

---

SYSTEM RESTART SERVICES:  
GUIDELINES FOR PREPARING  
LOCAL BLACK START PROCEDURES

---

February 2015



## **DISCLAIMER**

This document is made available to Recipients on the following basis:

- (a) This document is based on a similar document produced by NEMMCO.
- (b) Recipients are not permitted to commercialise it or any information contained in it.
- (c) This document may be subsequently amended. Any reliance on this document is at the Recipients risk.
- (d) Neither System Management, nor any of its officers, advisers, consultants or other contributors to this document (or their respective associated companies, businesses, partners, directors, officers or employees), make any representation or warranty, express or implied, as to the currency, accuracy, reliability or completeness of this document, or the information contained in it.
- (e) To the maximum extent permitted by law, neither System Management, nor any of its advisers, consultants or other contributors to this document (or their respective associated companies, businesses, partners, directors, officers or employees) shall have any liability (whether arising from negligence or otherwise) in respect of a Recipients use of the information (including any reliance on its currency, accuracy, reliability or completeness) contained in this document.

# TABLE OF CONTENTS

<b>1.</b>	<b>BACKGROUND .....</b>	<b>4</b>
<b>2.</b>	<b>LOCAL BLACK START PROCEDURES .....</b>	<b>4</b>
<b>3.</b>	<b>LBSP APPROVAL PROCESS .....</b>	<b>5</b>
<b>4.</b>	<b>GLOSSARY AND RULES OF INTERPRETATION .....</b>	<b>5</b>
	<b>APPENDIX 1 - INFORMATION TO BE INCLUDED IN A GENERATOR LBSP .....</b>	<b>8</b>
	SECTION 1: GENERAL INFORMATION ON THE POWER STATION .....	9
	SECTION 2: ASSESSMENT OF THE SITUATION AND SAFE SHUT DOWN OF GENERATING UNITS	10
	SECTION 3: RESTARTING THE GENERATING UNITS .....	11
	SECTION 4: USE OF TTHL CAPABLE GENERATING UNITS.....	13
	SECTION 5: RESTARTING WIND GENERATORS .....	14
	SECTION 6: TECHNICAL DETAILS ASSOCIATED WITH THE POWER STATION .....	15
	SECTION 7: TECHNICAL DETAILS ASSOCIATED WITH TTHL CAPABLE GENERATING UNITS....	16
	SECTION 8 : COMMUNICATION FACILITIES .....	17

## 1. BACKGROUND

Section 3.7 of the WEM Rules requires:

- (i) System Management to make operational plans and preparations to restart the *SWIS* in the event of a system shutdown;
- (ii) System Management to publish guidelines for the preparation of local black start procedures (LBSP);
- (iii) a LBSP to be developed for *each Scheduled Generator* and each *Non-Scheduled Generator*, and
- (iv) the LBSPs to provide sufficient information to enable System Management to understand the likely conditions and the capabilities of plant following any major supply disruption such that System Management is able to make plans and preparations to respond to a system restart event.

The WEM Rules also provide for System Management to request a *Market Generator* to submit the LBSP that have been developed for *Scheduled Generators and Non-scheduled Generators*.

This document aims to provide sufficient guidelines for *Market Generators* to prepare a LBSP for their facilities registered as *Scheduled Generators and Non-scheduled Generators*.

## 2. LOCAL BLACK START PROCEDURES

The information required in the LBSP is stated at high level in this section. A generic list of information to be provided is covered in the **Appendix 1**, in the form of a template. *Market Generators* are expected to use this template to develop the LBSP for their *Scheduled Generators and Non-scheduled Generators*.

The LBSP prepared by *Market Generators* for their *Scheduled Generators and Non-scheduled Generators* will be the main source of the information required for System Management to understand the likely condition and the capabilities of generation plant, following major supply disruptions resulting in disconnecting power station/s from the rest of the power system or the loss of supply to a significant portion of the transmission network and distribution network.

The provision of accurate information in the LBSP is extremely important for System Management. When developing robust system restart operational plans, it is necessary to be fully informed of the technical requirements and limitations of power station plant. In providing the required information, the basic assumption may be made that the power station plant is not damaged due to the events resulted in the major supply disruption.

System Management recognises that some of the information provided would be in the order of “best estimates” giving consideration to the known limitations of generation and network plant. Inclusion of a suitable disclaimer on the information provided is acceptable to System Management.

System Management will treat the information provided as confidential.

It is important to note that the LBSP **will not be** the detailed internal procedures of the power station, detailing switching sequences used by the power station staff in restarting the generating units.

A LBSP is required for all *Scheduled Generators* and *Non-scheduled Generators* at all power stations of a *Market Generator* with rated capacity of 10 MW or more that are or can be connected to the SWIS. System Management may request a *Market Generator* to submit the LBSP.

The information that is required to be included in a LBSP for a *Scheduled Generator* or *Non-scheduled Generator* includes the following areas:

- general information on the power station;
- assessment of the emergency situation and safe shut down of generating units;
- restart of generators and high-level strategies followed by power stations in the event of a major supply disruption;
- technical and operational information needed to be considered in developing system restart plans; and
- specific information to be provided by embedded generation and wind generation.

If some of the required information for the *Scheduled Generators* and *Non-scheduled Generators* is not readily available, the *Market Generator* should, in the space provided to include the required information, state when that information is likely to be available.

System Management may request a *Market Generator* to provide information, in addition to that specified in the **Appendix 1**, for a *Scheduled Generator* or *Non-scheduled Generator*.

*Market Generators* must, on the request of System Management or whenever significant changes to generation plant are implemented, review and amend the information for *Scheduled Generators* and *Non-scheduled Generators* as appropriate.

### 3. LBSP APPROVAL PROCESS

System Management is required to develop its system restart operational plans consistent with the System Restart Standard. Restoration of the power stations and transmission and distribution networks within certain timeframes is required to meet the System Restart Standard.

System Management will assess whether the strategies and information provided in the LBSP are sufficient for the power system to be restarted to meet the System Restart Standard. If the strategies provided are not adequate, System Management may request changes and/or additional information as required.

### 4. GLOSSARY AND RULES OF INTERPRETATION

- a) a word or phrase *in this style* has the same meaning as given to that term in the WEM Rules;
- b) a reference to a "MR" followed by a number refers to a provision of the WEM Rules;
- c) a word or phrase in this document has the meaning given to set opposite that word or phrase in the table below;
- d) all references to System Restart Standard refer to the System Restart Standard published by System Management; and
- e) the singular includes the plural and vice versa.

Word or Phrase	Meaning
black system	The absence of voltage on all or a significant part of the transmission network or within a region following a major supply disruption, affecting one or more power stations and a significant number of customers – formal declaration of a black system condition requires loss of 60% of forecast supply
distribution network	A network that is not a transmission network
generating unit	The actual generator of electricity and all related equipment essential to it functioning as a single entity
generation	The production of electrical power by converting another form of energy in a generating unit
load	A connection point (or points) in an electrical network at which electrical power is delivered from a distribution network or transmission network to a <i>Rule Participant</i>
local black start procedures	The procedures, used by staff of <i>Scheduled Generators</i> and <i>Non-scheduled Generators</i> to assist in the restarting of generating units and the restoration the SWIS network to normal operation, that contain the information required by System Management
LBSP	local black start procedures
major supply disruption	The unplanned absence of voltage on a part of the SWIS affecting one or more power stations
network	The apparatus, equipment, plant and buildings used to convey, and control the conveyance of, electricity to customers (whether whole sale or retail) excluding any asset used to provide a connection that is part of a transmission system or distribution system, which is registered as a Network according to the WEM Rules.
power system	The electrical power system of the SWIS grid including associated generating units and transmission networks and distribution networks for the supply of electricity, operated as an integrated arrangement
System Management	System Management, established as a ringfenced entity of Western Power pursuant to MR 2.2
System Restart Standard	The document of that name published by System Management and any alterations or revisions to that document
system restart operational plan	A plan developed by System Management specifying the strategies and procedures to be used in recovering from black system conditions
system shutdown	Widespread failure of supply that may (or may not) qualify as a black system condition

Word or Phrase	Meaning
trip to house load (TTHL)	Large generating units that can disconnect from the network through a major system disruption and continue to supply their own auxiliaries or an isolated segment of system load.
transmission network	Any network operating at nominal voltages of 132 kV and above plus any part of a network operating at nominal voltage between 66 kV and 132 kV that operates in parallel to and provides support to the higher voltage networks
WEM Rules	Wholesale Electricity Market Rules

## **APPENDIX 1 - INFORMATION TO BE INCLUDED IN A GENERATOR LBSP**

Note:

- a. Information is to be provided by all *Market Participants* registered with the IMO as a *Market Generator* for each of their *Scheduled Generator* and/or *Non-scheduled Generator* generators with rated capacity of 10 MW or more that are or can be connected to the SWIS.
- b. Information to be provided for wind generation is covered by sections 1 and 6 of the Appendix 1.



**Section 1: General information on the power station**

Item	Information required	Include the information in this column (If the required information is not readily available, include the likely date that this information will be provided)
1A	Registered name of the Generator:	
1B	Name of the power station:	
1D	Address of the power station:	
1E	Primary and back up contact for matters relating to local black start procedures:	
1F	Substation where the generator/s connect to the power system.	
1G	Generating unit type: (leave the correct type, and strikethrough or delete others)	coal-fired gas-fired CCGT hydro wind other, please indicate :
1H	Number of generating units and MW capacity of each unit	
1J	Number of generating units that can be returned to service without external supply:	
1K	Is the power station staffed under normal operation conditions?	
1L	Number of generating units capable of tripping to house load (TTHL):	

## Section 2: Assessment of the situation and safe shut down of generating units

Item	Information required	Include the information in this column (If the required information is not readily available, include the likely date that this information will be provided)
2A	Do staff need to be called out to manage the situation at the power station? If yes, how long will it take to get on-call / standby/ other staff to the power station site?	
2B	Is external supply required to safely shut down the generating units?	
2C	Are emergency diesels/ gas turbines installed at the power station sufficient to safely shut down the generating units?	
2D	How long will it take to safely shutdown, secure and make ready to restart the generating units?	
2E	Can the generating units that are in a shut down sequence, be restored to service as soon as external supply becomes available or does the shut down sequence need to be completed first?	
2F	Indicate how the time without external supply following a supply disruption affects the time to restart generating units. The required information may be provided in the following format. If external supply is made available within X hours, the generator can start in Y hours. If the external supply is not made available within P hours, it will take Q days to start the generator.	
2G	How much time will be required for any off line units (at the time of black system event) to be available to participate in system restart process?	
2K	How long can a generating unit be without external supply and still maintain the capability to restart when external supply is made available?	

### Section 3: Restarting the generating units

Item	Information required	Include the information in this column (If the required information is not readily available, include the likely date this information will be provided)
3A	Are there any unique/complex switching requirements to receive station auxiliary supply from the power system?	
3B	From where does the power station receive its external start up supply?	
3C	Can generating units be connected to a de-energised bus? Can generating units operate supplying an isolated load and then synchronise to the rest of the system?	
3D	Provide a summary of the restart plan of the power station. Include: - power station specific information (at high level), that System Management should be aware of, in developing system restart plans - the order of unit restarts and estimates of time required to prepare units to synchronise	
3E	What is the fuel supply arrangement (coal, gas etc.) to start up and continue to run generating units?	
3F	What is the arrangement for supplying of other station essential services such as demineralised water?	
3G	What nominal capacity steps are available as each unit is progressively brought back on- line? What ramp rates for loading and unloading are available? Provide a generating unit MW loading capability curve, showing the size of load block as a function i.e. load block = f(unit active energy output). Is there a requirement for the load block to be a discrete value or is there a tolerance range? What are the main factors that dictate these increments?	
3H	If the MVAr capability of generating units during restart is different to the capability under normal operation, provide the restart MVAr capability as a function of MW output. i.e. unit MVAr capability = f(unit active energy output). Include transformer energisation current capability. Indicate whether generator excitation can be controlled to minimise transformer magnetising current.	

3J	Provide the estimated electrical power requirements during various stages of the unit restart? (provide a breakdown for individual units, an aggregate, and house load) Stage 1 – before startup Stage 2 - during startup	
3K	What is the minimum load requirement for stable operation of each generating unit? Both Normal and Emergency (SWIS Shutdown) conditions	
3L	What are the upper and lower values of the normal operating frequency band for each unit over which full rated output is available? What are the extreme frequency bands for each unit where partial output is available?	
3M	Are there any special procedures to be followed in energising the transformers, any interlocks that must be by-passed etc.?	

**Section 4: Use of TTHL capable generating units**

Item	Information required	Include the information in this column (If the required information is not readily available, include the likely date this information can be provided)
4A	The duration of time the generator is capable of stable operation on house load?	
4B	If there is a time limit for stable operation following trip to house load, what factors determine this time limit?	
4C	What stabilising load blocks are required? (include details of time-frames)	
4D	Are there any other requirements for stable operation supplying house load, until the required load blocks are provided?	

**Section 5: Restarting wind generators**

Item	Information required	Include the information in this column (If the required information is not readily available, include the likely date this information will be provided)
5A	How are the wind generating units started and connected to the power system under normal operating conditions?	
5B	Do you have any operational arrangements [as detailed in the Access Agreement or in any other agreement] regarding the starting and operation of wind generation in a black system condition or major supply disruption? If yes, please include relevant details	

**Section 6: Technical details associated with the power station**

Item	Information required	Include the information in this column (If the required information is not readily available, include the likely date this information will be provided)
6A	Do generating units have under-frequency trip setting/s? If so, provide the settings	
6B	Do generating units have over-frequency (and/or over-speed) trip settings? If so, provide the settings	

**Section 7: Technical details associated with TTHL capable generating units**

Item	Information required	Include the information in this column (If the required information is not readily available, include the likely date this information will be provided)
7A	What is the triggering mechanism of the TTHL capable generating units? (Include details of the levels, durations, and rates of change of frequency and voltage, and power swings)	
7B	Are the TTHL units fully or partially automated? Is any form of manual intervention required?	
7C	Are there any likely conditions that trip generating units prior to tripping to house load?	
7D	If there are multiple generating units with TTHL capability, how many generating units are normally enabled for TTHL? What strategy is used in selecting the number of generating units for TTHL?	



**Section 8 : Communication facilities**

Item	Information required	Include the information in this column (If the required information is not readily available, include the likely date this information will be provided)
8A	What communication facilities do you have to communicate with your on-call, standby and other staff?	
8B	What communication facilities do you have to communicate with System Management?	