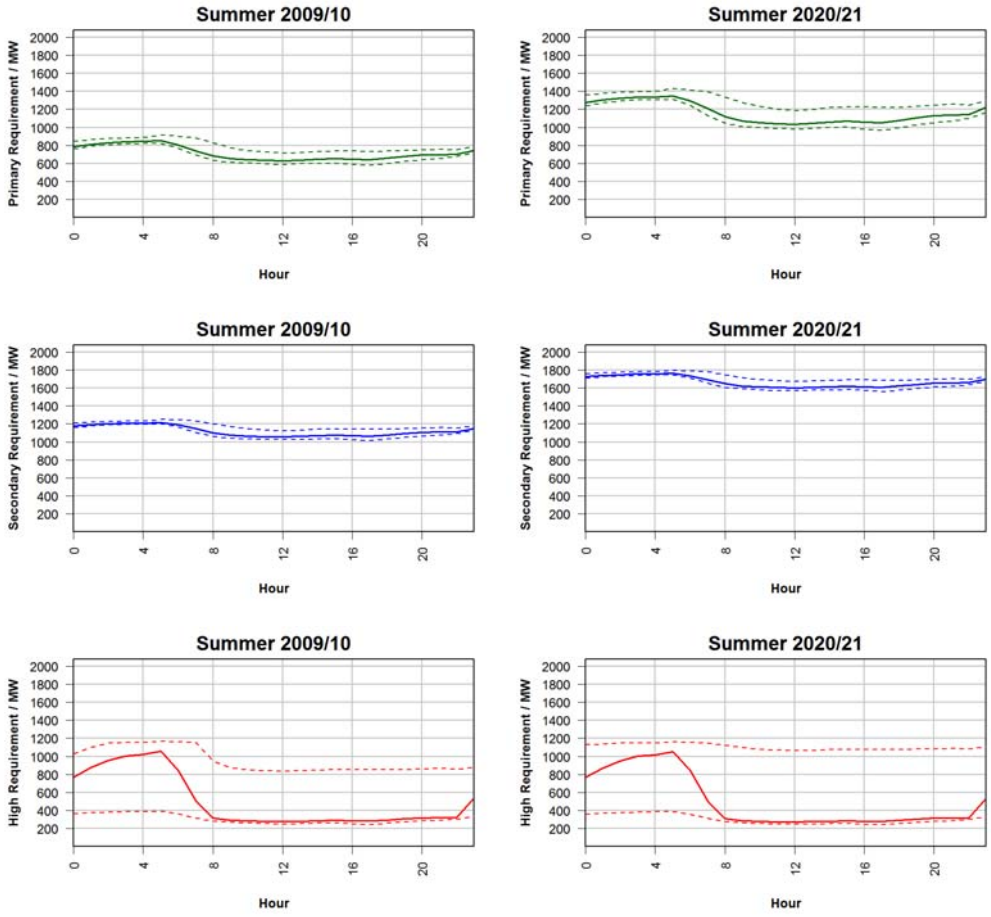
[5] For the primary requirement the range increases from 524MW in 2009/10 to 685MW in 2020/21.

Diurnal and Seasonal Shape of Frequency Requirements

The requirement for frequency response changes as the demand curve and plant mix changes. Therefore, it makes sense to look at the diurnal and seasonal shape of the requirement.

The graphs below show the diurnal shape of the requirements during the winter[6] and the summer[7]. As before: the minimum, average and maximum values are all plotted.

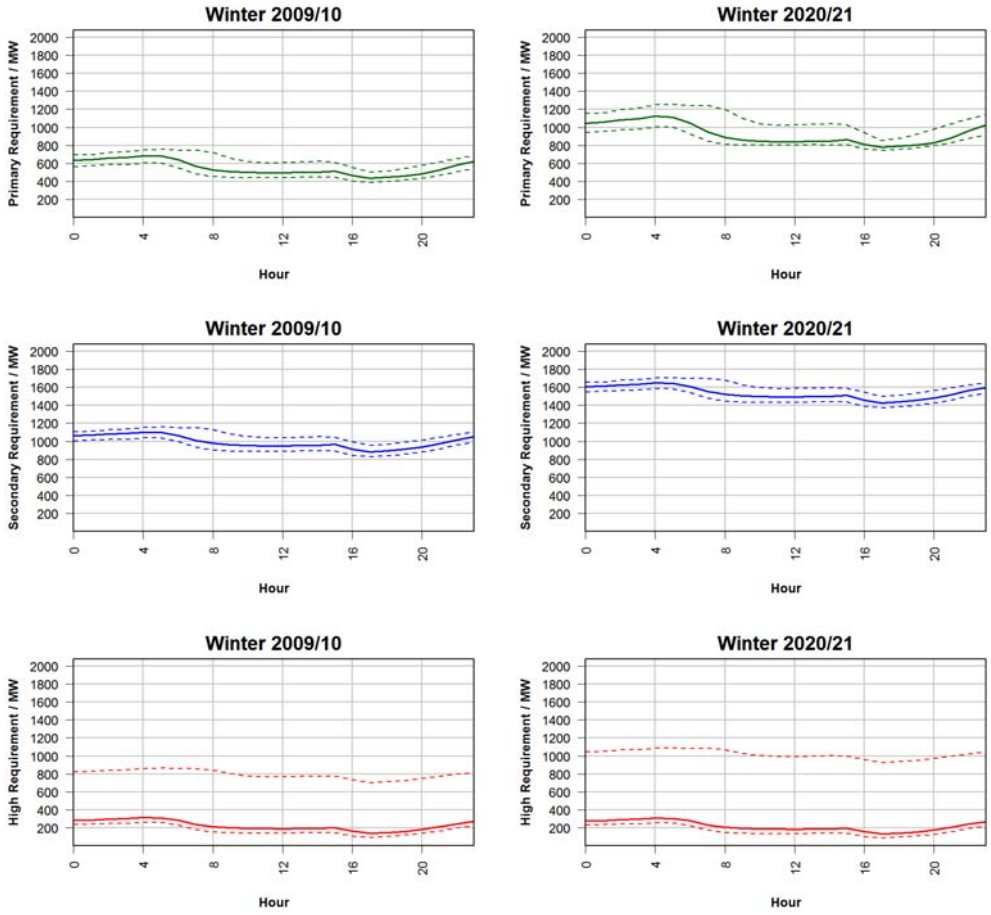
Summer



[6] Average requirement over engineering weeks 47- 50 (i.e. last two weeks in November, first two weeks in December)

[7] Average requirement over engineering weeks 27-31 (i.e. July)

Winter



As system demand provides some frequency response, there is a basic shape in the frequency response requirements.

In addition to the demand effect, overnight the largest credible demand loss increases (while pump storage power stations pump). Consequently, the high requirement increases much more than the primary requirement overnight.

Changes from 2009/10 to 2020/21

The basic diurnal and seasonal shape of the requirements are unchanged.

As the yearly summary suggested, the main change is an increase of the primary and secondary requirements caused by the introduction of 1800MW power stations.

By 2020/21 the installed wind capacity is significant, and as a result the slight increase in the range of primary and high requirements is just noticeable.

Minimum Dynamic Requirement

Most of the response requirements can be met either by static providers (that deliver a certain quantity of response at a single trigger frequency) or by dynamic providers (that smoothly deliver differing amounts of response with frequency changes). The part of the response requirement that cannot be met by static providers is referred to as the minimum dynamic response requirement.

This minimum dynamic response is used to keep the frequency close to 50Hz when small (< 300MW) events occur – such as units failing to synchronise, BOA profiling error / following error and very short term perturbations in demand.

The minimum dynamic requirement and system inertia are complementary. Should the system inertia decrease below a critical value the minimum dynamic response requirement will need to be increased, this point occurs when the lack of inertia moves the system from over damped to under damped[8].

In order to avoid this problem, National Grid is proposing a change to the grid code, specifying a 'synthetic inertia' requirement for plant that would not otherwise contribute to system inertia.

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[8] Assuming that the system is over damped then the minimum dynamic response requirement can be calculated from the steady state of frequency, rather than the path to that frequency.