| ENGINEERING NOTE | DMS#9281327v4 |
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System Management - SCADA & Information Systems

# Balancing / Load Following AGC Interface Requirement

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| First Author: | J Paguio / P Lancaster | |
| Queries: | | |

# 1 Revision History

| Version | Comments |
|---|---|
| 1 | Initial draft |
| 2 | Updated draft based on consultation with market participants |
| 3 | Further updated draft |
| 4 | Timeframes for Dispatch Instructions and Acknowledgement process updated. Point list updated.<br><br>Version approved as Final. |
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# 2 Definitions

| Term | Meaning |
|---|---|
| ABC | Automatic Balancing Control – a mechanism to represent Dispatch Instructions via AGC |
| AGC | Automatic Generation Control – a feature of System Managements Energy Management System (XA/21) |
| DCS | Distributed Control System (control system used to control facility) |
| EMS | Energy Management System – System Management's main SCADA system |
| GENERATED MW | The gross (generator terminal) MW value for a facility, before losses |
| LFAS | Load Following Ancillary Services – implemented via AGC |
| SCADA | Supervisory Control And Data Acquisition – control and indication logic used to remotely monitor and control plant |
| SENT OUT MW | The nett (over the fence) MW value for a facility |
| XA21 | The name of System Management's EMS |

# 3 Introduction

As part of the introduction of Balancing and LFAS markets, System Management acknowledged that there would be an increase in the required level of communications with the Market, the IMO, and generation facilities.

The changes to market rules and procedures relating to the issue of Dispatch results in significantly more Dispatch Instructions being issued, particularly at the end of the transitional period when there is an increase in the number of bidding tranches.

In order to ensure the dispatch process is robust, reliable and compliant with Market Rules, System Management needs to enhance its communications systems. One of the most expedient solutions is to utilise the existing AGC and SCADA infrastructure to issue dispatch instructions and facilitate IPP participation in the LFAS market.

Hence, for facilities to participate in Automatic Balancing and Load following, Facilities must be commissioned for AGC.

# 4 Automatic Generation Control

AGC is a module of GE Energy's XA/21 GDC (Generation Dispatch & Control) Suite, part of Western Power's XA/21 SCADA/EMS master station located at East Perth Control Centre. AGC provides closed loop control for selected generating units connected to the Western Power transmission system.

AGC is essential for Load Following facilities as the XA/21 SCADA system uses AGC to balance load with available generation and maintain a constant system-wide frequency of 50 Hz.

# 5 AGC interface Signalling requirement.

In addition to the standard connection signalling requirement, below are the additional signals required for units to be commissioned for AGC:

## SCADA IO List Requirement

### Inputs (RTU to DCS) Master Station to Facility

| Item no | Engineering Value Low | Engineering Value High | Units | Signal | Signal Description | Comment |
|---|---|---|---|---|---|---|
| 1 | | | MW | Analogue Output | Facility Desired MW Setpoint | Target MW setpoint, sent every 4 seconds if the unit is under AGC control. Note this is the Facility SENT OUT MW dispatch, facility must be able to work out the corresponding generator's GENERATED MW |
| 2 | | | MW/min | Analogue Output | Facility Desired Ramp Rate Setpoint | This is the Dispatch Required Ramp rate, sent every minute regardless wether the unit is in AGC control or Local control<br><br>If the unit is in AGC control and doing Balancing (see the AGC Control Mode indication in **Section 7**), facility should use this ramp rate to move the unit.<br><br>If the unit is in AGC control and doing load following (see the AGC Control Mode indication in **Section 7**) the facility should ignore this and use the maximum rate to move the facility |
| 3 | | | MW | Analogue Output | Look Ahead DI MW Setpoint | This is sent every minute regardless whether the unit is in AGC control or Local control<br><br>This is a 300 second (5 minute) look ahead which tells the facility what Desired MW the facility is expected to receive 5 minutes ahead of the current time, this is a representation of the actual Dispatch Instruction Target MW. |

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| 4 | | | MW/Min | Analogue Output | Look Ahead DI Ramp Rate Setpoint | This is sent every minute regardless wether the unit is in AGC control or Local control<br><br>This is a 300 second (5 minute) look ahead which tells the facility what Ramp Rate the facility is expected to receive 5 minutes ahead of the current time, this is a representation of the actual Dispatch Instruction ramp rate. |
| 5 | | | MW | Analogue Output | Look Ahead 2 MW Setpoint | This is sent every minute regardless whether the unit is in AGC control or Local control<br><br>This look ahead which tells the facility what Target MW the facility is expected to received in a configurable interval which can be specified by the Facility (minimum of 5 minutes, maximum of 60 minutes) |
| 6 | | | MW | Analogue Output | Look Ahead 3 MW Setpoint | This is sent every minute regardless whether the unit is in AGC control or Local control<br><br>This look ahead which tells the facility what Target MW the facility is expected to received in a third configurable interval which can be specified by the Facility (minimum of 5 minutes, maximum of 60 minutes) |
| 7 | | | MW | Analogue Output | Facility LFAS Low Operating Limit Setpoint | This is sent every 4 seconds via AGC and is calculated in as the difference between the current Dispatch Instruction Target MW and the cleared Load Following Margin Down. |
| 8 | | | MW | Analogue Output | Facility LFAS High Operating Limit Setpoint | This is sent every 4 seconds via AGC and is calculated in as the difference between the current Dispatch Instruction Target MW and the cleared Load Following Margin Up. |
| 9 | | | MW | Analogue Output | Facility Actual MW Setpoint | This is the current Facility Loading as seen from the Master Station. Can be used by the facility for information or can be just ignored, |
| 10 | | | MW | Analogue Output | AGC Basepoint MW Setpoint | This is the AGC basepoint. Can be used by the facility for information or can be just ignored, |

| | | | | | | |
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| 11 | | | MW | Analogue Output | AGC Control Mode Indication | This is sent every x seconds and is an indication of what AGC mode the Facility is currently set to. |
| 12 | | | | Digital Output | EPCC Master Station Communications Fail | Indication that the communications between the WP SCADA RTU and the WP SCADA Master Station has failed |
| 13 | | | | Digital Output | RTU to DCS Comms Watchdog | This bit is sent to the DCS and is read back via a output from the DCS below. If this bit fails to change state within a designated interval it generates a alarm |
| **Ouputs (DCS to RTU ), Facility to Master Station** | | | | | | |
| 1 | | | MW | Analogue Input | Facility Gross MW Telemetry | An instantaneous measure of the current MW loading level of the facility. This is the sum of the gross MW output of each generating unit. |
| 2 | | | MW | Analogue Input | Facility Net MW | An instantaneous measure of the SENT OUT MW loading level of the facility. |
| 3 | | | MW | Analogue Input | Facility Received Desired MW | Feed Back of the "Facility Desired MW Setpoint". |
| 4 | | | MW/min | Analogue Input | Facility Received Ramp Rate | Feed Back of the "Facility Desired Ramp Rate Setpoint" |
| 5 | | | MW | Analogue Input | Facility Received DI MW | Feed Back of the "Look Ahead DI MW Setpoint". |
| 6 | | | MW/min | Analogue Input | Facility Received DI Ramp Rate | Feed Back of the "Look Ahead DI Ramp Rate Setpoint" |
| 7 | | | MW | Analogue Input | Acknowledged Look Ahead DI MW | Represents Acknowledgement of the "Look Ahead DI MW Setpoint". See **Sections 7.1 and 8.2** below for implementation details. |
| 8 | | | MW/min | Analogue Input | Acknowledged Look Ahead DI Ramp Rate | Represents Acknowledgement of the "Look Ahead DI Ramp Rate Setpoint". See **Sections 7.1 and 8.2** below for implementation details. |
| 9 | | | MW | Analogue Input | Look Ahead 2 MW Received | Feed Back of the “Look Ahead 2 MW Setpoint” |
| 10 | | | MW | Analogue Input | Look Ahead 3 MW Received | Feed Back of the “Look Ahead 3 MW Setpoint” |
| 11 | | | MW | Analogue Input | Facility LFAS High Operating Limit | Feed Back of Facility LFAS High Operating Limit Setpoint |
| 12 | | | MW | Analogue Input | Facility LFAS Low Operating Limit | Feed Back of Facility LFAS Low Operating Limit Setpoint |

| | | | | | | |
|---|---|---|---|---|---|---|
| 13 | | | MW/min | Analogue Input | Unit Ramp Rate Up | Realtime actual Ramp Rate when unit is ramping up |
| 14 | | | MW/min | Analogue Input | Unit Ramp Rate Down | Realtime actual Ramp Rate when unit is ramping down |
| 15 | | | MW | Analogue Input | AGC Basepoint MW Received | Feed Back of the “AGC Basepoint MW Setpoint” |
| 16 | NA | NA | On/Off | Digital Input | Facility online status | An indication that the facility is connected to the Western Power transmission grid. This can be as simple as a single telemetered circuit breaker on/off indication, or a more complex calculation of breakers and switches for situations where the generating unit may be connected to more than one bus. For the latter, the calculation is normally performed in the XA/21 master station based on available breaker/switch telemetry. |
| 17 | NA | NA | On/Off | Digital Input | AGC Control Status | An indication from the facility that it is available for AGC control. In this mode the facility will received the 4 seconds "Facility Desired MW Setpoint" and must response to this signal correspondingly. |
| 18 | NA | NA | | Digital Input | RTU to DCS Comms Watchdog | This bit is sent from the DCS for the alarming on the status of the communications link |
| 19 | NA | NA | | Digital Input | DCS Internal Communications Fail | An indication of any internal communication failure. Facility should set the AGC Control Status to “Off” and tale control of the facility |

## 6 IMPORTANT NOTES

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| 1 | The above requirement describes the Additional Signal required for Facility already connected to the GRID. For new facilities connecting to the grid these signals needs to be added to the standard connection signalling requirement if the unit is to be commissioned for AGC/ABC. |
| 2 | Dispatch Instructions are re-estimated internally every minute, therefore it is possible for the Lookahead 2 and Lookahead 3 values to change each minute before being locked in as an actual Dispatch Instruction value. These values should be used for information only. |
| 3 | The Load Following High and Low limits are calculated based on cleared market information in the BMO and LFMO and the expectation is that the Facility is fully capable of running within these limits. However it is required that the Facility implement any additional limits internally that may be required to prevent any potential equipment damage or other implications from arising when running in AGC mode. |
| 4 | Some signals listed above may already be available due to previous commissioning activities, where possible existing signals will be re-used. |
| 5 | All signals required for control under AGC (Load Following) need to be scanned at a fast rate, at a minimum of 4 seconds. |

# 7 Automatic Balancing and Load Following Through AGC

The primary signals used by AGC are:

- Desired MW Setpoint
- AGC Control Status
- AGC Mode Indication

AGC is the common mechanism for providing the signalling for both Automatic Balancing and Load Following Services. Under AGC control the facility can either be in Automatic Balancing or Load Following Mode.

Note – the important distinction between ABC and LFAS is that whilst AGC is actively controlling the facility when providing LFAS, ABC is only providing a representation of Dispatch Instruction and an acknowledgement mechanism.

The AGC Control Status indicator is set by the Facility and determines whether the facility is participating in either Automatic Balancing or Load Following, if this is "Off" then the facility is under local (facility) control and AGC will be disabled.

In addition to the AGC Control Status indicator which is driven from the facility end, SM will provide an AGC Mode Indication point which will indicate to the facility whether AGC is actively sending balancing or load following signals. This is an analogue signal representing a matrix of possible AGC modes, the possible values for this are:

| **Control mode \ Participation mode** | **Full** | **Regulation** | **Assist** | **Non** |
|---|---|---|---|---|
| **Econ** | 200.0 | 180.0 | 190.0 | 170.0 |
| **Ramp** | 160.0 | 140.0 | 150.0 | 130.0 |
| **Base** | 120.0 | 100.0 | 110.0 | 90.0 |
| **Manual** | 80.00 | N.A | N.A | N.A |
| **Available** | 40.00 | N.A | N.A | N.A |
| **Unavailable** | 20.00 | N.A | N.A | N.A |

When actively providing Load Following, AGC will be in "Base Full" mode (value 120) and when in Automatic Balancing mode AGC will be in "Base None" mode (value 90). If AGC is in Manual (value 80) it will no longer be actively sending Desired MW signals and control will need to be transferred back to the facility.

Note – the other AGC modes are not actively used for Automatic Balancing or Load Following.

### 7.1 Automatic Balancing Control (ABC)

The following signals are sent to the facility every minute regardless whether the Facility is actively providing LFAS or not.

- Look Ahead DI MW Setpoint
- Look Ahead DI Ramp Rate Setpoint
- Look Ahead 2 MW Setpoint
- Look Ahead 3 MW Setpoint
- LFAS High Operating Limit Setpoint
- LFAS Low Operating Limit Setpoint
- Facility Desired Rate Setpoint

These setpoints are sent every 30 seconds

- AGC Control MODE
- Desired MW Setpoint (sent every 4 seconds if in AGC and 30 seconds if unit in MANUAL)
- Actual MW Setpoint
- AGC Basepoint Setpoint

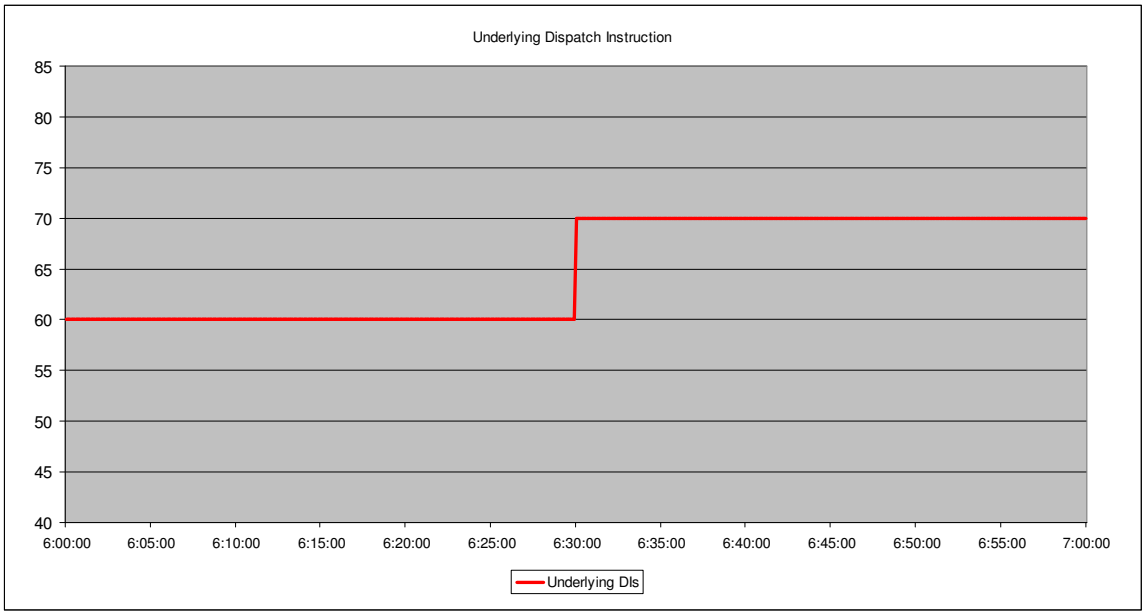
The Look Ahead DI MW and the Look Ahead DI Ramp Rate are the Target MW and Ramp Rate that the facility is expected to receive **300 seconds (5 minutes)** ahead of the current time and represent the actual issued Dispatch Instruction. The expectation is that the Facility will **commence ramping at 5 minutes after** the look ahead is received at the specified ramp rate, until it achieves the specified MW value. In terms of equivalent information to the formal Dispatch Instruction:

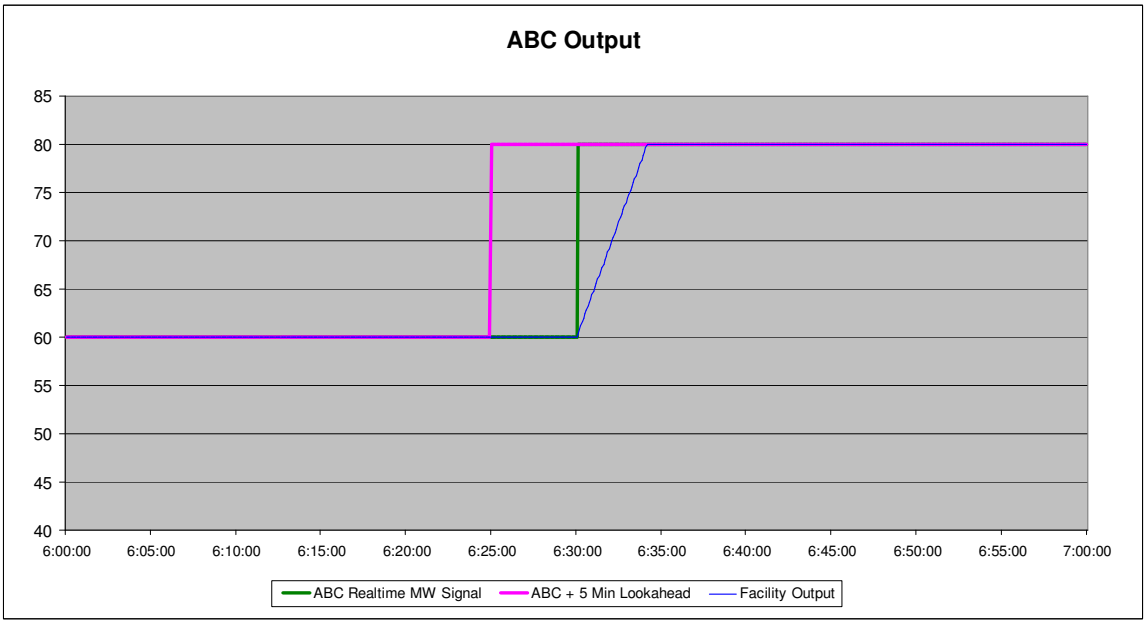
- Target MW = Look Ahead DI MW
- Ramp Rate = Look Ahead DI Ramp Rate
- Start Time = Time that the step change is received + 5 minutes

When under automatic balancing, the High Operating Limit and Low Operating Limit are set to be the same as the Desired MW Setpoint. This ensures that AGC can only send signals that match the current Dispatch Instruction.

A step change in the Look Ahead DI MW Setpoint (5-minute) indicates a new Dispatch instruction and (as per a normal Dispatch Instruction) has to be acknowledge by the Facility. This is done via the return “Acknowledged Look Ahead DI MW” and “Acknowledged Look Ahead DI Ramp Rate” analogue feedback points. If the facility is returning values that are greater to or equal to the required DI values **within 30 seconds** after receiving the step change, the Dispatch Instruction will be deemed by System Management to have been acknowledged (see section 8.2).

If the "AGC control Status" to 'On", XA21 will set the facility under AGC control ("Base None" mode in AGC) The facility will continue to receive the realtime Desired MW Setpoint signal which is indicating the underlying Dispatch Instruction, however it will not be directly controlling the facility. For example:




The frequency of the Look Ahead DI 2 and 3 can be configured separately for individual facilities and can be used by the facility for whatever purpose they need (information, or used for automatically starting and stopping a unit). The facility need not acknowledge these look ahead's.

### 7.2 Facility providing Load Following Services through AGC

If the facility is cleared for Load Following Services, the "Facility Desired MW setpoint" sent every 4 seconds would be frequently changing within the Facility LFAS High and Low Operating Limits to compensate for the changes in the frequency. Frequent changes on the "Facility Desired MW setpoint" indicates that the unit is doing load following.

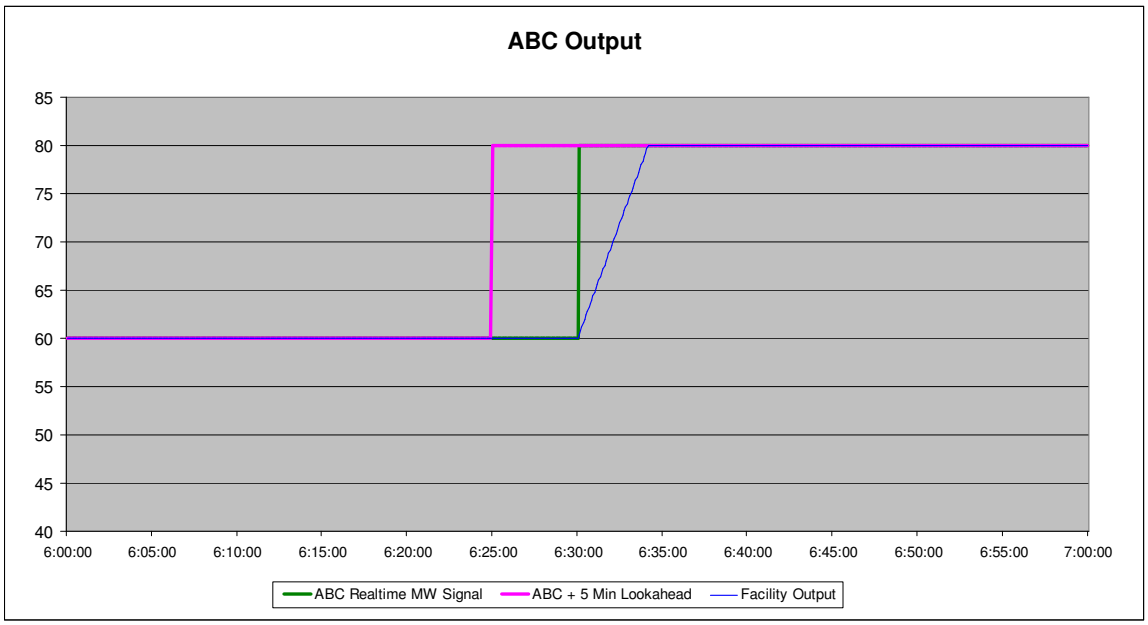
Also, the "Facility LFAS High Operating Limit" and "Facility LFAS Low Operating Limit" setpoint sent would not be equal to the "Facility Desired MW setpoint". A quick response is required in this mode, hence the facility should ignore the "Facility Desired Ramp Rate Setpoint" but instead use the facility ramp rate to respond to the "Facility Desired MW setpoint" sent. (The logic in the DCS should be able to use either the Operating Limits to check if the unit is in load following or the AGC Mode Indication to select the correct ramp rate to use, see section 5.3).

### 7.3 High and Low Limits

If the facility is doing Automatic Balancing Control, the "Facility Desired MW setpoint" sent every 4 seconds would be in step changes to reflect new dispatch instructions rather than individual small changes in the setpoint. The facility should be able to move to this new Sent Out MW output at the rate sent through the "Facility Desired Ramp Rate Setpoint" either Manually or Automatically are (this is an electronic representation of a Dispatch Instruction).

Aside from seeing a step change on the "Facility Desired MW Setpoint", the "High Operating Limit and the "Low Operating Limit" sent to the facility will also be equal to the "Facility Desired MW setpoint" to indicate the facility is just doing balancing.

This can be illustrated in the graph below. The 5-minute DI look ahead would come in 5 minutes before the required ramping time as a separate signal with a similar step change, then at the required ramp time the facility would be expected to commence ramping up to the new required value at the specified ramp rate (see the blue line).

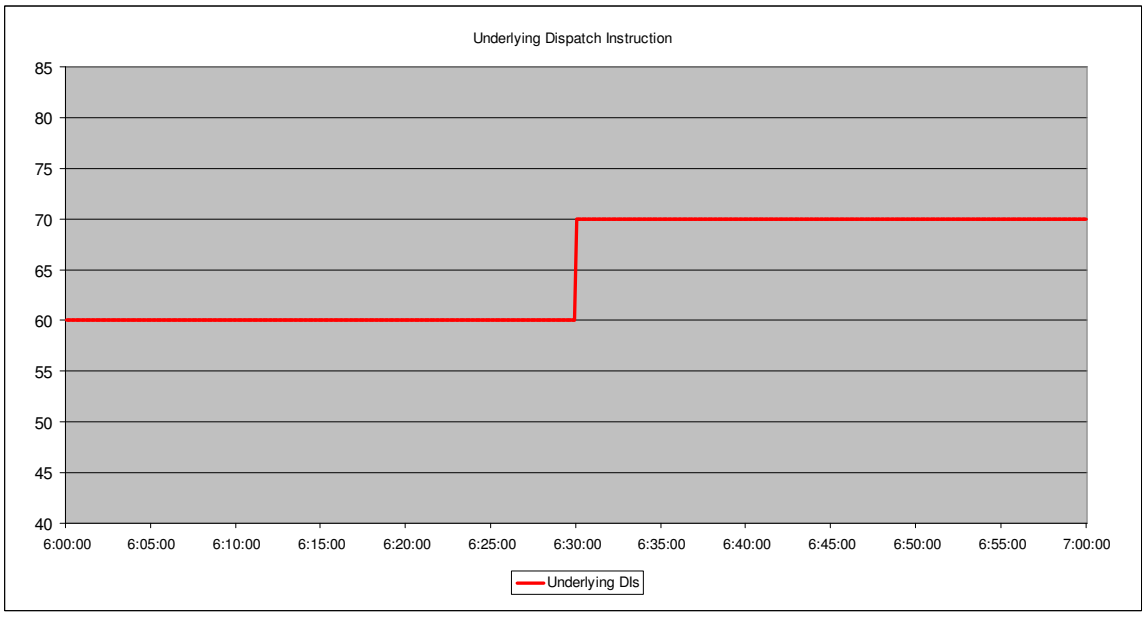



## 7.4 Load following Scenarios

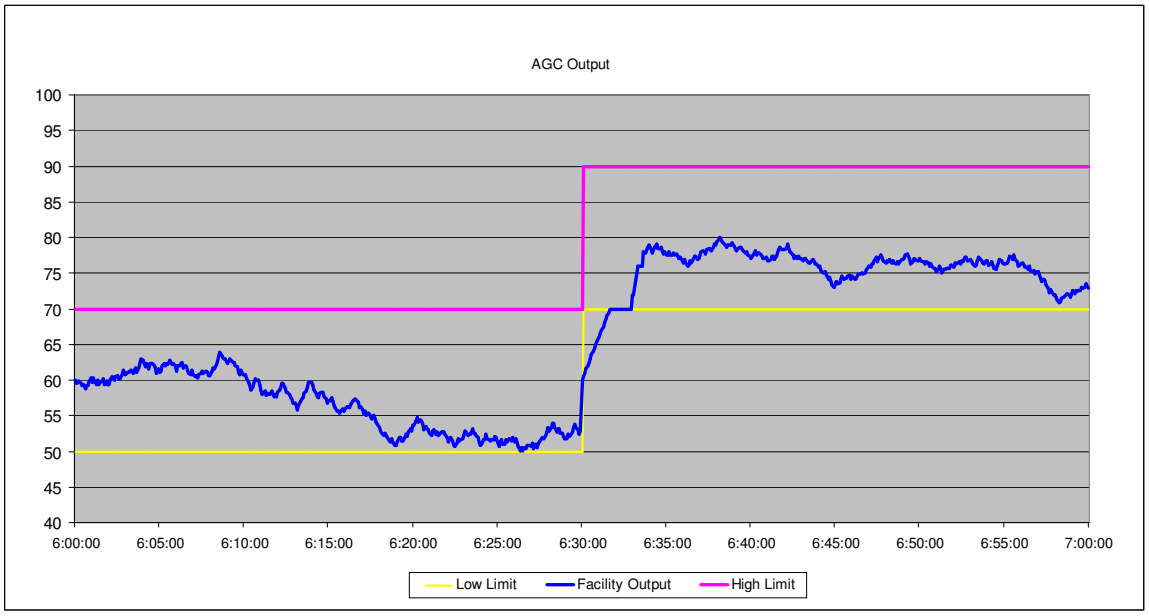
The graph below illustrate load following:

### Scenario one

Shown below is the underlying dispatch instructions (60MW for the first interval and 80MW for the next interval). The ramp rate for this example is 6MW/min.

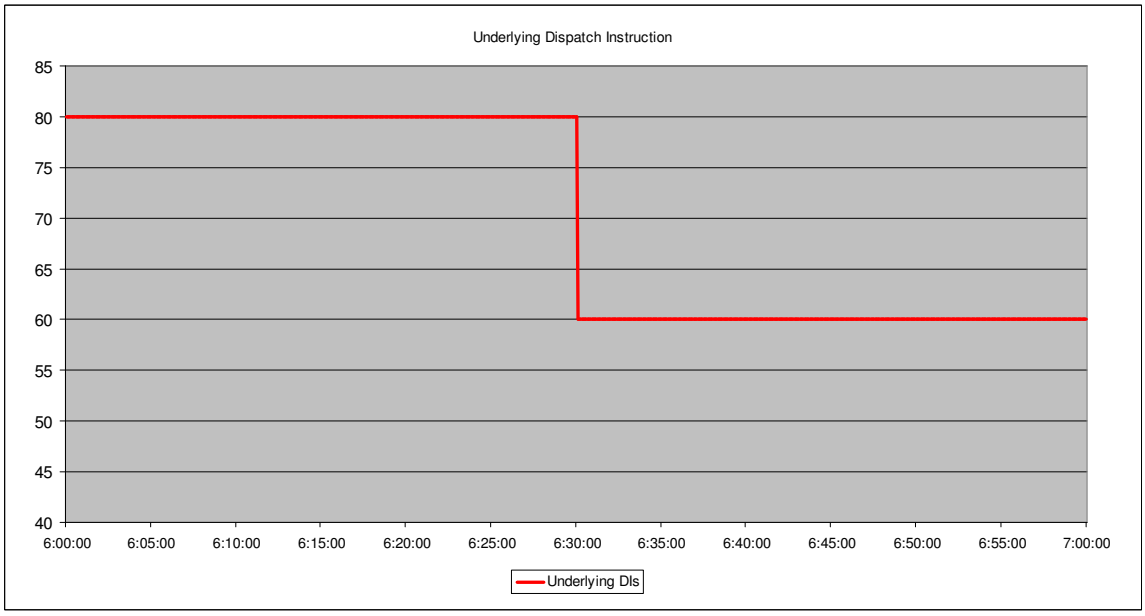


If the unit were on AGC providing load following support with (for example) a +/- 10MW range, AGC would automatically move the facility every 4 seconds within these limits based on what the frequency is doing. At the time that the new DI is issued, The Low and High operating limit is recalculated and there would be a step change of the AGC high and low Operating Limit relative to the new DI.

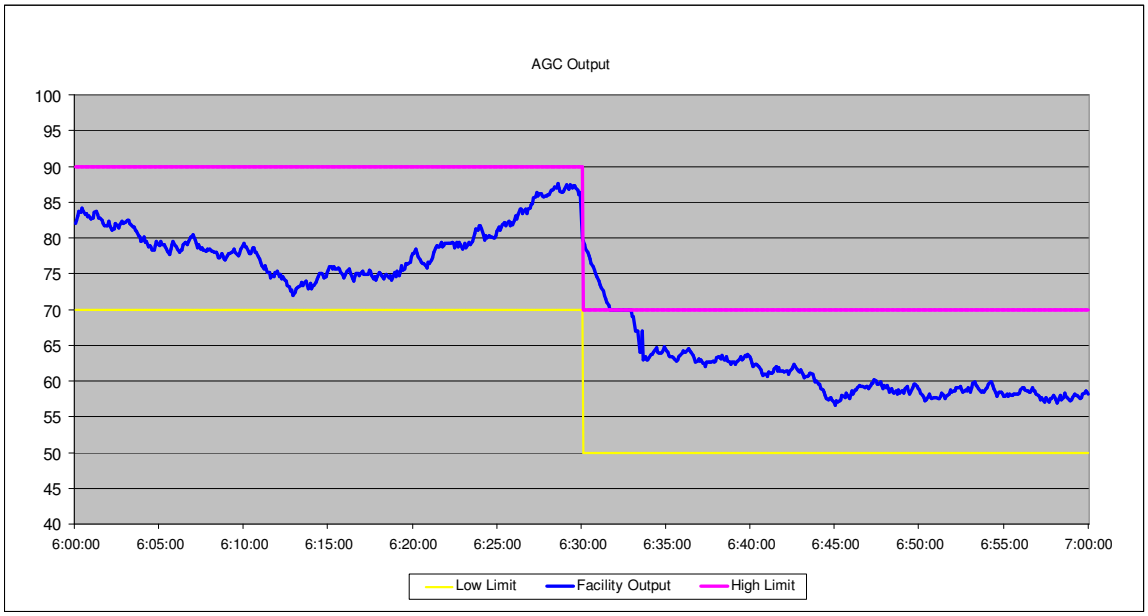



**Scenario 2**

Shown below is the underlying dispatch instructions (80MW for the first interval and 60 MW for the next interval). The ramp rate for this example is 6MW/min.

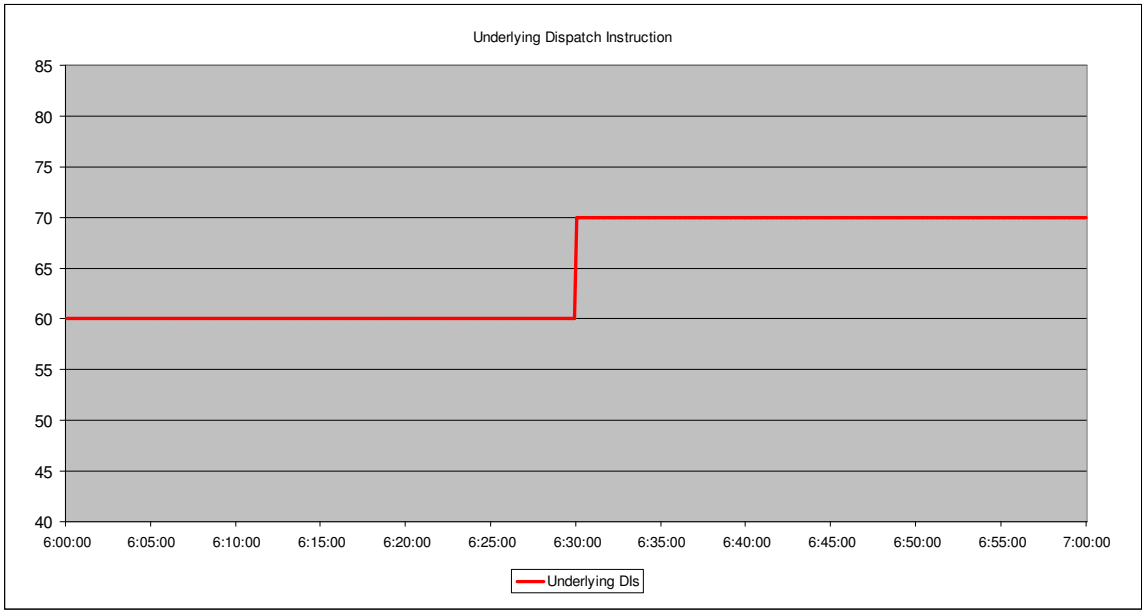


If the unit were on AGC providing load following support with (for example) a +/- 10MW range, AGC would automatically move the facility every 4 seconds within these limits based on what the frequency is doing. At the time that the new DI is issued, The Low and High operating limit is recalculated and there would be a step change of the AGC high and low Operating Limit relative to the new DI.

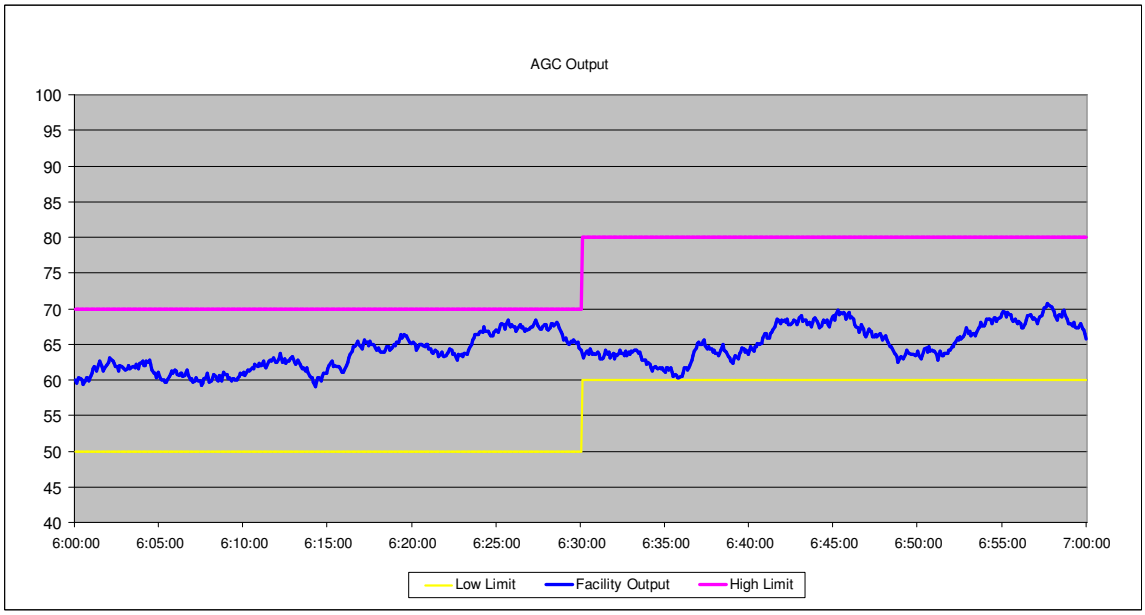



**Scenario 3**

Shown below is the underlying dispatch instructions (60MW for the first interval and 70 MW for the next interval). The ramp rate for this example is 6MW/min.

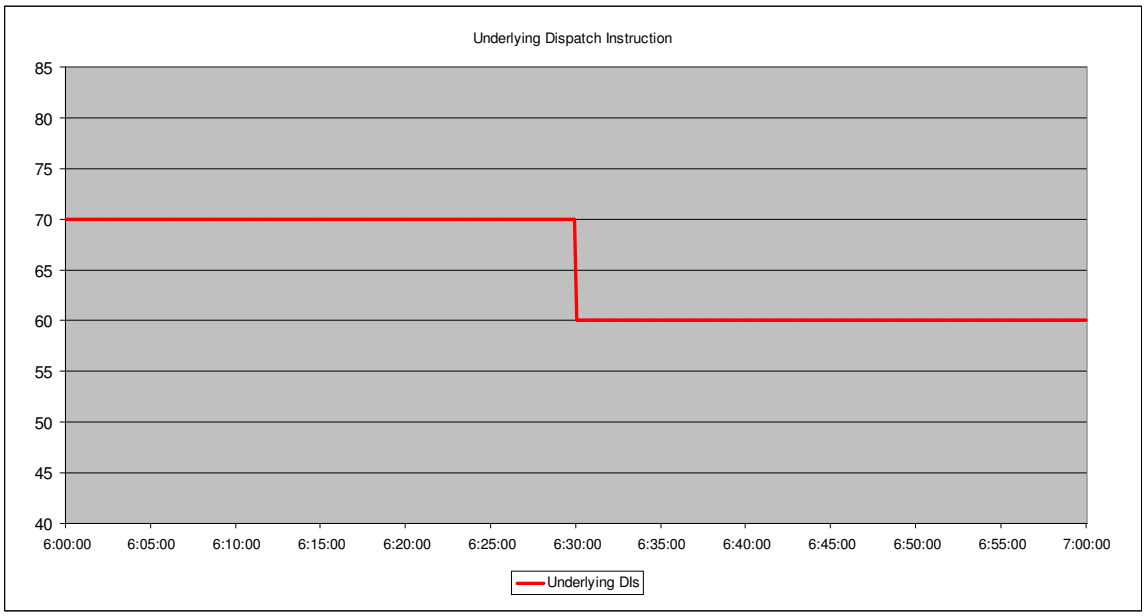



If the unit were on AGC providing load following support with (for example) a +/- 10MW range, AGC would automatically move the facility every 4 seconds within these limits based on what the frequency is doing. At the time that the new DI is issued, The Low and High operating limit is recalculated and there would be a step change of the AGC high and low Operating limit relative to the new DI

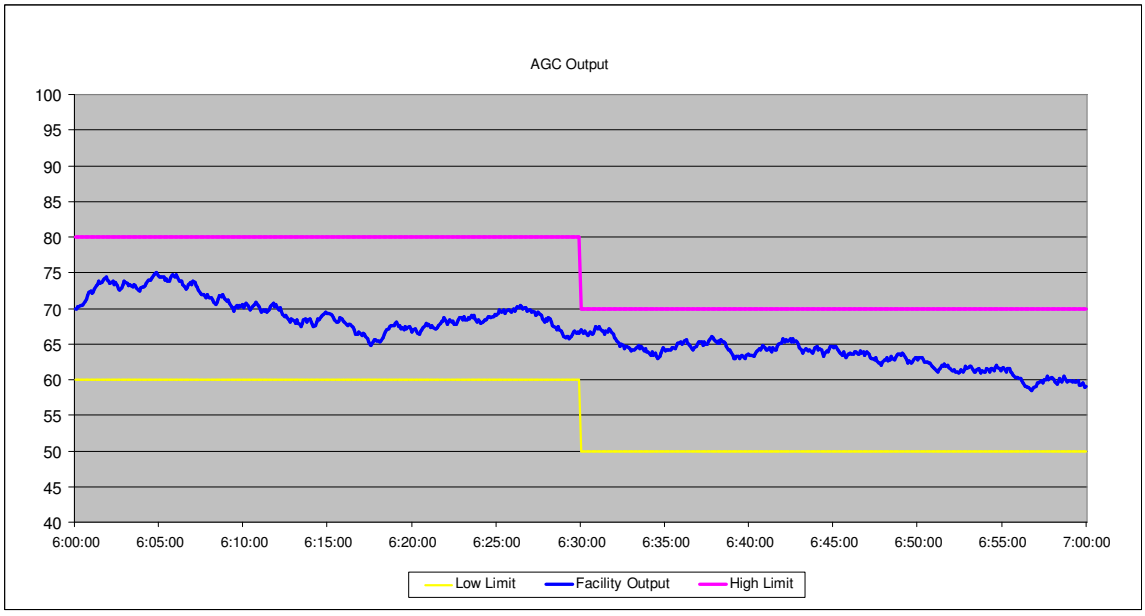


**Scenario 4**

Shown below are the underlying dispatch instructions (70MW for the first interval and 60 MW for the next interval). The ramp rate for this example is 6MW/min.




If the unit were on AGC providing load following support with (for example) a +/- 10MW range, AGC would automatically move the facility every 4 seconds within these limits based on what the frequency is doing. At the time that the new DI is issued, The Low and High operating limit is recalculated and there would be a step change of the AGC high and low Operating limit relative to the new DI



# 8 Facility DCS design considerations

## 8.1 Desired MW setpoint with multiple generating units

This is particularly critical for units participating in load following. The on-site logic must be designed to manage the Desired MW requirement across the available online units. The algorithm for this is customer dependent, however this re-allocation of Desired MW should be done without introducing any sizeable inherent delay to the process so as not to impact on the performance of AGC.

The facility must be able to follow a linear ramp rate at a constant ramp rate in order to be capable of providing Load Following Services.

The facility must demonstrate that it can respond to a change in Desired MW by commencing ramping within 5 seconds of receipt of the signal (as per the Power System Operating Procedure – Ancillary Services). See Section 9 below for testing requirements.

## 8.2 Dispatch Instruction Acknowledgement

The Facility DCS logic must be able to detect step changes in the “Look Ahead DI MW Setpoint”. Step changes in this signal represent a new Dispatch Instruction and will be correspondingly acknowledged **30 seconds** after the step change through the “Acknowledged Look Ahead DI MW” analogue feedback point and “Acknowledged Look Ahead Ramp Rate” analogue point.

Acknowledgement is performed by System Management based on whether the required Dispatch Instruction MW and Ramp Rate values are less than or equal to these values. That is, the “Acknowledged Look Ahead DI MW” analogue feedback point and “Acknowledged Look Ahead Ramp Rate” analogue points should represent the effective capability of the Facility, if the DI being issued is within this capability (checked 30 seconds after the step change has occurred) the DI will be automatically acknowledged by System Management.

## 8.3 Ramp Rates

The facility DCS should respond to the AGC “Facility Desired MW Setpoint” using the “DI Ramp Rate Setpoint” if the facility is only participating in balancing i.e.:

- AGC Mode Indication = 90
- Facility Desired MW Setpoint = Facility LFAS High and Low Operating Limit Setpoint.

The Facility DCS logic must be able to respond to the “Facility Desired MW Setpoint” using the facility ramp rate if the facility is participating in load following, i.e.

- AGC Mode Indication = 120
- Facility Desired MW Setpoint equal high operating limit and not equal to the Low operating limit ( load following in the DOWN direction)
- Facility Desired MW setpoint equal low operating limit and not equal to high operating limit (Load following in UP direction)
- Facility Desired MW setpoint not equal to high and low operating limit (load following in both directions).

### 8.4 AGC or SCADA/Communications Failure

For the loss of SCADA or communications between System Management and the facility, the facility DCS should trip the AGC Control Status back to local until the communications have been re-established with System Management. During this period the facility is under local control.

For an internal failure of AGC, or if there are repeated control or response failures between AGC and the facility, AGC will automatically switch back to “Manual” mode (AGC Mode Indication = 80). When this occurs the facility is under local control until AGC control can be re-established by System Management.

### 8.5 Feedback

Required feedback points are described in the SCADA IO List requirement.

### 8.6 AGC Control Selection

The facility has control on the “AGC Control Status” Point.

If the “AGC Control Status” is set to “On”, the facility control system should load up to receive the 4 seconds “Facility Desired MW Setpoint” and should respond to this setpoint accordingly.

If the “AGC Control Status” is set to “Off”, the facility is considered to be under local control and should ignore the “Facility Desired MW Setpoint”. Also, a calculation function in the master station will update the Facility Desired MW setpoint periodically to equal the GT's current MW output every 30 seconds even though this setpoint will be ignored by the Facility DCS.

### *8.7 Starting and stopping individual generating units*

It is assumed that the facility will have enough generating units online and synchronised to meet the requirements of any balancing dispatch instructions or load following commands received (Desired MW and ramp rate).

Given the delay in starting (and possibly stopping) individual generating units, it follows that the facility would need to be made aware of its requirements to run ahead of time. Where this information is not available in advance, or in the event that the facility is to be unmanned and/or automatically controlled, the use of look ahead setpoints (see section 2.2) is available.

The XA/21 master station interface is configured to transmit additional look ahead setpoints “Look Ahead basepoint 2”, “Look Ahead basepoint 3” which represent the Dispatch Instruction Target MW values at some point(s) in the future as interpreted from the current dispatch forecast. The look ahead values may be used by the facility DCS to determining when to start and stop generating plant to match required future dispatch instructions.

Take, as an example, a facility with a number of gas turbines each having an 8 minute start cycle. The XA/21 master station interface could be configured to send:

- A Desired MW setpoint (current dispatch instruction target) and Required Ramp Rate.
- A 5 minute Dispatch Instruction setpoint (and ramp rate)
- A 10 minute look ahead setpoint (used to start GTs so that they are online when required).
- A 30 minute look ahead (as information to plant operators, etc).

So at an arbitrary time t=7:50am:

- The Desired MW setpoint would contain the dispatch instruction target MW for 7:50am.
- The required Ramp Rate to achieve the desired MW target.
- The 5 minute look ahead setpoint would not yet contain the dispatch instruction target MW for 8:00am (as it has not yet been issued), but would still show the active dispatch instruction for 7:55am.
- The 10 minute look ahead setpoint would contain the currently ‘scheduled’ dispatch instruction target MW for 8:00am (based on the best information available at 7:50am). This would show a step-change for 8.00am if a new DI is required. Note – the DI itself will be locked in at 7:55:00am via the 5 minute look ahead and acknowledged at 7:55:30am.
- The 30 minute look ahead setpoint would contain the currently ‘scheduled’ dispatch instruction target MW for 8:20am (based on the best information available at 7:50am).

# 9 Testing/Commissioning

In order to prove that the signalling is working correctly and the facility is responding correctly to the AGC signals, the following suite of tests need to be conducted:

## *9.1 Automatic Balancing Testing*

Automatic Balancing requires the following testing:

- The signals in the table in Section 5 are all functioning and scanning correctly
- A step change in the Look Ahead DI MW Setpoint is picked up at the facility end as a new Dispatch Instruction and two Acknowledgement signals are received for the Target MW and Ramp Rate
- When the Desired MW Setpoint makes a step change the Facility commences ramping at the Desired Ramp Rate and stops ramping when the Desired MW is achieved (in SENT OUT MW terms)
- When the AGC Control Mode is switched to local that the facility is ignoring Desired MW signals from AGC and can be controlled locally
- When there is a SCADA/comms failure the AGC Control Mode is switched to local, the facility ignores the Desired MW signals from AGC and can be controlled locally
- When there is an AGC failure and the unit is tripped to Manual, that the facility ignores the Desired MW signals from AGC and can be controlled locally
- Other facility specific testing that may be required to prove automation at the facility end (e.g. automatic starting/stopping of units)

### *9.2 Load Following Testing*

Proving Load Following capability is more onerous than proving Automatic Balancing primarily due to the signal timing requirements and response time requirements. The following tests are required for this:

- The signals in the table in Section 5 must all be fully commissioned, functioning and scanning correctly
- Prove that the facility is capable of responding to a step change in Desired MW by commencing ramping within 5 seconds (Ancillary Services PSOP 2.1.1(c))
- For each available LFAS range, prove that the facility is able to achieve continuously the minimum ramp rate required (Ancillary Services PSOP 2.1.1(h)). This will be demonstrated by System Management implementing a MW step change equal to the full MW range and observing that the facility ramps continuously at no less than the minimum ramp rate required for that MW range (until the facility achieves the full MW change required). Several tests of this nature may be done to confirm consistent results (including in both the positive and negative directions).

  *Note – LFAS ranges are determined by the available ramp rate (see Ancillary Services PSOP 2.1.1(f), Ancillary Services PSOP 2.1.1(f) and Ancillary Services PSOP 2.1.1(k)).*

  *For example - the Ancillary Services PSOP specifies a minimum ramp rate of 0.2MW/min for each MW of the available LFAS range, so a facility with a ramp rate of 5MW/min would have a maximum LFAS range of 25MW.*

- Prove for a communications failure (e.g. RTU failure) the facility automatically trips back to local control and no longer responds to AGC MW setpoints
- Prove for an internal AGC failure where the AGC control mode is returned to Manual, the facility automatically trips back to local control and no longer responds to AGC MW setpoints
- Leave the facility actively running under AGC and actively responding to frequency variations for a period of 6 hours without material failures (e.g. unit trips or inadequate response times)

Test results pro-forma: DM#10070484

End of Engineering Note