

EirGrid plc

Replacement of the term SFRS with the term AGC

Proposed Grid Code Modification Paper

15 April 2009

1. Introduction

1.1 The term Secondary Frequency Regulation Systems (SFRS) is not an internationally recognised term. The term Automatic Generator Control (AGC) is a more globally understood term. EirGrid propose to replace SFRS with the term AGC throughout the Grid Code. This proposed modification is a standard language term change and it will have no material impact on the Grid Code and all associated obligations remain as is.

2. General overview of changes

2.1 It is proposed to remove all references to Secondary Frequency Regulation System (SFRS) and replace it with Automatic Generator Control (AGC).

2.2 This proposed modification occurs in the following sections of the Grid Code: the Index, Planning Conditions, Connection Conditions, and Operational Conditions.

2.3 In the glossary of acronyms and of definitions SFRS is removed and replaced with AGC.

Proposed Grid Code Modifications

It is proposed to amend the Grid Code by adding in the text in blue and by deleting the text in red strikethrough:

INDEX

~~OC4.3.6~~ **SECONDARY FREQUENCY REGULATION SYSTEM (SFRS)** ~~OC4-Error! Bookmark not defined.~~
OC4.3.6 **AUTOMATIC GENERATOR CONTROL (AGC)** ~~OC4-Error! Bookmark not defined.~~

PLANNING CONDITIONS

PC.A4.3 Generator Operating Characteristics And Registered Data

Minimum requirements for generator operating conditions are specified in the **Connection Conditions**.

* For thermal plant, provide a functional block diagram of the main plant components, showing boilers, alternators, any heat or steam supplies to other processes etc. indicate whether single shaft or separate shaft.

For each individual unit fill in the following:

Unit Number _____

Registered Capacity (MW) _____

| | Symbol | Units |
|--|--------|-------|
| * Normal Maximum Continuous Generation Capacity: | | MW |
| * Normal Maximum Continuous Export Capacity | | MW |
| * Power Station auxiliary load | | MW |
| § Power Station auxiliary load | | Mvar |
| * Maximum (Peaking) Generating Capacity | | MW |
| * Maximum (Peaking) Export Capacity | | MW |
| * Normal Minimum Continuous Generating Capacity | | MW |
| * Normal Minimum Continuous Export Capacity | | MW |
| * Generator Rating: | Mbase | MVA |
| * Normal Maximum Lagging Power Factor | | Mvar |
| * Normal Maximum Leading Power Factor | | Mvar |
| § Governor Droop | R | |
| § Forbidden zones | | MW |
| § Terminal Voltage adjustment range | | kV |
| § Short Circuit Ratio | | |
| § Rated Stator Current | | Amps |

| Description | | |
|---|--------|----------|
| § Capability Chart showing full range of operating capability of the generator including thermal and excitation limits. | | Diagram |
| § Open Circuit Magnetisation Curves | | Graph |
| § Short Circuit characteristic | | Graph |
| § Zero power factor curve | | Graph |
| § V curves | | Diagram |
| | Symbol | Units |
| § Time to synchronise from warm | | Hour |
| § Time to synchronise from cold | | Hour |
| § Minimum up-time | | Hour |
| § Minimum down-time | | Hour |
| § Normal loading rate | | MW / min |
| § Normal deloading rate | | MW / min |
| § Can the generator start on each fuel | | |
| § Ability to change fuels on-load | | |
| § Available modes (lean burn, etc.) | | |
| § Time to change modes on-load | | |
| § Control range for SFRS AGC operation | | MW |
| Other relevant operating characteristics not otherwise provided.... | | |

CONNECTION CONDITIONS

CC.7.3 Generators

CC.7.3.1 The conditions specified in this section of the code apply to all **Generation Units** connected to or connecting to the **Transmission System**.

CC.7.3.1.1 Each **Generation Unit**, shall, as a minimum, have the following capabilities:

- (a) operate continuously at normal rated output at **Transmission System Frequencies** in the range 49.5Hz to 50.5Hz;
- (b) remain synchronised to the **Transmission System** at **Transmission System Frequencies** within the range 47.5Hz to 52.0Hz for a duration of 60 minutes;
- (c) remain synchronised to the **Transmission System** at **Transmission System Frequencies** within the range 47.0Hz to 47.5Hz for a duration of

- 20 seconds required each time the **Frequency** is below 47.5Hz;
- (d) remain synchronised to the **Transmission System** during rate of change of **Transmission System Frequency** of values up to and including 0.5 Hz per second;
 - (e) sustained operation at the specified **Minimum Generation** within the range 49.8 to 51.0 Hz;
 - (f) remain synchronised to the **Transmission System** at normal rated output at **Transmission System Voltages** within the ranges specified in CC.8.3.2 for step changes in **Transmission System Voltage** of up to 10%.
 - (g) sustained operation in accordance with the **Reactive Power** capability as required by CC.7.3.6 at **Transmission System Voltages** within the ranges specified in CC.8.3.2, unless otherwise specified;
 - (h) remain synchronised during and following **Voltage** dips at the **HV** terminals of the **Generator Transformer** of 95% of nominal **Voltage** (5% retained) for duration 0.2 seconds and **Voltage** dips of 50% of nominal **Voltage** (i.e. 50% retained) for duration of 0.6 seconds. Following the fault clearance the **Generation Unit** should return to pre-fault conditions subject to its normal **Governor Control System** and **Automatic Voltage Regulator** response;
 - (i) remain synchronised to the **Transmission System** during a negative phase sequence load unbalance in accordance with IEC 60034-1
 - (j) The short circuit ratio of each **Generation Unit** shall be in accordance with IEC 60034-1
 - (k) **Minimum Load** not greater than 50% of **Registered Capacity** for **CCGT Installations** and not greater than 35% of **Registered Capacity** for all other **Generation Units**. For **CCGT Installations** whilst operating in **Open Cycle Mode** as a result of combined cycle plant capability being unavailable, the **Minimum Load** of each **Combustion Turbine Unit** must be not greater than 35% of the **Registered Capacity** divided by the number of **Combustion Turbine Units**.
 - (l) **Ramp up capability** not less than 1.5% of **Registered Capacity** per minute when the **Unit** is in the **Normal Dispatch Condition**.
 - (m) **Ramp down capability** not less than 1.5% of **Registered Capacity** per minute when the **Unit** is in the **Normal Dispatch Condition**.
 - (n) **Minimum up-time** not greater than 4 hours for **Thermal Units**
 - (o) **Minimum down-time** not greater than 4 hours for **Thermal Units**

- (p) **Forbidden Zones** within the range between normal **Minimum Load** plus 5% and **Registered Capacity** less 10%, not more than 2 specified zones each not greater than 10% of **Registered Capacity**
- (q) **Block Loading** not greater than 10% of **Registered Capacity**
- (r) Time off-load before going into longer standby conditions remain in a hot condition for at least 12 hours and remain in a warm condition for at least 60 hours
- (s) Time to **Synchronise** (from instruction) hot : not greater than 3 hours
warm : not greater than 8 hour
cold : not greater than 12 hours
- (t) (i) Time from **Synchronising** to **Minimum Load** hot : not greater than 40 minutes
warm : not greater than 90 minutes
cold : not greater than 180 minutes
- (ii) **Time to deload from Minimum Load to De- Synchronising** not greater than 40 minutes, except where agreed with the TSO.
- (u) **Operating Reserve**
- (i) **POR** not less than 5% **Registered Capacity**
To be provided, at a minimum, at **MW Outputs** in the range from 50% to 95% **Registered Capacity**, with provision in the range of 95% to 100% **Registered Capacity** to be not less than that indicated by a straight line with unity decay from 5% of **Registered Capacity** at 95% output to 0 at 100% output.
- (ii) **SOR** not less than 5% **Registered Capacity**
To be provided, at a minimum, at **MW Outputs** in the range from 50% to 95% **Registered Capacity**, with provision in the range of 95% to 100% **Registered Capacity** to be not less than that indicated by a straight line with unity decay from 5% of **Registered Capacity** at 95% output to 0 at 100% output.
- (iii) **TOR1** not less than 8% **Registered Capacity**
To be provided, at a minimum, at **MW Outputs** in the range from 50% to 92% **Registered Capacity**, with provision in the range of 92% to 100% **Registered Capacity** to be not less

than that indicated by a straight line with unity decay from 8% of Registered Capacity at 92% output to 0 at 100% output.

(iv) **TOR2 not less than 10% Registered Capacity**

To be provided, at a minimum, at **MW Outputs** in the range from 50% to 90% **Registered Capacity**, with provision in the range of 90% to 100% **Registered Capacity** to be not less than that indicated by a straight line with unity decay from 10% of Registered Capacity at 90% output to 0 at 100% output.

- (v) The **TSO** may request **Generation Units of Registered Capacity** greater than or equal to 60MW to have the capacity to operate under **SFRS AGC** at all loads between **SFRS AGC Minimum Load** and **SFRS AGC Maximum Load**

OPERATIONAL CONDITIONS

OC4 SYSTEM SERVICES

OC4.1 INTRODUCTION OC4-Error! Bookmark not defined.

OC4.2 SCOPE OC4-Error! Bookmark not defined.

OC4.3 FREQUENCY CONTROL OC4-Error! Bookmark not defined.

OC4.3.1 INTRODUCTION OC4-ERROR! BOOKMARK NOT DEFINED.

OC4.3.2 OBJECTIVE OC4-ERROR! BOOKMARK NOT DEFINED.

OC4.3.3 DESCRIPTION OF FREQUENCY CONTROL OC4-ERROR! BOOKMARK NOT DEFINED.

OC4.3.4 REQUIREMENTS OF GENERATION UNIT GOVERNOR SYSTEMSOC4-ERROR! BOOKMARK

OC4.3.5 DISPATCH INSTRUCTIONS.....OC4-6

~~**OC4.3.6 SECONDARY FREQUENCY REGULATION SYSTEM (SFRS)**OC4-Error! Bookmark not defini~~

~~**OC4.3.6 AUTOMATIC GENERATOR CONTROL (AGC)** OC4-Error! Bookmark not defined.~~

~~**OC4.3.6 SECONDARY FREQUENCY REGULATION SYSTEM (SFRS)**~~

OC4.3.6 AUTOMATIC GENERATOR CONTROL (AGC)

OC4.3.6.1 The secondary **Frequency** regulation system operational on the **Transmission System** is known as the "~~Secondary Frequency Regulation System~~"-(~~SFRS~~) "**Automatic Generator Control**" (**AGC**).

OC4.3.6.2 **Generation Units** with a **Registered Capacity** of 60MW or greater are, under **Connection Conditions**, required to be connected to **SFRS AGC**, the **SFRS AGC Control Range** being a **Registered Operating Characteristic**.

- OC4.3.6.3 Other than as provided for in OC4.3.6.4 and OC4.3.6.5 all **Generation Units** fitted with **SFRS AGC** shall operate under the control of **SFRS AGC** when within their **SFRS AGC Control Range**.
- OC4.3.6.4 In the event that the **Generator** (acting in accordance with **Good Industry Practice**) considers that it is necessary to secure the reliability of a **Generation Unit**, or for the safety of personnel and/or **Plant**, to prevent a **Generation Unit** from operating under **SFRS AGC** and commences to control the MW output manually, then the **Generator** shall inform the **TSO** of this without delay. **Generators** shall also inform the **TSO** of the reasons for not operating the **Generating Unit** under **SFRS AGC**, and the course of action being taken to rectify the problem forthwith. When the problem has been rectified, the **Generator** shall contact the **TSO** to arrange for the **Generation Unit** to return to operation under the control of **SFRS AGC**.
- OC4.3.6.5 The **TSO** may issue a **Dispatch Instruction** to a **Generator** to prevent a **Generation Unit** (fitted with **SFRS AGC**) from operating under **SFRS AGC**, in accordance with **SDC2**.
- OC4.3.6.6 **Generation Units** not operating under **SFRS AGC** for reasons set out in OC4.3.6.4 and OC4.3.6.5 shall nevertheless continue to follow **MW Dispatch Instructions** as required by **SDC2**.

GLOSSARY

ACRONYMS

| | |
|-------------|--|
| SFRS | Secondary Frequency Regulation System |
| AGC | Automatic Generator Control |

DEFINITIONS

| | |
|--|--|
| Secondary Frequency Regulation Systems (SFRS) Automatic Generator Control (AGC) | A control system installed between the NCC and a Power Station whereby MW set points can be adjusted remotely by the TSO to reflect the Dispatch Instruction |
| SFRS AGC Control Range | The range of loads over which SFRS AGC may be applied. |
| SFRS AGC Maximum Load | The upper limit of the SFRS AGC Control Range . |
| SFRS AGC Minimum Load | The lower limit of the SFRS AGC Control Range . |
| | |

