



**GRID CODE
CONSULTATION DOCUMENT**

OC6.6 (Automatic LFDD)

The purpose of this document is to consult on the above Grid Code Modification Proposal with authorised electricity operators liable to be materially affected by the proposed changes and forms the basis of the subsequent Report to the Authority

Consultation Ref	D/09
Issue	1.0
Date of Issue	3rd September 2009
Responses required by	1st October 2009
Prepared by	National Grid

DOCUMENT LOCATION

National Grid website:

<http://www.nationalgrid.com/uk/Electricity/Codes/gridcode/consultationpapers/>

DISTRIBUTION

Name	Organisation
AEO's	Various
GCRP Members/Alternates	Various
Interested Parties	Various
National Grid Website	

A. INTRODUCTION

1. Paragraph 2 of Condition C14 of the Transmission Licence granted to the National Grid Electricity Transmission plc ("National Grid") provides that National Grid shall, in consultation with Authorised Electricity Operators liable to be materially affected thereby, periodically review the Grid Code and its implementation. That paragraph also requires National Grid, following such review, to send to the Authority:-
 - (a) a report on the outcome of such review;
 - (b) any proposed revisions to the Grid Code as National Grid (having regard to the outcome of such review) reasonably thinks fit for the achievement of the objectives set out in sub-paragraph (b) of Condition C14 of the Transmission Licence; and
 - (c) any written representations or objections from Authorised Electricity Operators (including any proposals by such operators for revisions to the Grid Code not accepted by National Grid in the course of the review) arising during the consultation process and subsequently maintained.
2. This review examines proposed amendments to the existing Grid Code provisions relating to automatic low frequency demand disconnection schemes (LFDD) that are intended to clarify the requirements and ensure a consistent approach by the DNOs. The proposals were developed through the Grid Code OC6.6 (Automatic LFDD) Working.
3. The proposed changes to the Grid Code were discussed with the Grid Code Review Panel (GCRP) on 21st May 2009. Panel Members agreed that National Grid should issue a Consultation Paper regarding the proposed changes.
4. Comments upon the proposed changes within this consultation should be sent to National Grid by **1st October 2009** as detailed in section C. The comments will be reviewed and responded to.
5. Following this consultation, National Grid will prepare a Report to the Authority detailing National Grid's recommended changes to the Grid Code and all comments/responses received from Authorised Electricity Operators through this consultation. Once sent to the Authority this report will be made available on National Grid's website.
6. Where Authorised Electricity Operators' responses have been marked as confidential they will not be published within the version of the Report to the Authority placed on the National Grid website.
7. The revisions to the Grid Code proposed by National Grid and sent to the Authority require approval by that body and will, if approved, come into force on such date (or dates) of which you will be notified by National Grid, in accordance with the Authority's approval.

B. DESCRIPTION OF THE PROPOSED AMENDMENTS AND THEIR EFFECTS

Background

8. On 27th May 2008 an exceptional loss of generation led to the operation of the first stage of the national Low Frequency Demand Disconnection (LFDD) scheme. Though the LFDD scheme operated successfully and limited the frequency fall, there were a few isolated instances of ineffective operation of relays, and many relays did not operate. An investigation by the Energy Emergency Executive Committee (E3C) Task Group led to a recommendation that the Grid Code requirements of OC6.6 be reviewed to see if any improvement to the scheme could be made. The Grid Code Review Panel established the OC6.6 (Automatic LFDD) working group to undertake this review. The group comprised representatives of DNOs, National Grid, the AEP and OFGEM.
9. The rationale behind the proposals was developed through discussions in the Working Group. A link to the Working Group Report, which includes the group's Terms of Reference, is given below. The group considered issues, such as relay maintenance regimes, that are not within the scope of the Grid Code in addition to Grid Code requirements. This consultation only concerns the recommended Grid Code modifications.

https://www.nationalgrid.com/uk/Electricity/Codes/gridcode/workinggroups/E3C_Working_Group/

10. Working Group Discussions

11. Grid Code clause OC6.6.1 specifies the percentage of demand that should be available for LFDD disconnection and the time on which this figure is based. It specifies a percentage at the time of the DNO's peak demand. This time varies between DNOs and the requirement may not result in the specified percentage demand being available for disconnection at the time of the GB system peak demand, which is the intention of the requirement. It is therefore proposed to modify the requirement to specify the percentage of demand available for low frequency disconnection at the time of GB transmission system peak demand.
12. There is a lack of clarity as to whether the requirement should be based on the forecast or historic GB system peak demand. Both interpretations have been made by DNOs in setting up their schemes. Discussions took place on the relative merits of both options. It was agreed that in practice no significant differences were expected. Some members supported using historic demand as a basis as this would not require the application of forecast demand growths, which may not be accurate, at BSP level. Some members preferred to leave the requirement unchanged, allowing DNOs to use historic demands as a basis but taking into account expected significant changes, such as network reconfiguration or the connection of large new loads. Others believe that it is preferable to include a clear requirement that forecast demand should be used to ensure consistency. It is NGET's view that the latter is preferable as the forecast demand growths applied by DNOs to demands for the next winter will be sufficiently accurate and this option will ensure that any network changes are considered. The proposal is to change the requirements so that they specify that the scheme should be based on forecast demand.
13. Table 12a is a proforma drawn up by NGET for the purpose of Grid Code clause OC6.6.2 (d), which requires the annual submission of LFFD data by DNOs. This

proforma does not explicitly indicate that the data required relates to a forecast time of GB transmission system peak demand. It is proposed to clarify this and incorporate the table in the Data Registration Code (DRC).

14. CC.A.5.1 in Appendix 5 of the Grid Code Connection Conditions specifies the functional requirements of the scheme relays. The stated operating time of 100ms – 150ms refers to the relay, not the demand disconnection time. This operating time is dependent on the rate of change of frequency as that affects the measurement time, and includes any time delay set by the user. As modern relays, for example MICOM P941 and ARGUS AR8, can have a typical operating time of less than 100ms it was agreed that a minimum operating time should not be specified and it is proposed to modify the clause accordingly.
15. The total time to disconnect demand includes the operation of the trip relay and circuit breakers. Modern 33kV circuit breakers have a typical operating time of 40-80 ms including arc extinction; older types having typically 80-100ms.
16. For the LFDD scheme to perform optimally, the total operating time, ie including breaker operation, should not be more than 200ms. In some cases, even with modern circuit breakers, 200ms may not be achievable (tests would be needed to assess this). The slower scheme operating times associated with existing, slower circuit breakers may require the operation of more scheme stages but they are not expected to prevent successful scheme operation. As low frequency events initiating LF relays are quite rare and sub-optimal operation will not prevent successful scheme operation, the group agreed that accelerated circuit breaker or other asset replacement cannot be justified on the grounds of slower operating time. The group agreed that the Grid Code requirement should reflect the aim to achieve a 200ms operating time whilst recognising that generally it would not be economically justifiable to replace assets to achieve this.
17. Table CC.A.5.5.1a specifies for each stage the percentage demand blocks and associated frequency settings. Some DNOs have expressed concern that as there is no tolerance in these settings, it is practically impossible to comply. It is proposed that the % demand blocks shall be qualified with “as far as reasonably practical” for each stage.

18. Proposed Grid Code Changes

19. The proposed Grid Code changes are to:

- modify OC6.6.1 to specify that the LFDD scheme should be based on forecast demand at the time of the GB transmission system peak demand.
- remove the minimum operating time requirement from CCA.5.1.1 (b)
- add a new clause CC.A.5.3.2 requiring that the total scheme operating time is less than 200ms where practicable
- modify CC.A.5.5.1 in line with the changes to OC6.6.1. In the working group report this proposed change does not include that the basis should be forecast data. This is an error in the report.
- to clarify in CC.A.5.5.1 that the percentage figures should be achieved as far as reasonably practicable

- add schedule 12A to the DRC, indicating the format for the submission of LFDD scheme data.

20. The proposed amendments are shown in Appendix A.

21. Impact on GB Transmission System

22. The proposed changes will not have any adverse impact on the GB Transmission System.

23. Impact on Grid Code Users

24. The proposals will provide additional clarity to Users and ensure consistency in interpretation of the requirements.

25. Assessment Against Grid Code Objectives

26. The proposed changes will better facilitate Grid Code Objectives by improving the clarity of the requirements.

27. Impact on Industry Documents

Impact on Core Industry Documents

28. None.

Impact on other Industry Documents

29. None.

C. RESPONSES

30. This section will contain a summary of responses received during the Consultation and will be completed as part of the Report to the Authority.

31. Views are invited upon the proposals outlined in this report, which should be received by 1st October 2009. Views on the following areas would be especially welcomed:

- Impact of the proposals on Grid Code users.
- Any improvements or changes to the proposals that in a respondent's view would better facilitate the objectives of the Grid Code.

34. Your formal responses may be:-

Posted to: Tom Ireland
Electricity Codes
Regulatory Frameworks
National Grid Electricity Transmission plc
National Grid House
Warwick Technology Park
Gallows Hill
Warwick
CV34 6DA

Emailed to: thomas.ireland@uk.ngrid.com

Appendix A: Proposed Grid Code Changes

Proposed Changes in Grid Code

OC6.6.1 Each **Network Operator** will make arrangements that will enable automatic low **Frequency Disconnection** of at least:

- (i) 60 per cent of its total **peak Demand** (based on **Annual ACS Conditions**) **at the time of forecast GB transmission system peak demand** where such **Network Operator's System** is connected to the **GB Transmission System** in **NGET's Transmission Area**
- (ii) 40 per cent of its total **peak Demand** (based on **Annual ACS Conditions**) **at the time of forecast GB transmission system peak demand** where such **Network Operator's System** is connected to the **GB Transmission System** in either **SPT's** or **SHETL's Transmission Area**

in order to seek to limit the consequences of a major loss of generation or an **Event** on the **Total System** which leaves part of the **Total System** with a generation deficit. Where a **Network Operator's System** is connected to the **GB Transmission System** in more than one **Transmission Area**, the figure above for the **Transmission Area** in which the majority of the **Network Operator's Demand** is connected shall apply.

CC.A.5.1.1 The **Low Frequency Relays** to be used shall have a setting range of 47.0 to 50Hz and be suitable for operation from a nominal AC input of 63.5, 110 or 240V. The following general parameters specify the requirements of approved **Low Frequency Relays** for automatic installations installed and commissioned after 1st April 2007 and provide an indication, without prejudice to the provisions that may be included in a **Bilateral Agreement**, for those installed and commissioned before 1st April 2007:

- (a) **Frequency settings:** 47-50Hz in steps of 0.05Hz or better, preferably 0.01Hz;
- (b) **Operating time:** ~~Between 100 and 150ms dependent on measurement period setting~~ Relay operating time shall not be more than 150 ms
- (c) **Voltage lock-out:** Selectable within a range of 55 to 90% of nominal voltage;
- (d) **Facility stages:** One or two stages of **Frequency** operation;
- (e) **Output contacts:** Two output contacts per stage to be capable of repetitively making and breaking for 1000 operations:
- (f) **Accuracy** 0.01 Hz maximum error under reference environmental and system voltage conditions.
0.05 Hz maximum error at 8% of total harmonic distortion **Electromagnetic Compatibility Level.**

CC.A.5.3 SCHEME REQUIREMENTS

CC.A.5.3.1 The tripping facility should be engineered in accordance with the following reliability considerations:

(a) Dependability

Failure to trip at any one particular **Demand** shedding point would not harm the overall operation of the scheme. However, many failures would have the effect of reducing the amount of **Demand** under low **Frequency** control. An overall reasonable minimum requirement for the dependability of the **Demand** shedding scheme is 96%, ie. the average probability of failure of each **Demand** shedding point should be less than 4%. Thus the **Demand** under low **Frequency** control will not be reduced by more than 4% due to relay failure.

(b) Outages

Low **Frequency Demand** shedding schemes will be engineered such that the amount of **Demand** under control is as specified in Table CC.A.5.5.1a and is not reduced unacceptably during equipment outage or maintenance conditions.

CC.A.5.3.2 The total operating time of the scheme, including circuit breaker operating time, shall where reasonably practicable, be less than 200 ms.

CC.A.5.5 SCHEME SETTINGS

CC.A.5.5.1 Table CC.A.5.5.1a shows, for each **Transmission Area**, the percentage of **peak Demand** (based on **Annual ACS Conditions**) **at the time of forecast GB transmission system peak demand** that each **Network Operator** whose **System** is connected to the **GB Transmission System** within such **Transmission Area** shall disconnect by **Low Frequency Relays** at a range of frequencies. Where a **Network Operator's System** is connected to the **GB Transmission System** in more than one **Transmission Area**, the settings for the **Transmission Area** in which the majority of the **Demand** is connected shall apply.

Table CC.A.5.5.1a

Frequency Hz	%Demand disconnection for each Network Operator in Transmission Area		
	NGET	SPT	SHETL
48.8	5		
48.75	5		
48.7	10		
48.6	7.5		10
48.5	7.5	10	
48.4	7.5	10	10
48.3			
48.2	7.5	10	10
48.0	5	10	10
47.8	5		
Total % Demand	60	40	40

Note – the percentages in table CC.A.5.5.1a are cumulative such that, for example, should the frequency fall to 48.6 Hz in the **NGET Transmission Area**, 27.5% of the total **Demand** connected to the **GB Transmission System** in the **NGET Transmission Area** shall be disconnected by the action of **Low Frequency Relays**.

The percentage demand at each stage shall be allocated as far as reasonably practicable. The cumulative total percentage demand is a minimum.

Schedule 12 in DRC

SCHEDULE 12

DATA DESCRIPTION	UNITS	TIME COVERED	UPDATE TIME	DATA CAT.
*Demand Control or Pump Tripping Offered as Reserve				
Magnitude of Demand or pumping load which is tripped	MW	Year ahead from week 24	Week 24	DPD
System Frequency at which tripping is initiated	Hz	"	"	"
Time duration of System Frequency below trip setting for tripping to be initiated	S	"	"	"
Time delay from trip initiation to Tripping	S	"	"	"
<u>Emergency Manual Load Disconnection</u>				
Method of achieving load disconnection	Text	Year ahead from week 24	Annual in week 24	OC6
Annual ACS Peak Demand (Active Power) at Connection Point (requested under Schedule 11 - repeated here for reference)	MW	"	"	"
Cumulative percentage of Connection Point Demand (Active Power) which can be disconnected by the following times from an instruction from NGET				
5 mins	%	"	"	"
10 mins	%	"	"	"
15 mins	%	"	"	"
20 mins	%	"	"	"
25 mins	%	"	"	"
30 mins	%	"	"	"
Automatic Low Frequency Disconnection				
Magnitude of Demand disconnected, and frequency at which Disconnection is initiated, for each frequency setting for each Grid Supply Point	MW Hz	Year ahead from week 24	Annual in week 24	OC6

Notes

- Network Operators** may delay the submission until calendar week 28.

- No information collated under this Schedule will be transferred to the **Relevant Transmission Licensees**

AUTOMATIC LOW FREQUENCY DEMAND DISCONNECTION- SCHEDULE 12A

Time Covered: Year ahead from week 24

DataCategory: OC6

Update Time: Annual in week 24

Grid Supply Point	GSP Demand MW	Low Frequency Demand Disconnection Blocks MW									Residual demand MW
		1 48.8Hz	2 48.75Hz	3 48.7Hz	4 48.6Hz	5 48.5Hz	6 48.4Hz	7 48.2Hz	8 48.0Hz	9 47.8Hz	
GSP1											
GSP2											
GSP3											
Total demand disconnected per block	MW %										
Total demand disconnection		MW (% of aggregate demand of MW)									

Note: All demand refers to that at the time of forecast GB transmission system peak demand.
Network Operators may delay the submission until calendar week 28

No information collated under this schedule will be transferred to the **Relevant Transmission Licensees**