GB SQSS Fundamental Review

Outline Principles Document

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Great Britain Security and Quality of Supply Standard Fundamental Review

Outline Principles Document

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1 Introduction

The Great Britain Security and Quality of Supply Standard (GB SQSS) Review Group is responsible for ensuring the GB SQSS is kept up-to-date and relevant as the energy industry develops and technology advances.

The energy industry is actively seeking solutions to integrate new generation technologies such as wind generation into the electricity networks. As a result, a wide range of initiatives are under consideration, ranging from a review of transmission access and commercial frameworks to a number of security standard reviews. In addition to the review areas identified by the GB SQSS Review Group, the Transmission System Operation Review Group (TSORG) has also identified a number of issues to be reviewed.

Following the submission of a formal review request (GSR008), which was approved by the GB SQSS Review Group, the GB SQSS Review Group is now conducting a Fundamental Review of the GB SQSS. This Fundamental Review forms part of the wider industry initiatives to support the government's renewable and carbon reduction targets and takes a co-ordinated, holistic approach to the development of the GB SQSS. The review will take account of interdependencies with other reviews in progress (e.g. the Transmission Access Review (TAR)) as well as a number of reviews currently being processed by the GB SQSS Review Group.

This Outline Principles Document (OPD) has been produced in accordance with the overall GB SQSS Fundamental Review project plan and provides a summary of: the drivers to the Fundamental Review; the key issues which need to be addressed by the review; and describes four models, which have been developed to address those issues (collectively referred to as the Outline Principles).

In conducting the Fundamental Review, the GB SQSS Review Group is keen to engage all stakeholders in the GB SQSS in an open and inclusive manner. While this OPD is not intended as a formal consultation document, readers are invited and encouraged, at this early stage of the review, to comment on these Outline Principles. In particular, your views are sought on the proposed approach, outlined in Section 5, for addressing the various issues.

2 Principles of the Current GB SQSS

2.1 Background

The transmission licensees are required to plan, operate and maintain the transmission system in an efficient and economical manner and to facilitate competition in the electricity market.

Compliance with the GB SQSS is an electricity transmission licence requirement. Standard condition C17 obliges NGET to plan and develop its transmission system and to operate the GB transmission system in accordance with the GB SQSS. Standard condition D3 obliges SPT and SHETL to plan and develop their transmission systems in accordance with the GB SQSS.

The GB SQSS has its roots in the 1940s and has evolved from a suite of six individual standards which concerned: the design of generation connections (PLM-SP-1); the design of the supergrid transmission network (PLM-SP-2); criteria for system transient stability studies (PLM-ST-4); voltage criteria for the design of the 400kV and 275kV supergrid system (PLM-ST-9); the design of demand connections (ER P2/5); and the operational standards of security of supply (OM3). At vesting in March 1990, these standards were inherited by National Grid and were lodged with the then Office of Electricity Regulation (Offer

subsequently Ofgem) in accordance with Condition 12 of National Grid's transmission Licence and became commonly known and referred to as the Licence Standards.

The standards were written as separate, relatively independent, guidance notes for engineers. Their use by National Grid identified a number of areas of ambiguity and inconsistency both within and between the standards. A Review of Security Standards (RSS) was initiated by National Grid following a formal request by Offer (now Ofgem) in 1992. In 1996, following the conclusion of the review, Offer requested National Grid to update the standards and, in so doing, maintain the principles of the original Licence Standards except as modified by the RSS (e.g. in respect of customer choice and the greater use of operational flexibility).

In meeting Offer's request, National Grid took the opportunity to combine all the standards into a single document referred to as the NGC System Security and Quality of Supply Standard (NGC SQSS). The previous six standards ceased to have effect from November 2000 when the new GB SQSS came into force. However, in Scotland the transmission licensees had a different set of transmission planning and operational standards such as NSP 366, OM3 and GCI B1 and these were not part of the RSS undertaken by National Grid. Consequently, the Scottish transmission licensees continued to apply these standards until the introduction of the GB SQSS.

In 2003, in preparation for the introduction of the British Electricity Trading and Transmission Arrangements (BETTA), Ofgem requested that National Grid (as GBSO designate) and the three GB transmission owners (i.e. NGC, SHETL and SPT) harmonise the standard, as far as practical, while still retaining the principles of the NGC SQSS and without altering the underlying security of the system or incurring significant infrastructure expenditure. With the introduction of BETTA on 1st April 2005 the new standard, referred to as the great Britain Security and Quality of Supply Standard (GB SQSS), replaced the previous standards used by the three GB transmission owners (including the NGC SQSS).

More recently, Ofgem and the Department for Business and Regulatory Reform (BERR) have been working together to implement a regulatory regime for offshore transmission systems. As part of this Ofgem/BERR work, Ofgem requested that National Grid develop the current GB SQSS to include offshore transmission systems as well as the onshore transmission system. National Grid submitted their final change proposals to Ofgem in April 2008 and these currently form part of Ofgem's consultation process on offshore electricity transmission. The offshore generation criteria contained in the draft were based on a series of cost benefit analyses bounded by certain pragmatic assumptions. The assumptions recognised the technology available at the time the analyses were carried out; including the Round 1 and Round 2 offshore developments but not including Round 3 developments.

2.2 Content of the GB SQSS

The current GB SQSS presents criteria and methodologies, which the relevant onshore transmission licensees are obliged to apply when planning and operating onshore transmission systems. The GB SQSS presents these onshore criteria and methodologies according to the functional part of the onshore transmission system to which they primarily apply.

The GB SQSS defines a set of events which the transmission system must be able to withstand. In a widely used shorthand, an N-1 security standard requires the system to work satisfactorily following the loss (e.g. due to a fault of maintenance outage) of any one of its N elements. For planning purposes, N usually refers to the total number of transmission circuits but may also include busbar sections, generating units or blocks of reactive compensation. However, in operation, N may also refer to conditions when some elements of the network are already out of service to permit maintenance or construction work. In such cases, the shorthand N' is often used to avoid confusion.

There are currently seven sections and five appendices. The key sections are Sections 2, 3, 4, 5 and 6. Each of these sections includes criteria in the form of specified secured events

(e.g. N-1, N-2 or N-D where D represents a double circuit) for which specified unacceptable conditions shall not arise. The following paragraphs provide an overview of their content.

2.2.1 Section 2: Design of Generation Connections (Transmission Entry)

An aim of the generation connection criteria is to: provide an equitable balance between investment in local connection assets, operational costs and the level of generation access provided; and to facilitate competition in the electricity market; while, at the same time, ensuring the transmission system is planned (and operated) in an economic and efficient manner.

Criteria include those which relate to 'Limits to Loss of Power Infeed (LOPI) Risk' and those which relate to 'Capacity Requirements'. Application of the LOPI criteria determine the minimum number of circuits, busbars and switchgear required while application of the 'Capacity' criteria determine the capacity of those circuits, busbars and switchgear and, depending on available circuit capacity, may lead to additional circuits being required.

The LOPI criteria are based around a normal infeed loss risk of 1000MW and an infrequent infeed loss risk of 1320MW. For certain secured events no loss of power infeed is permitted.

For example, the GB SQSS requires that generation connections shall be planned such that, starting with an intact system (i.e. N), following the secured event of a fault outage of a single transmission circuit (i.e. N-1) there shall be no loss of power infeed. Similarly, and again starting with an intact system, following the secured event of a concurrent fault outage of two transmission circuits (i.e. N-2), the loss of power infeed shall not exceed the infrequent infeed loss risk (i.e. 1320MW).

The values of normal and infrequent infeed loss risk are the limits to the loss of power infeed which can be accepted for certain specified secured events. These values, and perceived frequency of occurrence of the secured events causing them, are consistent with the requirements of the Electricity Supply Regulations 1989 and National Grid's policy to contain frequency response costs. That is, they represent an equitable balance between risk and cost to the end user.

The background conditions against which the capacity criteria should be applied are also specified. These background conditions cover times of off-peak as well as peak demand.

It is permissible to design to standards higher than those set out provided the higher standards can be economically justified. A lower standard is also permitted under the provisions of a 'Variation to Connection Designs' clause (i.e. customer choice).

The main developments which have the potential to impact on this standard include: the possible introduction of generation infeeds in excess of 1320MW which would naturally impact on the LOPI criteria; the introduction of new transmission access arrangements; and the introduction of high volumes of renewable (e.g. intermittent wind generation) and other low carbon generation which may require different treatments under the standard.

2.2.2 Section 3: Design of Demand Connections (Transmission Exit)

An aim of the demand connection criteria is to provide an equitable balance between investment in local demand connections, operational costs and the level of demand security provided.

The demand connection criteria are essentially based on the time of peak demand although the maintenance period demand, which is likely to occur at off-peak times, is considered. The criteria specify the minimum level of local connection to demand and are based on the original Licence Standard ER P2/5.

The unacceptable conditions that shall not arise as a result of specific secured events include loss of supply capacity beyond specified limits, unacceptable overloading, unacceptable

voltage conditions and system instability. The permitted loss of supply capacity is a function of the size of demand group. Different sizes of demand group are provided with different levels of security. An assumed effective contribution from embedded large power stations to group demand is also taken into account.

For example, the transmission capacity for the connection of a 400MW demand group shall be planned such that for certain specified background conditions and a fault outage of a single transmission circuit (e.g. a single transformer (N-1)), the full group demand must continue to be met. For the connection of a 10MW demand group, following a fault outage of a single transmission circuit (i.e. again N-1), group demand minus 1MW must be restored within 3 hours and full group demand restored within repair time.

As in Section 2, it is permissible to design to standards higher than those set out provided the higher standards can be economically justified. A lower standard is also permitted under the provisions of a 'Variation to Connection Designs' clause (i.e. customer choice).

The main developments which have the potential to impact on this standard include: the possible need for amendments for harmonisation with ER P2/6; and the contribution of intermittent generation (embedded or directly connected) to demand security.

2.2.3 Section 4: Design of the Main Interconnected Transmission System (MITS)

The level of demand security is determined, in large part, by the capacity of generating plant connected to the system in excess of the ACS peak demand. The MITS provides the vital link between generation and the delivery of electricity to the demand customer and it is important that sufficient transmission capacity is provided to ensure that the MITS does not unduly restrict the ability of generation to meet demand. Any change in the reliability of the MITS will impact on both the level of demand security and on the level of transmission access as well as operational costs.

An aim of the MITS criteria is to provide an equitable balance between investment in the MITS, generation access, demand security and operational costs (e.g. constraints and losses).

The MITS criteria apply to the situation where the main interconnected transmission system can be divided into any two contiguous parts such that the smaller part contains more than 1500MW of demand at the time of the ACS peak demand. The criteria are applied to the boundaries between the two contiguous parts. The criteria also apply to the boundaries between the Transmission Areas of the three transmission owners (i.e. NGC, SHETL and SPT). Application of the criteria provides a level of security to both demand and generation access.

The section makes reference to two appendices, namely: Appendix C (Modelling of Planned Transfer); and Appendix D (Application of the Interconnection Allowance). These two appendices describe methodologies which are fundamental to the MITS planning criteria.

Appendix C describes the techniques which shall be used for modelling the transfer across a boundary (i.e. the planned transfer). In brief, the ranking order technique is used to determine, on the basis of a 20% plant margin, which generating plant may be assumed contributory and which may be assumed non-contributory (i.e. not expected to operate at the time of winter peak). The straight scaling technique is used to determine the contribution of each contributory generating plant by applying a scaling factor; again based on a 20% plant margin.

Appendix D describes how an allowance for security (i.e. the interconnection allowance) is added, in whole or in part, to transfers arising out of the planned transfer condition. Appendix D also describes how the interconnection allowance shall be calculated.

For example, the North to Midlands boundary divides the system into two contiguous parts each of which contain more than 1500MW of demand. Accordingly, the transmission capacity

of the boundary circuits across the North to Midlands boundary shall be planned such that, inter alia, for a power flow equal to the planned transfer (as determined under the techniques set out in Appendix C of the GB SQSS) plus the interconnection allowance (in whole or in part as determined under the techniques set out in Appendix D of the GB SQSS) and for the secured event of a fault outage of up to two transmission circuits (N-1 or N-2), there shall not be any unacceptable overloading or unacceptable voltage conditions.

As in Section 2, the background conditions against which the criteria should be applied are also specified. These background conditions cover the times of off-peak as well as peak demand.

As in Section 2 and 3, it is permissible to design to standards higher than those set out provided the higher standards can be economically justified. However, unlike Sections 2 and 3, the deterministic criteria for the MITS represent a minimum requirement. Variations in design, which would result in a reduction below the minimum set by the criteria, are not permitted and, accordingly, there is no 'Variation to Connection Designs' clause (i.e. customer choice).

The main developments which have the potential to impact on the criteria and methodologies referred to (i.e. Appendices C (Modelling of the Planned Transfer) and Appendix D (Application of the Interconnection Allowance)) in this section include: the introduction of new transmission access arrangements including measures to facilitate early access; the contribution of intermittent generation to demand security; and the treatment of large demand zones with little generation. Any resultant change will impact on transmission investment, the level of transmission access and demand security provided by the MITS.

2.2.4 Section 5: Operation of the GB Transmission System

These criteria are concerned with the day to operation of the transmission system and, accordingly, are applied against the background of prevailing system conditions.

The secured events include a fault outage of the 'most onerous loss of power infeed' rather than a specific value of normal or infrequent infeed loss risk.

For example, under prevailing system conditions the system shall be operated so that for the secured event of a fault outage leading to the most onerous loss of power infeed (N-1 or N-D) there shall be no unacceptable frequency conditions.

The unacceptable conditions which shall not arise include loss of supply capacity beyond specified limits. Those limits are consistent with ER P2/5.

Conditional further operational criteria are also included which cover situations where conditions are adverse and during periods of major system risk.

2.2.5 Section 6: Voltage Limits in Planning and Operating the GB Transmission System

These criteria cover pre-fault planning voltage limits, voltage step change limits (for planning and operation) and steady state voltage limits (for planning and operation).

3 Summary of Key Drivers to the Fundamental Review

The current GB SQSS was established for a power system predominantly supplied by conventional generation and has provided the basis for the development of an economic and efficient transmission system over the years.

However, over more recent years there have been a number of developments and technological advances in generation which have led to the perception that the GB SQSS may no longer be delivering the required level of transmission capacity and may have

become a barrier to connecting the large volumes of renewable energy projects seeking to use the transmission system. The developments leading to this perception are summarised in paragraphs 3.1 to 3.8 below.

In addition, there are two reviews which are already currently being addressed by the GB SQSS Review Group, but which fall outside the scope of the main Fundamental Review in view of their advanced stage of progress. These are:

- Review of 'Design of Generation Connections' (GSR003); and
- Review of Infeed Loss Limits (GSR007).

These two reviews will continue to be conducted in parallel with the Fundamental Review. Their findings, along with the impact of the findings of other related reviews (e.g. TAR), will be taken into account and form part of the conclusions of the Fundamental Review.

A common theme of many of the developments (i.e. items 3.1 to 3.6) summarised in the following paragraphs is the need to facilitate the timely connection of renewable and other low carbon generation to meet the Governments targets while, at the same time, ensuring effective competition in generation and efficient and economic transmission investment and operation. Other drivers to the Fundamental Review (i.e. items 3.7 and 3.8) are also relevant.

In considering the developments below (i.e. items 3.1 to 3.8), the Fundamental Review will take account of interactions between: transmission access arrangements; the criteria of the GB SQSS; and transmission investment.

3.1 Growth in Renewable Generation

The amount of renewable generation, particularly wind generation, is increasing as a consequence of the government's aspirations to reduce greenhouse gas emissions from electricity generation and thereby meet the UK's share of the EU renewable targets by 2020 and beyond. At the same time, a significant portion of the UK's existing conventional and nuclear capacity will need to be replaced with new lower carbon generation.

3.2 Transmission Access Arrangements

The Transmission Access Review (TAR) was announced by the Government in its Energy White Paper 2007. The necessary development of the transmission system infrastructure has been identified as one of the critical barriers to: providing timely access to the GB transmission system to the high volumes of renewable and other low carbon generation; and to maintaining secure domestic energy supplies. The need to consider changes to the present access arrangements was driven by the current delays facing the large volumes of renewable generation and other forms of generation seeking connection to the transmission system and the potential effects these delays may have on enabling the Government to achieve its climate change targets.

While the principal issue is the ability to gain planning consent, TAR seeks to allow new parties to gain early access through network sharing with interested parties. The 'Transmission Access Review – Final Report', dated June 2008, includes, inter alia: actions that allow faster connection of some renewable generation to the GB transmission system in the short-term; steps to introduce new enduring grid access arrangements that allow faster connection and expansion of transmission capacity; and measures to identify the new transmission infrastructure necessary to meet the UK share of the 2020 EU renewable energy targets.

These developments have led to the need to review the GB SQSS to take account of these changing access arrangements. In recognition of its significance in the context of the Fundamental Review, Section 3 of this report considers the TAR in a little more detail.

3.3 Contribution of Intermittent Generation to Demand Security

In view of the intermittent nature of much of the renewable generation (e.g. wind generation) seeking connection to the transmission system, there is a need to review the contribution of the different generation technologies, assumed in the application of the GB SQSS, to meeting demand security.

3.4 External Interconnections

Given the increasing number of External Interconnections with External Systems connecting to the GB transmission system, the question arises as to the appropriate level of security that should be provided for exports to External Systems.

3.5 Offshore Networks.

Offshore networks connecting offshore power stations (again mainly wind generation) to an onshore network are emerging. Such networks of 132kV or above will be classified as offshore transmission systems and will form part of the overall GB transmission system (i.e. onshore and offshore).

To date, work on developing the GB SQSS to include offshore transmission systems has focussed on the connection of Round 1 and Round 2 offshore developments. This initial GB SQSS review for offshore has been progressed as part of the Ofgem/DECC (Department of Energy and Climate Change) offshore transmission project. There is now a need to analyse and define the basis for an offshore security standard that can cater for the connection of offshore generation projects of the size and location of Round 3 projects and also for the connection of External Interconnections (from External Systems) to offshore transmission systems.

3.6 Transmission System Operational Review Group (TSORG).

The TSORG was established by Ofgem to assist with a review of transmission system operation; its purpose being to determine whether additional transmission capacity might be available on the GB transmission system by determining ways to further optimise the operation of the GB transmission system. The Transmission System Operational Review Group final report dated 8 October 2007 identified a number of areas which might be pursued and make some limited improvements in capacity in operational timescales which may reduce constraint volumes. However, such measures would be unlikely to release additional capacity for new generation connections. Those measures include:

- Increased use of real time ratings;
- Review of a particular GB SQSS generation criterion to possibly allow use of local intertripping arrangements in planning timescales; and
- Review the GB SQSS to assess if changes are needed (e.g. changes to the contingency criteria) to the underpinning principles and to quantify the impact.

3.7 Largest Generation Infeed.

Advances in generation technologies have seen large generating sets (1500MW and above) become viable in recent years. The current GB SQSS planning and operational criteria were not designed for such large single units. As a consequence, the change in generation technologies has two modes, namely: the increase in intermittent generation (particularly wind generation) and the prospect of larger units than previously foreseen. This potential shift in generation mix presents new challenges both in operational and planning timescales to ensure continued development of an economic and efficient transmission system.

As previously mentioned, a review of infeed loss limits (GSR007) is already being conducted under the GB SQSS Review Group. The conclusions of that review will feed into and inform this Fundamental Review.

3.8 Large Demand Zones with Little Generation

The criteria for the design of the main interconnected transmission system (MITS) are set out in Section 4 of the GB SQSS. In assessing whether the MITS meets those criteria the power flows are set to those arising from the 'planned transfer' (Appendix C of the GB SQSS refers) modified by an appropriate application of the 'interconnection allowance' (Appendix D of the GB SQSS refers). Appendix D applies in the situation where, when the transmission system is divided into two contiguous parts, the smaller of the two contains more than 1500MW of demand at the time of the ACS peak demand.

It has been recognised that, in the case of zones with over 1500MW of demand but little or no generation, the resultant security provided by application of the criteria can be lower than would otherwise be the case. Accordingly these criteria should be subject to review.

4 Transmission Access Review (TAR) Models

The Transmission Access Review is a key driver to the GB SQSS Fundamental Review. Proposals arising from TAR are targeted for implementation in April 2010; however there is a need to develop appropriate systems in advance of implementation.

To date a number of CUSC Amendment Proposals (CAP) have been formally submitted for industry assessment. Once submitted the amendments are presented to the Authority for decision in a fixed period of time. An underlying theme is that users are able to choose short-term or long-term access. Long-term access is associated with asset cost or user valuation and requires firm commitment. Short-term access, of which there are several options, is associated with operational costs. Current CAP proposals include:

- CAP 161: System Operator Release of Short-Term Entry Rights;
- CAP 162: Entry Overrun;
- CAP 163: Entry Capacity Sharing;
- CAP 164: Connect and Manage;
- CAP 165: Finite Long-Term Entry Rights; and
- CAP 166: Long-Term Entry Capacity Auctions.

Based on the above proposed framework changes, three access straw men are currently under consideration, namely:

- Connect and Manage;
- Evolutionary Change; and
- Capacity Auctions.

It is however possible to consider other combinations of CAP proposals that form a consistent arrangement. For example, either CAP 164 or CAP 166 could coexist with CAP 161 to CAP 163.

The key features of each of the above three models are outlined in the following paragraphs.

4.1 Connect and Manage.

Under this model (CAP 164 refers), generation connection may be in advance of any necessary investment in the main interconnected transmission system (MITS) to achieve GB SQSS compliance. That is, generation connection would not be delayed until such MITS investment for GB SQSS compliance is complete.

Generators would have a fixed date for receiving Transmission Entry Capacity (TEC). The TEC effective date would be the later of: completion of necessary local transmission reinforcement; or a fixed agreed lead time (possibly 3 or 4 years). TEC effective dates would

be codified in the appropriate Bilateral Agreement and may then only be changed through the Modification Application process.

The generator would pay TNUoS charges for a minimum period, irrespective of being ready to connect or not. However, once connected the generator would become eligible for constraint payments caused by limitations on the MITS.

The Connect and Manage model is an enduring, rather than short term, arrangement. The GB SQSS would be modified to accommodate the arrangement such that derogations would not normally be necessary. The exact definition of 'local works' is still being debated but, in this model, it is likely to be relatively shallow.

4.2 Evolutionary Change / Finite Long Term Access Rights.

This model (CAP 161, 162, 163 and 165 refer) provides enhanced generator commitment to long-term rights and is operated on a 'first come, first served' basis. The model provides defined 'finite long term access rights' and associated generator commitment.

Existing generators would nominate the number of (whole financial) years they require long-term entry access to the GB transmission system (years and MW). In return the generator is committed to pay associated charges and there is also a requirement for financial security to be put in place. The access rights may be extended by generator application.

New generators (and existing generators requesting an increased level of access) would book a defined number of years of entry access right (the 'trigger period' if new works are required) and provide associated commitment. These arrangements would apply in respect of access to the wider system.

A generator may also apply for a local connection only or a local connection at a capacity higher than his access rights to the wider system in recognition of the intermittent nature of his generation and rely on gaining additional access to the wider system when required. This decision would rest with the generator. The original proposal was for the long-term access rights to be defined by the GBSO on a zonal basis such that generators within a defined zone may share access in real time. Investigations have identified a number of significant problems with this approach and a nodal regime with defined exchange rates to facilitate intra zonal sharing is currently being investigated.

Generators may export in excess of their TEC access capacity holding; the additional export being referred to as 'Entry Overrun' (CAP 162 refers). Export would be capped by 'local' rather than wider system capability limitations and overrun would be priced based on the operational costs incurred; effectively removing the right to compensation, subject to the accuracy of the charge.

As mentioned above, the TAR Working Groups are considering a number of zonal access options. Point to point sharing (on an apportioned basis) of access rights (CAP 163 refers) between specific generators within a TEC zone would be permitted (e.g. a wind farm within a TEC zone could share the permitted Zonal Transmission Entry Capacity with a thermal station). The total generation within a TEC zone would be limited by relevant boundary capabilities determined by application of the deterministic GB SQSS. Users would apply for a local only connection and then share close to real time. This local only application would apply across all of the proposals.

The GBSO may release short-term entry rights through auction in operational timescales when the GBSO believes that it can facilitate the access at a cost less than the bid price (CAP 161 refers). The access provided could be more than spare capacity and may be considered as a form of facilitated trading by the GBSO.

Under the 'Evolutionary Change' model, it was envisaged that the TO would only reinforce the transmission system to provide the long-term access in accordance with the deterministic GB SQSS. This would not preclude additional investment, over and above that required by

application of the GB SQSS, should this be justified by cost benefit analyses (CBA) although interaction with short-term signals and the resulting incentives to request long-term access need to be carefully considered. It would be the responsibility of the generator to determine its balance between short-term and long-term transmission access. The generator may connect once the local connection works are complete.

4.3 Capacity Auctions

This model (CAP 166 refers) would be similar to the 'Evolutionary Change' but finite long-term access rights would be purchased through auction rather than purchased on a 'first come, first served' basis. Bidding would be a multi stage process and bids would probably be for a specific capacity (MW), in a specific TEC zone or node and for a finite period of time. It is likely that the volume of incremental capacity, the reserve price and the date available would need to be identified prior to the auction.

5 Summary of Issues

5.1 Primary Issue

In the event, it may be that the findings of this review determine that little or no change is required to the GB SQSS. However, some of the potential changes to the transmission access arrangements could have a far reaching impact on the GB SQSS. Accordingly, a primary issue to be addressed by the review is the identification and implementation of appropriate change proposals necessary to the current GB SQSS such that the standard remains relevant and appropriate in the climate of the various transmission access options under consideration by the TAR.

An aim of the Fundamental Review is to determine appropriate criteria and methodologies for planning and operating the transmission system in an efficient and economic manner given current and potential future developments and technological advances. Any changes, out of the review, to criteria and/or methodologies will be fully evaluated and their economic and social consequences fully considered before any such change proposals are implemented.

Consideration of the potential changes to transmission access arrangements (Section 3 refers) and other issues identified, poses a number of key questions, relating to the GB SQSS, including:

> *Question 1: Are the current GB SQSS security criteria adequately defined to reflect proposed changes to the commercial framework (in respect of each of the proposed TAR options)?*
>
> *Question 2: How should transmission access arrangements translate into criteria and methodologies for the determination of transmission capacity?*
>
> *Question 3: How do we ensure that the GB SQSS provides the appropriate balance between demand security, generation access, transmission investment and operational costs?*
>
> *Question 4: Does application of the GB SQSS deliver an appropriate level of demand security. ?*
>
> *Question 5: Are the GB SQSS criteria relating to voltage, stability and frequency consistent and appropriate?*
>
> *Question 6: Should DC circuits from offshore networks connecting to the main interconnected transmission system (MITS) at more than one onshore substation be subject to MITS criteria or possibly less stringent offshore criteria?*

The Fundamental Review will address the above along with other questions which may emerge during the course of the review.

5.2 Specific Issues

In addition, the Fundamental Review will address the more specific issues, which broadly fall into one of the following three categories:

- Transmission Entry (generation) and Exit (demand) principles (TEE);
- Main Interconnected Transmission System (MITS) principles;
- Planning and Operational Contingency Criteria (POCC); and
- Offshore transmission systems.

There are interactions and interdependencies between many of the specific issues within these four categories. Issues for review are wide ranging and include: the secured events (e.g. whether N-1, N-2, N-D etc remain appropriate); the unacceptable conditions that shall not arise as a result of a secured event (e.g. unacceptable voltage conditions); appropriate background conditions against which the secured events are applied (e.g. the treatment of renewable intermittent generation); methodologies and techniques (e.g. the modelling of the planned transfer and the interconnection allowance); and other issues (e.g. the use of dynamic ratings and the use of cost benefit analyses).

New transmission access arrangements will have an impact, in varying degrees, on each of the above areas. The specific issues being addressed under each of the above categories are summarised in the following paragraphs.

5.2.1 Transmission Entry and Exit Principles

Issues relating to entry principles will mainly affect Section 2 of the GB SQSS and include:

- The level of secure generation access appropriate to different types of generation (e.g. conventional and intermittent) taking account of load factor, size and whether discrete or multiple dispersed units;

- The impact of TEC trading zones (Section 3 refers);

- Review of customer choice (i.e. the ‘Variations to Connection Designs’ clauses) and the cost-benefit approach;

- Review of recommended substation configuration and switching arrangements (Appendix A of the GB SQSS refers);

- Review of the use of the term ‘Registered Capacity’ in the context of other defined parameters (e.g. Transmission Entry Capacity (TEC), Local Capacity Nomination (LCN));

- Consideration of whether revisions to the deterministic criteria are appropriate in order to take account of potentially high levels of renewable intermittent generation in the ‘background conditions’ (paragraph 2.8 of the GB SQSS refers) against which generation connection criteria are applied;

- Review of regional differences in criteria and methodologies (i.e. between the NGET, SPT and SHETL transmission systems); and

- The development of criteria for assessing the consequences of any change proposals.

Issues relating to exit principles will mainly affect Section 3 of the GB SQSS and include:

- The alignment, where appropriate, of the onshore demand connection criteria (currently based around ER P2/5) with Engineering Recommendation (ER) P2/6;
- The treatment of demand transfer (i.e. the ability to transfer demand from one demand group to another) in assessing grid supply point compliance;
- The capacity contribution to demand security from embedded generation (Table 3.2 of the GB SQSS refers);
- The treatment of exporting grid supply points including the need to establish a more transparent means of assessing the impact of embedded generation; and
- Local, area and transmission boundary effects of embedded generation on transmission capacity, voltage performance and fault levels;

5.2.2 Main Interconnected Transmission System (MITS)

Issues relating to MITS principles will mainly affect Section 4 of the GB SQSS and include:

- Appropriate criteria and methodologies whereby market access signals may be converted into transmission capacity requirements;
- The use of cost benefit analyses; including consideration of the appropriate balance between operational costs, investment costs and demand security costs i.e. value of lost load), sharing methodology (taking due account of the findings of the Transmission Access Review) and overrun (e.g. where a generator may exceed its share allocation);
- Regional differences in criteria and methodologies (i.e. between the NGET, SPT and SHETL transmission systems);
- The use of intertrip schemes to disconnect exports across interconnections with external systems;
- The contribution of different generation technologies (e.g. conventional, renewable and intermittent generation) to meeting demand;
- The appropriate methodology for setting the year round background conditions (recognising the contribution of different generation technologies) against which the need for additional transmission capacity is judged in planning timescales to provide generation access to the MITS (e.g. exporting group);
- The treatment of large demand zones with little or no generation;
- The integration of offshore transmission systems;
- Clarity with regard to the possible relaxation of operational criteria during favourable weather conditions;
- Methods for assessing options including: accuracy of results; complexity of applying proposed methodology; assumptions including reliability of data source; and the sensitivity of the results to data changes;
- The implications of TAR options for long term access rights and short term access rights;

- Treatment of potentially non-compliant parts of the GB transmission system during periods when short term access rights are applicable (i.e. where the transmission system is not designed to accommodate all short term access rights either bought or acquired through auction); and

- Criteria for assessing the consequences of any change proposal.

5.2.3 Planning and Operational Contingency Criteria (POCC)

Issues relating to POCC principles will affect all sections of the GB SQSS and include:

- N-1, N-2, N-D, N-3 etc. Any change proposals identified would include: the results of a survey of fault statistics; an assessment of the consequences of different types of event; identification of areas of the GB SQSS where there are currently regional differences; and consideration as to whether such differences are appropriate;

- The impact of changing the contingency criteria on demand security, constraint costs and infrastructure requirements from a MITS planning and operational perspective;

- The use of intertrip schemes (the current GB SQSS does not permit the use of generator and/or demand intertripping to create system capacity in planning timescales);

- The treatment of bus coupler and bus section switch faults under intact and outage conditions;

- The use of dynamic ratings;

- Voltage limits including: Voltage limits including: the differences (in percentage terms) between 400kV and 275kV voltage limits; the background and purpose of the 15min relaxation; the differences between planning and operational voltage limits; 90% reactive availability on generators; the 6% and 12% voltage step change limits; review notes 2 and 3 of Table 6.1 i.e. up to 105%, or, at least 105%; a review of current methodology used for voltage analyses; and the use of manual and/or automatic facilities;

- Stability assessment criteria including: the rational for using the 3 phase close up fault criterion; the failure of the fastest main protection; and the increase in effective capacity available from the use of less onerous criteria; and

- Criteria for assessing the consequences of any change proposal.

5.2.4 Offshore Transmission Systems (OTS)

GB SQSS change proposals for the inclusion of planning and operating offshore transmission systems designed to cater for Round 1 and Round 2 offshore wind farms and gas turbines was submitted to Ofgem in April 2008 and is currently being progressed as part of the Ofgem/DECC offshore transmission project (section 3.5 refers). Issues relating to OTS principles will affect the proposed new offshore sections of GB SQSS arising out of the above work and include:

- Analyse and define the basis for an offshore security standard that can cater for generation projects of the size (i.e. larger than 1500MW) and location (i.e. more than 100km from the shore) of R3 projects and the connection of External Interconnections (from External Systems) to offshore transmission systems.

6 Fundamental Review Outline Principles

There is a clear case for reviewing the current GB SQSS to address the range of issues outlined in Section 4 and, to this end, a number of working groups have been established under the Fundamental Review. An international benchmarking working group has also been established to conduct a comparison of international planning and operational criteria and methodologies. The primary issue identified in Section 5 of this document, which relates to the need for the GB SQSS to take account of potential changes to the transmission access arrangements arising from the Transmission Access Review (TAR), is wide ranging and affects many areas of the Fundamental Review.

At present, the work of the TAR is ongoing and a number of options for transmission access are currently under active consideration (Section 3 refers). The TAR proposals will not be firmed up and implemented until April 2010. However, there is a need to develop appropriate systems and change proposals to the GB SQSS in advance of implementation of TAR proposals.

Accordingly, it is necessary to develop an appropriate range of GB SQSS change proposals at a relatively early stage in order to address the various options being considered under the TAR. The final Fundamental Review change proposals may then be flexed in a timely fashion to match the outcome of the TAR.

6.1 GB SQSS Models

To this end, four discrete framework GB SQSS models have been developed (collectively referred to as the Outline Principles) to address the various TAR options. The issues identified in section 5 of this document will affect each model to a greater or lesser extent.

An important feature of each model is the different treatment provided for Demand Security and for Generation Access to the MITS.

Under each of the four models, both the application of deterministic criteria and the use of cost benefit analyses (CBA) are included in varying degrees. It should be noted, however, as part of the work of the Fundamental Review the deterministic criteria themselves would be subject to justification based, in part, on CBA.

Appendix 1, included at the end of this report, provides a quick reference summary of each of the four GB SQSS models. The following paragraphs provide a more detailed explanation.

6.1.1 Model 1: Operational Standards Only

Model 1 may be considered to be the most radical of the four models in that it represents a significant departure from the current GB SQSS which, inter alia, contains deterministic criteria and methodologies for both planning and operating the MITS. This model assumes that deterministic criteria and methodologies for planning the development the MITS would no longer be included in the GB SQSS. Accordingly, the MITS criteria would be restricted to operational criteria only. Planning the development of the MITS would fall outside the scope of the standard. Accordingly, Sections 2, 3 and 4 of the current GB SQSS would no longer be required.

This model does not consider demand security in the planning time phase. Investment in additional transmission capacity to provide generation access would be outside the scope of the standard and would be the subject of internal assessment by the relevant transmission licensee. This could lead to a change in the level of transmission investment and, as a consequence, the level of security provided.

> *Question 7: Would the lack of transparency in planning be acceptable and how would consistency of planning be achieved?*

Question 8: Would the removal of planning criteria for demand security from the GB SQSS be acceptable?

Question 9: Would the lack of transparency on how generation access signals are translated into transmission investment signals be acceptable?

Question 10: Would it be acceptable for appropriate incentive schemes to displace the need for explicit criteria in the GB SQSS?

Question 11: Is it acceptable to satisfy the requirements of the GB SQSSS through market arrangements (e.g. through buyback solutions)?

Question 12: Is it appropriate to consider relaxing planning criteria for demand security in order to facilitate the timely connection of renewable and other low carbon generation?

6.1.2 Model 2: Operational Standards plus Demand Security Planning Standards

Model 2 is the same as Model 1 except that demand security is considered in the planning time phase. Accordingly, deterministic planning criteria would be included which specify the secured events (e.g. N-2 etc) for which specified unacceptable conditions relating to the supply of demand shall not arise. Section 2 of the current GB SQSS would not be required.

Unlike Model 1, this model would aim to ensure that demand security is maintained at an appropriate level. Investment in additional transmission capacity to provide generation access would again be the subject of internal assessment by the relevant transmission licensee in the same way as Model 1.

Question 13: How will the level of demand security provided be measured and determined?

Question 14: If demand security were to be based on a value of lost load, what would be the appropriate VOLL?

6.1.3 Model 3: Operational Standards plus Demand Security Planning Standards plus Access Driven Capacity (obligatory).

Model 3 is the same as Model 2 but with the addition of obligatory deterministic planning criteria/rules to establish whether it is appropriate to provide additional transmission capacity to meet generation access market signals. This model would require all Sections of the current GB SQSS to be retained, albeit in a modified form.

As Model 2, this model also ensures that demand security is maintained at an appropriate level. Relative to Model 2, Model 3 provides enhanced transparency in relation to the provision of transmission capacity for generation access.

Relative to Model 4 (below) the obligatory deterministic approach of this model, for the provision of additional transmission for generation access, may be regarded as relatively transparent and straight forward to apply.

6.1.4 Model 4: Operational Standards plus Demand Security Planning Standards plus Access Driven Capacity with a greater discretionary element relative to the current GB SQSS.

Model 4 is the same as Model 3 except that additional flexibility is provided such that either more or less transmission capacity may be provided. Such flexibility would be justified on the basis of guidance to be provided within the GB SQSS. Like Model 3, this model would require all Sections of the current GB SQSS to be retained, albeit in a modified form. In addition, an a 'Variation to Designs' clause would be included in Section 4 (MITS) or equivalent.

As Models 2 and 3, this model ensures that demand security is maintained at an appropriate level. Like Model 3, transparency on the provision of transmission capacity for generation access is provided but, unlike Model 3, there is the ability to provide either more or less transmission capacity. It should be noted that the current GB SQSS only allows for additional transmission capacity (on the MITS) to be provided on the basis of justification by CBA. An appropriate derogation is currently required where less transmission capacity is provided than that required as a result of application of the deterministic criteria.

Potential difficulties relating to application of Model 4, relative to Model 3 (above), include the dependence of the discretionary (CBA) element of this model on additional input data and assumptions. Accordingly, its application may be more complex and less transparent than that of Model 3.

6.2 Options Assessment Measures.

Each of the three TAR models (i.e. 'Connect and Manage', 'Evolutionary Change' and 'Capacity Auctions') should be assessed against each of the four GB SQSS models. In conducting this assessment, due account will be taken of the following factors:

6.2.1 Complexity of Proposed Methodology.

Complexity includes factors such as: dependence on the availability of large volumes or difficult to obtain data; level of resources required for implementation; the need for the development of new analysis tools; and potential difficulties relating to interfaces with existing analysis tools.

6.2.2 Transparency.

Transparency includes factors such as whether the data, criteria and methodologies are transparent to all market participants.

6.2.3 Auditability.

Considerations here would include: whether the results are readily repeatable; and will the same result arise from several independent applications of the criteria or methodology.

6.2.4 De-Centralisation.

This relates to the ability of different market participants being able to independently apply the proposed methodologies to determine: the level of access that they require; and the overall economic solution.

6.2.5 Robustness.

This relates to dependency of the results arising from application of the methodology on assumptions made. Assumptions will change with the passage of time. Methodologies will be judged on the basis of their robustness to: changes in underlying assumptions; and the availability of updated assumptions (e.g. some data may be commercially sensitive to market participants and therefore not directly available).

6.2.6 Sensitivity.

This includes how sensitive the results are to minor changes in underlying data.

6.2.7 Effectiveness.

This includes consideration of how useful the results, arising from application of the criteria and methodologies, are in providing a clear signal to the appropriate way forward.

6.2.8 Economic and Efficient.

This includes consideration of whether application of the criteria and methodologies would facilitate the efficient and economic planning, operation and maintenance of the GB transmission system.

Question 15: Are the above assessment measures sufficient and appropriate?

7 Next Steps

The potential impacts on the GB SQSS of the developments detailed in Section 2 of this document are wide ranging. The primary driver to the GB SQSS Fundamental Review is the need to accommodate the potential new transmission access arrangements arising from the Transmission Access Review (TAR), which has yet to conclude.

Pending the conclusions of TAR, four GB SQSS models have been developed to address the range of potential TAR outcomes and other issues.

On 24th June 2008, Edgar Goddard, Chairmen of the GB SQSS Review Group, issued an open letter on the subject of the GB SQSS Fundamental Review to potentially interested parties together with a copy of the Terms of Reference (TOR). A copy of the letter may be accessed from the National Grid website using the following link:

http://www.nationalgrid.com/uk/Electricity/Codes/gbsqsscode/fundamental/

It is intended that the GB SQSS Fundamental Review shall be inclusive and transparent. Amongst other things, the TOR explain that the Review Group will report and consult on the high level principles being adopted for the review in the autumn of 2008. This Outline Principles Document (OPD) constitutes that report.

Accordingly, the GB SQSS Review Group invite your comments on the content of this OPD and in particular would encourage your views and suggestions in relation to the approach adopted (outlined in Section 5) to address the issues set out in Sections 3 and 4.

It would be most helpful if you could please forward your responses by 5th December 2008 to:

GBsqss.Review@uk.ngrid.com

Appendix 1: Summary of GB SQSS Models Currently Under Active Consideration

Model		Basis	Features
1	Operational Standards only	Operational criteria determined on the basis of CBA i.e. a balance between operational costs and the cost of not supplying demand (i.e. O+X)[1]	1) No consideration given to demand security. 2) Operational criteria on the basis of CBA. 3) Capacity provided for generation access is outside the scope of standard and subject to internal assessment by relevant transmission licensee (possibly determined on the basis of CBA such that, when investment cost is lower then constraint risk, investment is undertaken).
2	Operational Standards + Demand Security Planning Standards	Operational criteria on the basis of CBA as Model 1 (i.e. O+X)[1] In planning timescales, demand security provided by application of deterministic criteria.	1) Ensures Demand security is maintained at appropriate level. 2) Operational criteria on the basis of CBA. 3) Capacity for generation access provided as in Model 1.
3	Operational Standards + Demand Security Planning Standards + Access Driven Capacity (obligatory)	Operational criteria on the basis of CBA as Models 1 and 2 (i.e. O+X)[1] In planning timescales, demand security provided by application of deterministic criteria as Model 2. Deterministic planning criteria to determine transmission capacity to meet generation access market signals.	1) Ensures Demand security is maintained at appropriate level. 2) Operational criteria on the basis of CBA. 3) Transparency in the provision of transmission capacity for generation access through application of deterministic planning criteria.
4	Operational Standards + Demand Security Planning Standards + Access Driven Capacity (discretionary element)	Operational criteria on the basis of CBA as Models 1, 2 and 3 (i.e. O+X)[1] In planning timescales, demand security provided by application of deterministic criteria as Models 2 and 3. Deterministic planning criteria to determine transmission capacity to meet generation access market signals. CBA to justify both more and less (as appropriate) transmission capacity for generation access than the level determined through straight application of the deterministic planning criteria (i.e. balance between T+O+X)[1]	1) Ensures Demand security is maintained at appropriate level. 2) Operational criteria on the basis of CBA. 3) Transparency in the provision of transmission capacity for generation access through application of deterministic planning criteria. 4) Provides the flexibility to provide more/less transmission capacity for generation access where justified by CBA.

Note 1:
T = Transmission Investment Costs
O = Operational Costs (including losses and constraint costs)
X = Cost of Unsupplied Energy