ELECTRICITY INDUSTRY ACT

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WHOLESALE ELECTRICITY MARKET RULES

Power System Operation Procedure:

Operational Data Points For Generating Plant

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Version history	
21 September 2006	Power System Operation Procedure (Market Procedure) for Operational Data Points For Generating Plant
1 August 2009	System Management proposed amendments to this procedure resulting in publication of Procedure Change Report PPCL 0007
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1.   OPERATIONAL DATA POINTS FOR GENERATING PLANT

1.   Operational Data Points for Generating Plant specifies System Management's requirements for the real time operational data points to be transmitted through the SCADA Operational Interface between a Market Participants generating plant connected to the South West Interconnected System (**SWIS**), the Western Power Networks (**WPN**) , and the East Perth Control Centre (**EPCC**). It does not specify the requirements for the real time operational data points to be transmitted through the SCADA Operational Interface between WPN owned and operated Transmission and Distribution elements of the SWIS network and the EPCC. Nor does it specify the performance requirements for the Supervisory Control and Data Acquisition (SCADA) Operational Interfaces.

2.   The operational data points specified in the Appendices provide real time data that will be directly used by System Management for the monitoring, control ,control, and on-line studies associated with the management of the security of the SWIS.

3.   Operational data points, other than those specified and agreed according to the provisions of this document, that are required by System Management for non real-time studies and forecasting purposes, may be provided in a form, at an update rate, and using a communications media that has been agreed between the Market Participant concerned and System Management.

2.   SCOPE

1.   This Power System Operation Procedure: Operational Data Points For Generating Plant Procedure (**Procedure**) has been developed in accordance with clause 2.35.4 of the Wholesale Electricity Market (**WEM**) Rules (**Market Rules**).

2.   The Operational Data Points for Generating Plant procedure discusses the factors that influence the requirements and how they are to be applied to the specific types of generators connected to the system.

3.   The requirements are summarised in the tables in the appendices to this document.

4.   The operational data points specified in the appendices comprise of the minimum requirements, and Market Participants may in agreement with System Management, agree modified requirements.

3.   ASSOCIATED PROCEDURES AND OPERATIONS STANDARDS

The following Power System Operation Procedures are associated with this Operational Data Points for Generating Plant procedure:

a. Power System Operation Procedure - Communications and Control Systems.
b. Power System Operation Procedure - The Performance of Power System Operational Data Communications Facilities

4. TYPES OF GENERATION FACILITIES

The requirements detailed in this document shall apply to all types of generating plant that are likely to be connected to the SWIS including, but without limitation:

- Intermittent Generating Systems with a large number of small units
- Conventional Steam Turbine Generators
- Open Cycle Gas Turbine Generators
- Combined Cycle Gas Turbine Generators with associated Steam turbine Generators
- Generators that are part of a co-generation facility
- Biomass Generators
- Landfill Gas Generators

5. APPLICATION OF THESE REQUIREMENTS

1. The minimum requirements specified in this procedure will apply to all new generation plant that is not already connected to the SWIS for which an Access Application is submitted after the commencement date of this procedure.

2. Where the provisions of item 5.1 above apply, once the Market Participant has signed an Electricity Transfer Access Contract the Market Participant must consult with System Management and agree on the operational data points requirements for their generating plant

3. The minimum requirements specified in this procedure will not apply to any new generating plant that is not already connected to the SWIS for which an Access Application has already been submitted prior to the commencement date of this procedure, except where the Market Participant and System Management agree that the minimum requirements specified in this procedure will be applied.

4. Where the provisions of items 5.1 and 5.3 above apply and modifications or major upgrades are being made to the generating plant that will result in a requirement for operational data points additional to those already provided, the Market Participant must apply to System Management to vary the minimum requirement based upon their particular circumstance.

5. The minimum requirements specified in this procedure will not apply to existing generating plant that is already connected to the SWIS at the commencement date of this procedure except under the following circumstances:

   a) where modifications or major upgrades are being made to the generating plant that will result in a requirement for operational data points additional to those already being provided
   b) where an agreement exists between the Market Participant and SM for additional data points to be provided

6. Where the provisions of items 5.3.a) above apply to existing generating plant, the Market Participant must apply to System Management to vary the minimum requirement based upon their particular circumstance.

6. AGGREGATION OF FACILITIES

1. In the case of Non-Intermittent Generators classified as an aggregated facility the requirements detailed in the document shall apply to individual generators within the facility.

2. In the case of Intermittent Generators classified as single Non-Scheduled Generators, the requirements detailed in this document shall apply to the aggregated facility.

7. BOUNDARIES OF RESPONSIBILITY

1. The level of operational data to be interfaced with the SCADA will depend upon how the generating plant involved is to be operated. In most cases it is expected that the generating plant will be operated from a 24 per hour 7 day per week attended generator control facility. However in some cases the owner/operator of the generating plant may include in an agreement the provision for the generating plant to be remotely operated by System Management.

2. To enable System Management to monitor the operating state of generators connected to the SWIS, the Market Generator shall provide real time operational data points from the generators to interface through the Remote Monitoring Equipment for transmission to the WPN SCADA Master Station at the EPCC. At the EPCC the operational data points shall be interfaced with the System Management SCADA operational displays that will provide operational information similar to that provided on the generating plant operational displays.

3. For generating units where the owner/operator has agreed that System Management will remotely operate the plant, the operational data points shall provide the same level of control and monitoring that is provided to a local operator. Where appropriate alarms from generating units operated remotely by System Management, which require System Management to take the same action, shall be grouped.

4. Where System Management has the provision to transmit desired set point levels to the generating plant the operational data points shall include separate feedback data points to enable the actual operating set point level to be monitored independently of the desired level.

5. It is assumed that operational data points from:

   a) Equipment owned by the Market Generator, will be interfaced from the control equipment in the Market Generators facility with either a Remote Monitoring Equipment or a Remote Terminal Unit provided by the Network Operator.

   b) Equipment owned by the Network Operator, will be interfaced with the Remote Terminal Unit provided by the Network Operator.

6. The Remote Monitoring Equipment and the Remote Terminal Unit provided by the Network Operator is assumed to be located in a separate room/building provided within the Market Operators facility.

8. INTERMITTENT GENERATION

1 Where System Management issues a Dispatch Instruction (either verbally or through an automatic control system) that requires the generating system to operate below its actual capability at that time, System Management may be required to provide the IMO with an estimate of the actual capacity that would have been available if the output of the generating system had not been limited. This data is used by the IMO to calculate the compensation to be paid to the Intermittent Generator.   Intermittent Generators shall provide sufficient operational data points to enable System Management to calculate and provide the IMO with an estimate of the actual capacity available from the generating system for the prevailing conditions. The Intermittent Generator shall include operational data points for the number of generator units in service and the number of generating units available for service and for the critical quantities required to enable the required capacity calculations to be made (e.g. wind speed at hub height, wind direction, air temperature and air density).

2. Where it has been identified that different parts of the facility have different wind performance characteristic, the units in that part of the facility shall be grouped and these data points shall be provided separately for each group.

3. Where the loss of integral reactive support devices causes a reduction in the permitted operating capacity of the generating system the Intermittent Generator shall include operational data points to indicate the number of reactive support devices available.

4. For Intermittent Generators the operational data points that are to be provided shall be at the discretion of System Management.

9. SYSTEM SECURITY

9.1 Network Analysis Facilities

1. In order to facilitate the monitoring and control of the security of the SWIS it is necessary for System Management to analyse the operating state of the SWIS using a number of Network Analysis facilities that are integrated with the SCADA Systems at the EPCC.

2. To account for the loss of incoming operational data points System Management must be able to estimate the operating state of the SWIS using the State Estimation facility.

3. To anticipate possible operating scenarios, where the Power System Security limits may be breached, System Management must be able to perform calculations, using Contingency Selection and Analysis facility, to determine voltage and ampere levels in the power system for a range of contingency situations.   System Management will, when necessary, use the results of these calculations to take appropriate pre-emptive action in order to prevent the occurrence of a breach of Power System Security limits.

4. To ensure that the elements of the Power System are not subject to fault, operating conditions that may exceed the switchgear fault rating System Management must be able to perform Fault Level calculations as the Power

System configuration changes. System Management, when necessary, will use the results of these calculations to reconfigure the network to ensure that the network elements are operating within their rated capacity.

5. The Network Analysis facilities in the SCADA require System Management to be able to model operation of the Power System using modelling data provided through the SMMITS interface and using real time Power System operational data provided through the SCADA Operational Interface including real time operational data from generating systems. The Market Generator shall provide all the operational data points, as shown in the tables in the appendices that are required to enable System Management to model the generating plant and its connections to the SWIS.

6. Where the generating system is embedded into a local network, the Market Generator shall provide operational data points, as shown in the tables in the appendices, for all elements in the local network that can interconnect the generation plant with the SWIS and account shall be taken of any locally connected loads.

7. In the case of intermittent generating systems, where the individual generating units contribute to the fault current, operational data points for the number of units available shall be provided to enable the Power System model to be correctly configured.

9.2 Emergency Disconnection of Unattended Generating Systems

1. The Technical Rules provides for Western Power to direct that a generation system must be taken out of service and/or disconnected if it is likely to adversely affect the secure operation of the SWIS. Where a generating system does not comply with such directions within a reasonable period of time Western Power may disconnect it from the SWIS without notification.

2. It should be noted that a generator will only be disconnected as a last resort when System Management have taken all reasonable measures to contact the owner/operator of the generating plant or when the owner/operator has not complied with a reasonable request to disconnect and the secure operation of the SWIS is still being adversely affected.

3. Where the generating unit is to be operated unattended or may be unattended at any time the Market Generator shall provide operational data points to allow System Management to remotely open the generator main circuit breaker connecting the generating unit to the SWIS.

4. Where the generating unit is operated from a 24 hr 7 days per week attended control facility and where the connection arrangement does not include a generator main circuit breaker, System Management will implement emergency disconnection by opening the circuit breaker(s) at the point of connection in the WPN substation on the circuits through which the generator(s) are connected to the SWIS

10. ANCILLARY SERVICES

Ancillary Service requirements in the Wholesale Electricity Market (WEM) are governed by chapter 3 of the Wholesale Electricity Market Rules (WEM Rules) together with the Ancillary Rules and Procedures issued by System Management.

Where a generating unit is or may intend to provide Ancillary services requiring connection to the Automatic Generation Control (**AGC**) relating to one or more types of Ancillary Services. The Market Generator shall provide the operational data points required to enable System Management to send and receive real time operational data to and from the AGC facility incorporated in the SCADA system at the EPCC. This shall include governor system raise/lower commands, AGC enable and disable commands, loading and unloading ramp rate commands, and target MW output, as well as "handshake" signals to ensure that the communications channels are intact.

11. NETWORK CONTROL SERVICES

1. Network Control Service requirements in the WEM are governed by chapter 5 of the WEM Rules.

2. Where the generating unit is contributing to the provision of Network Control Services the Market Generator shall include operational data points to enable System Management to monitor and, where agreed, control the operational status of any device that is critical to the provision of these services. This shall include start and stop commands, starting/rundown in progress, Synchronous Compensator/Generator mode selection commands, Reactive Plant switching commands, Tap Changer position commands, excitation system raise/lower commands, voltage levels, and MVAr output, SVC control mode (power factor or voltage) selection and related set point commands.

3. In the case of intermittent generating systems where static reactive compensator devices have been provided for network voltage support operational data points for the number of devices available and the MVAr input/output to the devices shall be provided.

12. NETWORK PROTECTION SCHEME

Where the agreed access conditions include the provision of special network protection schemes, the SCADA operational interface shall include operational data points for the control and monitoring of the generating system. This shall include signals to control the output of the generating systems and to provide both the Power Station operators and System Management with indications that these schemes have operated.

13. COMPLIANCE MONITORING

1. System Management is required to monitor compliance of generating systems with the Scheduled Resource Plans, Dispatch Instructions and Advisories, Ancillary Service provisions, and Network Control provisions. In order to monitor compliance System Management must be able to monitor the operating state of critical operational data points on all generating systems connected to the SWIS. This will normally be implemented by

interfacing data points from the generating systems to a separate high-speed disturbance recording device.

2. Where it has been determined that System Management will monitor the performance of the generating systems the Market Generators shall provide the operational data points that System Management considers critical to ensuring that the generating systems are meeting their obligations under the WEM Rules. These data points shall be separate to those transmitted to System Management and shall normally be interfaced directly with the separate high-speed disturbance recording device.

14. SCADA INTERFACE PERFORMANCE

1. The provision of reliable, accurate and timely operating data to and from the generating systems is critical for System Management to perform its role required by the WEM Rules. The Market Generator shall ensure that the SCADA Operational interface operates in accordance with the specified performance requirements.

2. The performance requirements for the SCADA Operational Interfaces are dealt with in a separate document.

15. SPECIFIED POINTS

The attached tables indicate the types of SCADA Operational Data points that are required. Alarm points may be provided as a single point where the points from individual devices are paralleled within the generation facility or may be provided as individual points from the individual devices and paralleled within the WPC RTU. To ensure adequate redundancy for the Security Dispatch Functions in the SCADA System all analogue points must be provided from a direct measurement of the quantities. Summated analogue values are not acceptable.

16. COMMUNICATIONS AND CONTROL

1. Clause 2.35.4 of the **WEM Rules** requires that System Management document the communication and control system requirements needed to support the dispatch process. System Management has documented this in the Power System Operating Procedure: Communications and Control Systems.

17. CONFIDENTIALITY

The data from the operational data points agreed between System Management and a Market Participant in accordance with the provisions of this procedure, which is transmitted through the SCADA Operational Interface between generating plant connected to the SWIS and the EPCC will:

      a) be used by System Management for the monitoring, control, and on-line studies associated with the management of the security of the SWIS

      b) not be disclosed to a third party without the written consent of the Participant concerned

Table 1 - System Management Operational Data Points Requirements for Scheduled Generators without AGC

Point Description	Transmission Connected and 10 MW or more	Transmission Connected and less than 10 MW	Distribution Connected
Status			
All IPP facility switching devices opened/closed (isolators, earth switches, circuit breakers, etc - 2 complementary contacts ie.i.e. NO/NC pair)	√	√	√
Remote generation load control on/off	R		
Generating unit operating mode (e.g. gen/synch comp if applicable)	R		
AVR or SVC control mode (ege.g. constant q, constant V, manual or off)	R		
Turbine control limiting operation (e.g. temp etc)	R		
Governor mode (e.g. droop/isochronous)	√		
Generating facility synchronising	√	√	√
Generator run up and run down	R		
Fuel type (e.g. liquid/gas/coal)	√		
Base/Peak mode	G		
Associated reactive plant switching devices opened/closed (isolators, circuit breakers, etc 2 complementary contacts ie NC/NO pair)	√		
Alarms			
Main circuit breaker(s) tripped by protection			√
Protection defective alarms	R		
Over/Under Excitation Limiter Operated	R		
Protective Load Shed Operated	√		
Communications Link(s) Fail	√	√	√
High/Low Severity Alarms	R		
Generator protection operated	√	√	
Step up transformer protection operated	√	√	
Associated Reactive plant protection operated	√		
Measured Values			
Gross active and reactive power output of each generating unit	√		
Nett active and reactive power output of each generating unit	√		
Net facility active and reactive power import or export at each connection point	L	L	L
Local Load and/or Unit Auxiliary active power and reactive power	L	L	L
Generating unit stator voltage	√	√	√ see note 1
Generator step-up transformer tap position	√		
Net facility output of active energy (impulse)	M	M	M
Speed of rotor as percentage of synchronous speed	R		
Reactive power flow for each associated reactive power device	√		

Point Description	Transmission Connected and 10 MW or more	Transmission Connected and less than 10 MW	Distribution Connected
Control			
Pulse or set point control of exciter	R		
Generator step-up transformer tap position	R		
Generator Start /Stop (note: separate start commands are required if unit can be started to different output levels (i.e. min, 50%, max)	R		
Generator main circuit breaker	U		
Base/Peak mode selection	R		
Associated reactive plant operating mode (power factor/voltage)	R		
Power factor and voltage set points	R		
Each reactive power device circuit breakers	R		

Note 1 : voltage on Western Power side of Main Switch
Blank cell = not required
Points with grey background are sent from WPN SCADA to the Generator
√ = required
F = If providing AGC for frequency load following ancillary service support
G = required for Gas Turbines generators only
L = required if local load or a unit auxiliary transformer is connected anywhere between the generator terminals and the point of connection
M = not required if metered
R -=required if WP contracted to provide remote control
U = required if facility unattended or if WP contracted to provide remote control

Table 1A – System Management Additional Operational Data Points Requirements for Scheduled Generators with AGC

Point Description	Transmission Connected and 10 MW or more	Transmission Connected and less than 10 MW	Distribution Connected
Automatic Generation Control (AGC)			
AGC pulse or Desired Load MW Set Point (control of the governor)	F		
Base Load MW	F		
AGC Control and Participation Mode (Assist/Full/Regulation/None)	F		
AGC Communications Link Fail Alarm	F		
AGC Control Status (Local/SOCC)	F		
High Loading limit MW value	F		
Low Loading limit MW value	F		
Ramp up rate limit MW/min value	F		
Ramp down rate limit MW/min value	F		
Governor On/Off	F		
AGC Regulation Mode (Normal/Assist)	F		
AGC Control Mode (Base/Econ/Ramp)	F		

Blank cell = not required
Points with grey background are sent from WPN SCADA to the Generator
F = required if providing AGC for frequency load following ancillary service support

Table 2 – System Management Operational Data Points Requirements for Transmission Connected Non- Scheduled Generators

Point Description	Non-Intermittent and 10 MW or more	Non-Intermittent and less 10 MW	Intermittent and 10 MW or more	Intermittent and less than 10 MW
Status				
All IPP facility switching devices opened/closed (isolators, earth switches, circuit breakers, etc – 2 complementary contacts ie.i.e. NO/NC pair)	√	√	√ See note 1	√ See note 1
Associated reactive plant Control Mode (ege.g. power factor, voltage)	√		√	
Generating facility synchronising	√	√	√	√
Associated reactive plant switching devices opened/closed (isolators, circuit breakers, etc 2 complementary contacts iei.e. NC/NO pair)	√		√	
Alarms				
Main switch tripped by protection		√		√ see note 1
Generator protection operated	√		√	
Step up transformer protection operated	√		√	
Associated Reactive plant protection operated	√		√	
Communications Link(s) Fail	√	√	√	√
Measured Values				
Gross active and reactive power output of each generating unit	√		See note 1	
Nett active and reactive power output of each generating unit	√		See note 1	
Net facility active and reactive power import or export at each connection point	√	√		√ see note 1
Local Load and/or Unit Auxiliary active and reactive power	L		L	
Generating unit stator voltage	√		√ see note 1	
Generator step-up transformer tap position	√		√	
Net facility output of active energy (impulse)	M	M	M	M
Number of individual generator units available for service	√		√	
Number of individual reactive power devices in service	√ see note 3		√ see note 3	
Number and rating of reactive power devices available for services	√ see note 3		√ see note 3	
Reactive Power flow in each reactive power device	√ see note 4		√ see note 4	

Point Description	Non-Intermittent and 10 MW or more	Non-Intermittent and less 10 MW	Intermittent and 10 MW or more	Intermittent and less than 10 MW
Wind Data at nacelle height (see note 2)				
Wind Speed (km/h) (10 minute average) (see note 5)			W	
Wind Direction (deg) (10 minute average)			W	
Air Pressure (10 minute average)			W	
Air Temperature (10 minute average)			WO	
Number of wind turbines available for generation data			W	
Number of wind turbines in operation data			W	
Relative humidity (%) or Dew Point (deg C)			WO	
Control				
Generator Set point from special network protection schemes	S		S	
Set point control of reactive power devices (power factor and voltage)	R		R	
Generator step-up transformer tap position	R		R	
Generator Emergency Stop	√	√	√	√
Generator Main Circuit Breaker	U	U	U	U
MW Control Scheme Set points			W	
Solar Data				
Solar Radiation - Horizontal			√	
Solar Radiation - Panel face			√	
Temperature - Panel face			√	
Air Temperature (10 minute average)			SO	

Note 1: For intermittent generators with a large number of small generating units the SCADA interface does not need to monitor individual units but must provide data points for the aggregate of all the units
Note 2: For windfarms multiple sets of data points for wind quantities should be provided where necessary iei.e. the specified wind quantity data should be provided for each group of wind turbines within the windfarm wherewindfarm where the wind characteristics in each group differ fromdiffer from those in other groups. The 10 minute average data is the average of samples taken at specified intervals over a 10 minute period that are transmitted as real time data
Note 3: Required only if individual reactive devices are connected to each generating unit
Note 4: Required only if reactive power devices are connected to the substation low or high voltage busbars
Note 5: At hub height for wind farms or nominated height, in the absence of hub height
Points with grey background are sent from WPN SCADA to the Generator
Blank cell = not required
√ = required
L = required if local load or a unit auxiliary transformer is connected anywhere between the generator terminals and the point of connection
M = not required if metered
S = required where special network protection schemes are installed
U = required if facility unattended
W = required for wind farms
WO = optional for wind farms
SO = optional for solar

Table 3 - System Management Operational Data Points Requirements for Distribution Connected Non- Scheduled Generators

Point Description	Intermittent and 1MW or more and less than 10MW (see note 1)	Non-Intermittent and 1 MW or more and less than 10MW (see note 1)
Status		
All IPP facility switching devices opened/closed (isolators, earth switches, circuit breakers, etc - 2 complementary contacts ie.i.e. NO/NC pair)	√	√
Generating facility synchronising	√ see note 2	√
Alarms		
Generating unit circuit breaker(s) tripped by protection;	√	√
Main switch tripped by protection;	√	√
Generator electrical or mechanical protection operated	√	√
Communications Link(s) Fail	√	√
Measured Values		
Gross active power output of each generating unit;	√ see note 2	√
Gross reactive power output of each generating unit;	√ see note 2	√
Net facility active power import or export at each connection point;	√ see note 2	√
Net facility reactive power import or export at each connection point;	√ see note 2	√
Voltage on Western Power Side of Main Switch voltage;	√	√
Net facility output of active energy (impulse); (not required if metered)	√ see note 2	√
Wind speed data including relationship of wind to generator output	W	
Number of individual generator units available for service	√	√
Number and rating of reactive power devices available for services	√	√
Control		
Generator circuit breaker (s) or Main Switch Intertrip	√	√
Generator circuit breakers(s) or Main Switch Close Enable Interlock	√	√

Note 1: The requirements listed may be applied to generators with a rating less than 1 MW whereMW where concerns for safety and reliability arise.

Note 2: For intermittent generators with a large number of small generating units the SCADA interface does not need to monitor individual units but must provide data points for the aggregate of all the units

Points with grey background are sent from WPN SCADA to the Generator

Blank cell = not required
√ = required
W = required for wind farms