

SYSTEM RESTART SERVICES

DESCRIPTION OF REQUIREMENTS FOR GENERATION SYSTEMS SEEKING TO PROVIDE SYSTEM RESTART SERVICES

System Management

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INTRODUCTION

System Management acting as the segregated business unit of Western Power, is responsible for operating the South West interconnected system (SWIS) in a secure and reliable manner pursuant to the Wholesale Electricity Market (WEM) Rules established under Part 9 of the *Electricity Industry Act 2004*. System Management's responsibilities include determining the requirements for and procurement of System Restart Ancillary Services (System Restart Services) pursuant to clause 3.11 of the WEM Rules.

System Restart Services as defined by the WEM Rules, is the ability of a generation system (Black Start Generator or generation system involving a Trip to House Load scheme) to start without requiring energy to be supplied from a Network to assist in the re-energisation of the SWIS in the event of system shutdown. The generation system must be a Registered Facility with the Independent Market Operator pursuant to the requirements of the WEM Rules.

The purpose of this document is to specify the requirements for generation systems seeking to provide System Restart Services.

SM considers open cycle gas turbines, both industrial (Frame) and aero derivative types, to be the most suitable generating units for providing black start capability to the SWIS.

The use of Trip To House Load (TTHL) schemes are also feasible. As each is custom designed a detailed description of how the scheme will operate and be tested should be submitted.

DEFINITIONS

A System Restart Service is the service provided by a Black Start Generator when used to assist with re-energisation of the SWIS in the event of a system shutdown.

A System Restart Service Facility:

- is a generating unit that has the ability to start and close its output circuit breaker onto a dead bus without energy being supplied to it from other generating units within 30 minutes, unless on an approved outage, and supply an islanded power system controlling both its frequency and voltage. Note a black start unit may comprise of one or more generators located at the same site.
- is a generating facility that will automatically island from the rest of the SWIS during a system shutdown and has the ability to close its output circuit breaker onto a dead bus without energy being supplied to it from

other generating units within 30 minutes, unless on an approved outage, and supply an islanded power system controlling both its frequency and voltage.

REQUIREMENTS

Black Start Units (BSU) must meet the following requirements.

- Each BSU should have a nominal power output of not less than 50 MW at the same location to enable starting and loading of the nearest large gas turbine, typically a 100-160MW gas turbine with a minimum loading of 25 MW. The black start machine will face a sudden reduction in load and must remain in stable operation upon synchronisation of the next large fast start machine.

The next large fast start machines are dependent on the subnetwork –

South Metro – next machine is Kwinana HEGT, minimum is 25 MW

North Metro – next machine is Pinjar Frame 9, minimum is 25 MW

South Country – next machine is Alinta Wagerup GT, minimum is 20 MW

- Sufficient on site or uninterruptible fuel reserve should be available to run each Black Start Unit for a minimum of 12 hours during a system black out at the nominal power output.
- The ability to provide at least three sequential black starts, to allow for possible tripping of the Transmission/Distribution System(s) during the re-instatement period and possible tripping of the Black Start Generator during the black start starting sequence itself.
- A mitigation plan is required for common mode failure in critical starting equipment that renders black start units inoperable. For example, install an emergency hook up for a mobile generator to replace a failed diesel starting generator.
- Permission from the environmental authority to waiver air pollution restrictions for extended operation of a Black Start Unit at reduced load levels during a black start event or test.
- Stable operation at low loads at 0 MW.
- Stable operation upon
 - block loading a network feeder of 10MW and
 - the start up of a power station auxiliary motor and its associated mechanical load of 5MW.
- Each Black Start Unit must be able to operate in isochronous governor mode to automatically regulate frequency.
- When not operating in isochronous mode each Black Start Unit must operate during re-energisation of the SWIS in droop governor mode with governor response enabled, at a minimum response value of 4% droop.
- The control systems of each Black Start Unit must be capable of setting generator output at fixed MW values, and of setting generator terminal voltage to regulate at fixed voltage values.

- Each Black Start Unit must be capable of operating in a voltage range between 95% and 105% of its rated terminal voltage.
- Generators connected at 330kV must be capable of energising a 330kV line section and 330/132kV 490MVA transformer to enable load connection. This should be achieved by allowing generator excitation to commence whilst its generator circuit breaker is closed. In South Country these transformers are located at Kemerton and Muja.
- Each Black Start Unit must be capable of absorbing reactive power from the SWIS while operating within the stable under excitation area of its generator capability curve (leading VARs). Due to the reactive power restrictions in the Eastern Goldfields those generator located at Kalgoorlie are not suitable for System Restart. Similar restrictions may apply for parts of the network in the country at the end of long radial lines such as Geraldton, Albany and Merredin. The ability to restart the system can only be determined through steady state and transient analysis engineering studies.
- Of each Black Start Unit that is not manned 24/7, SM may require remote control from its System Operations Control Centre (SOCC) in a system shutdown event for the purpose of system re-energisation.
- Each black start facility must maintain an SM approved emergency communication system with SOCC.
- Each black start facility must maintain an SM approved emergency communications plan for mobilisation of its operating personnel to meet a 30 minute time response.
- The facility must submit a testing plan to demonstrate the ability to start and energise part of the network and would require testing every 6 months.
- Has the ability to perform this function at least 90% of the time accounting for planned and unplanned outages.

Trip to House Load Units (TTHLU) must meet the following requirements

- Permission from the environmental authority to waiver air pollution restrictions for extended operation of a TTHLU at reduced load levels during a black start event or test.
- Stable operation at low loads at 0 MW export.
- Stable operation upon
 - block loading a network feeder of 10MW and
 - the start up of a power station auxiliary motor and its associated mechanical load of 5MW.
- Each TTHLU must be able to operate in isochronous governor mode to automatically regulate frequency.
- When not operating in isochronous mode each TTHLU must operate during re-energisation of the SWIS in droop governor mode with governor response enabled, at a minimum response value of 4% droop.

- The control systems of each TTHLU must be capable of setting generator output at fixed MW values, and of setting generator terminal voltage to regulate at fixed voltage values.
- Each TTHLU must be capable of operating in a voltage range between 95% and 105% of its rated terminal voltage.
- TTHLU connected at 330kV must be capable of energising a 330kV line section and 330/132kV 490MVA transformer to enable load connection. This should be achieved by allowing generator excitation to commence whilst its generator circuit breaker is closed. In South Country these transformers are located at Kemerton and Muja.
- Each TTHLU must be capable of absorbing reactive power from the SWIS while operating within the stable under excitation area of its generator capability curve (leading VARs). Due to the reactive power restrictions in the Eastern Goldfields those generator located at Kalgoorlie are not suitable for System Restart. Similar restrictions may apply for parts of the network in the country at the end of long radial lines such as Geraldton, Albany and Merredin. The ability to restart the system can only be determined through steady state and transient analysis engineering studies.
- Of each TTHLU that is not manned 24/7, SM may require remote control from its System Operations Control Centre (SOCC) in a system shutdown event for the purpose of system re-energisation.
- Each TTHLU must maintain an SM approved emergency communication system with SOCC.
- Each TTHLU must maintain an SM approved emergency communications plan for mobilisation of its operating personnel to meet a 30 minute time response.
- The TTHLU must submit a testing plan to demonstrate the ability to start and energise part of the network and would require testing every 6 months.
- Has the ability to perform this function at least 90% of the time accounting for planned and unplanned outages.

RELATED INFORMATION

- System Restart Standard: Sets benchmarks to assist System Management in the procurement of System Restart Services to meet the requirements of the WEM rules.
(See http://www.westernpower.com.au/documents/system-management-standard-system_restart_services.pdf).
- Further related information can be found on the System Management System Restart Services page on the Western Power website (See <http://www.westernpower.com.au/electricity-retailers-generators-system-restart-services-srs-.html>)

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