Information to be included in Generator LBSPs

Instructions for completion

Generators must complete relevant Parts of this template depending on all applicable technology and connection categories detailed in Table 1.

All fields in the applicable sections must be filled out.

Table 1

Section	Embedded Generators	Thermal/Gas Generators	Hydro	TTHL - capable Generators	Wind Generators	Solar Generators	Battery energy storage system	Hybrid Generators	Pumped Hydro
Part A	✓	✓	✓	✓	✓	✓	✓	✓	✓
Part B	✓	✓	✓	✓	✓	✓	✓✓	✓✓	✓✓
Part C			(✓)		✓	✓	✓	✓	(✓)
Part D				✓					
Part E									✓
Part F	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Optional

✓ = *Required*

(✓) = *If applicable*

✓✓ = *Sections may need to be filled out multiple times for different modes of operation.*

(blank) = *unlikely to be required, but must be included if utilised within the plant*

Part A

Section 0: LBSP version Information

The following information is to be provided using the table below or equivalent company sheet.

Generation facility	
Version:	
Release Date:	
Approver:	

Section 1: General information on the generation facility

Item	**Information required**	**Include information in this column**
1A	Name of Registered Participant:	
1B	Is the Generator a party to an energy support agreement (refer to the Rules definition)?	(Yes / No) (If yes, include all relevant information associated with the generation facility in section 9)
1C	Name of the generation facility:	
1D	Address of the generation facility:	
1E	Primary and back up contact for matters relating to local black system procedures[1]	<table><tr><td></td><td>Primary Contact</td><td>Secondary Contact</td></tr><tr><td>Name</td><td></td><td></td></tr><tr><td>Position</td><td></td><td></td></tr><tr><td>Phone</td><td></td><td></td></tr><tr><td>Email</td><td></td><td></td></tr></table>
1F	Provide the TNSP or DNSP substation where the generator/s connect to the power system.	
1G	Generating unit type:	Choose an item. coal-fired gas-fired CCGT hydro wind solar battery storage system If other or hybrid, please indicate :
1H	Number and grouping of generating units and MW capacity of each unit:	Number of units: Individual unit capacity: Combined station capacity:

[1] This field is seeking contact details for personnel that provide and update LBSP information. Any updates to contact details for operational staff e.g. control room personnel or traders, are to be provided to the following email: supporthub@aemo.com.au.

Item	Information required	Include information in this column
1J	Number of generating units that can be returned to service without external supply:	
1K	What are staffing arrangements for the generation facility: staffed 24 hours / staffed during normally working hours / not normally staffed How is station operated: operated by staff on site / operated by staff attending site / operated remotely.	

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

For generation facilities with multiple modes of operation please include information for all relevant modes, for example pumping or synchronous condenser modes for pumped hydro storage systems, and charging mode for battery energy storage systems.

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	Who would the generation facility staff contact to get an assessment of the situation and the estimated time to receive external power? How would the generation facility staff contact this person/organisation?	
2B	What organisation is responsible for restoring the power system in the vicinity of the generation facility? How would the generation facility staff contact this organisation?	
2C	Following a loss of grid power, do staff need to be called out to shut down or restart units if there are no faults? If faults occur on equipment, do staff need to be called out to manage the situation at the generation facility? If yes, how long will it take to get on-call / standby/ other staff to the generation facility site?	
2D	Is external supply required to safely shut down the generation facility?	
2E	Is there an emergency supply (e.g. diesel, gas turbine, UPS and batteries) installed at the generation facility and how long it can operate independently?	

<table>
<tr><th>Item</th><th>Information required</th><th>Include the information in this column (if the required information is not readily available, include the likely date that this information will be provided)</th></tr>
<tr><td></td><td>If yes, is it sufficient to safely shut down the generating units?

Furthermore, is the backup system capable of barring the units (if required) and maintaining hydraulic pressure for the bearings (if required)?</td><td></td></tr>
<tr><td>2F</td><td>How long will it take to safely shutdown, secure and make ready to restart the generating units (e.g. dynamic breaking etc.)?</td><td></td></tr>
<tr><td>2G</td><td>Can the generating units that are in a shutdown sequence be restored to service as soon as external supply becomes available? Or, does the shutdown sequence need to be completed first (e.g. sequence needs to be complete, countdown /timer, temperature, speed, auxiliary etc.? Please provide this information as necessary for the following conditions:
• Cold/offline prior to black system
• Warm (recently shutdown) prior to black system
• Hot/online prior to black system
• Storage mode, where applicable (such as nitrogen mode)
• Charging/pumping/synchronous condenser modes (if applicable)</td><td></td></tr>
<tr><td>2H</td><td>Indicate how the time without external supply following a supply disruption affects the time to restart generating units, under the following scenarios (identify and additional scenarios if applicable):
• Unit offline and cold/standstill prior to event
• Unit offline and warm (recently shutdown) prior to event
• Unit warm (was operating prior to event).
• Unit in storage mode, where applicable (e.g. nitrogen stored)
• Unit charging/pumping
The required information may be provided in the example table format.</td><td>(example:)
<table>
<tr><td>Time without External Supply:</td><td>15 mins</td><td>1 hour</td><td>2 hours</td><td>4 hours</td></tr>
<tr><td>Scenario</td><td colspan="4">Time to restart units</td></tr>
<tr><td>Unit offline and cold/standstill prior to event</td><td>30 mins to start 1 unit
45 mins to start all units</td><td>30 mins to start 1 unit
45 mins to start all units</td><td>(same as 1 hour offline)</td><td>(same as 1 hour offline)</td></tr>
<tr><td>Unit offline and warm/ recently shutdown</td><td>10 mins to start 1 units</td><td>30 mins to start 1 units</td><td>(same as 1 hour offline)</td><td>(same as 1 hour offline)</td></tr>
</table></td></tr>
</table>

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)				
	Please add additional columns and information if appropriate (e.g. relevant casing temperature limits).	prior to event	20 mins to start all units	45 mins to start all units		
		Unit warm/was operating prior to event.	10 mins to start 1 units 20 mins to start all units	30 mins to start 1 units 45 mins to start all units	(same as 1 hour offline)	(same as 1 hour offline)
		Unit in storage mode (as applicable)				
2I	How long can a generating unit(s) and generating system be without external supply?					

Section 3: Restarting the generating units

For generation facilities with multiple modes of operation please include information for all relevant modes. For example pumping or synchronous condenser modes for pumped hydro storage systems and charging mode for battery energy storage systems.

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)
Electrical Supply To The Station		
3A	Are there any unique/complex switching requirements to receive station auxiliary supply from the power system (including key protection that requires manual reset and whether the reset requires involvement from external parties)? If there are unique requirements, please specify the details of these requirements.	
3B	Do you need external supply to start a generating unit or the generating system?	
3C	Where does the generation facility receive its external start up supply from?	

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)
	Provide the bus number, feeder and voltage level.	
3D	Energy source used to return units to service without external supply, if different from above.	(e.g. Diesel generator can provide electrical supply in the absence of external grid supply. Other fuel sources are the same as in question (3E) below.
Other Fuel/Energisation Sources Used By The Station		
3E	What is the fuel supply arrangement, reserve and normal requirements (coal, gas, diesel etc.) to start up and continue to run generating units, or generating system under normal conditions? Identify primary source of fuel supply and any alternative sources of fuel supply, including gas pipelines and coal mines.	(e.g. For starting, LPG from onsite storage used to fire units – sufficient for 8 starts. For continuous operation, coal from nearby mine used for continuous operation – indefinite supply subject to no issues with supply from mine.) (e.g. Units 1&2 are supplied by the Alpha pipeline, Units 3&4 are supplied by the Beta pipeline, Units 5&6 can be supplied by either Alpha or Beta pipelines)
3F	Energy source used to return units to service without external supply.	e.g. gas / diesel generator / stored hydro
3G	Are the units dependent on an external fuel supply (other than electricity) to return to service? If not, identify the alternative fuel supplies	(e.g. Yes, dependent on gas supply to return to service / No, if gas supply is unavailable, fuel oil is available onsite as an alternative fuel supply however the station capacity will be limited to xx MW)
Station Operation and control		
3H	Can generating units or generating system be connected to a de-energised bus (e.g. dead-bus synchronisation)?	
3I	Can the generating units or generating system operate supplying an isolated load or an island (without a frequency or voltage reference and external supply)? If so, what are the control mode(s) (e.g. voltage and frequency) as well as settings (if different from normal operation) of the generation facility that would be utilised under this condition?	

<table>
<tr><th>Item</th><th>Information required</th><th>Include the information in this column (if the required information is not readily available, include the likely date this information will be provided)</th></tr>
<tr><td></td><td>Please provide settings of control mode(s) if different from normal operation.

Following restoration of other islands, does the generation facility have facilities to synchronise to the rest of the system?

If so, please provide details of the synchronising facilities and its settings (e.g. normal and dead-bus operation, sync point and breaker, voltage levels, paralleling conditions like max. allowable voltage difference, slip and angle limits etc.).</td><td></td></tr>
<tr><td>3J</td><td>Provide a detailed step-by-step procedure of the restart plan of the generation facility.

Include:
• Specific information about the generation facility that AEMO should be aware of, in developing system restart plans
• Switching sequence (can be attached to the LBSP)
• The order of unit restarts and estimates of time required to prepare units to synchronise
• Procedures for the following conditions where applicable
– Cold/offline prior to black system
– Warm (recently shutdown) prior to black system
– Hot/online prior to black system
– Storage mode (such as nitrogen mode)
– Charging/pumping
– When operating in synchronous condenser mode</td><td>Examples:

Restart steps if generating units online prior to the black system

<table>
<tr><th>Event</th><th>Time (mins)</th><th>Time (running total)</th><th>Potential Output (MW)</th><th>Input required (MW)</th><th>Reason/ Notes</th></tr>
<tr><td colspan="6">Black system (Time=0)</td></tr>
<tr><td>Safe shutdown</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Restart units (from hot/warm/ online state prior to black system)</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Initial output available</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Initial ramp</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Nominal ramp</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Continuous operation</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Restart steps if generating offline units prior to the black system</td></tr>
</table>

<table>
<tr><th>Item</th><th>Information required</th><th>Include the information in this column (if the required information is not readily available, include the likely date this information will be provided)</th></tr>
<tr><td></td><td>The required information may be provided in the example table format (Please add additional columns and rows as appropriate)</td><td>
<table>
<tr><th>Event</th><th>Time (mins)</th><th>Time (running total)</th><th>Potential Output (MW)</th><th>Input required (MW)</th><th>Reason/ Notes</th></tr>
<tr><td colspan="6">Black system (Time=0)</td></tr>
<tr><td>Safe shutdown</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Restart units from standstill/ offline/cold state prior to black system</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Initial output available</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Initial ramp</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Nominal ramp</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Continuous ramp</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>3K</td><td>What is the arrangement for supplying of other station essential services? For example demineralised water, instrument air etc?</td><td></td></tr>
<tr><td>3L</td><td>What nominal capacity steps are available as each unit is progressively brought back on-line?

What ramp rates for loading and unloading are available (e.g. for cold/warm/hot start/storage mode)

Provide load curve and time durations (for the above conditions pre black system).

Provide a generating unit MW loading capability curve, showing the size of load block as a function of the unit MW output., i.e. load block = f(unit active energy output), or a description</td><td></td></tr>
</table>

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)
	of the capability curve (both is preferred) 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?	
3M	Please advise of any operational loading requirements (such as no go zones between certain MW loading levels, including rough running bands)	
3N	Please advise if the Mvar capability of the generating units differ from normal operation during the various stages of restart (i.e. as a black start unit, initial restart, under islanding conditions) If yes, provide the individual unit and plant specific reactive power capability charts associated with the various stages of restart. Please include a voltage range from e.g. 0.9-1.1pu = f(unit active power output).	
3O	Provide the estimated electrical power requirements during various stages of the unit restart, including a breakdown for individual units, an aggregate, and house load where relevant.	
3P	What is the minimum load requirement for stable operation of each generating unit?	
3Q	Please specify the time which the generation facility can operate with minimum loading requirements while system load is being restored, including providing dynamic reactive power support	
3R	What are the upper and lower values of the normal operating frequency band for each unit and auxiliary equipment (e.g. pumps,	

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)
	drives, motors etc.) over which full rated output is available? What are the extreme frequency bands for each unit and auxiliary equipment where partial output is available?	
3S	Please specify the largest size of transformer that can be energised by the generation facility.	
3T	Are there any special procedures to be followed when energising transformers, such as: • any interlocks that must be by-passed etc.? • Soft start capability (include a voltage-time profile)	
3U	For transformer energisation: Please provide the soft-start procedure to manage inrush currents when energising transformers and impacts on the generating units(s) as well as its auxiliary equipment Also, include transformer energisation current capability. Indicate whether generating units/ system can be controlled to minimise transformer magnetising current (e.g. transformer or line charging function, manual control/field current regulator etc.) Provide the harmonic signature when energising the largest transformer the generating unit can energise	
3V	Do you have contingency plan if the generation facility fails during any stage of power system restoration? If so, please provide the contingency plan(s).	

Section 4: Technical details associated with the generation facility

For generation facilities with multiple modes of operation please include information for all relevant modes. For example, pumping or synchronous condenser modes for pumped hydro storage systems and charging mode for battery energy storage systems.

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)
4A	Do the generating units or generating system have under-frequency trip setting/s? If so, provide the settings.	
4B	Do the generating units or generating system have over-frequency (and/or over-speed) trip settings? If so, provide the settings.	
4C	Can the generating units or generating system provide steady state and dynamic voltage control, under emergency and restoration conditions, including when supplying its own auxiliary loads? If so, please specify the voltage control capability under these conditions.	
4D	Can the generating units or generating system provide active power and frequency control capability under emergency and restoration conditions, including when supplying its own auxiliary loads? If so, please specify the active and frequency control capability under these conditions.	
4E	Are there any additional protection settings that would apply during emergency and restoration conditions, including when supplying its own auxiliary loads? If so, please specify the protection settings that would need to apply under these conditions.	
4F	Indicate the fault current that the generation facility can provide during emergency and restoration conditions, including: • How long it can be sustained? • Whether the fault current will vary over time?	

Section 5: Generator participation in energy support or operational arrangements

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	Is the generator a party to an energy support arrangement?	
5B	Include relevant information on the energy support arrangement associated with this generation facility.	
5C	Do you have any operational arrangements [as detailed in the Connection and Access Agreement (CAA) or in any other agreement] with a TNSP/ DNSP regarding the starting and operation of generation in a black system condition or major supply disruption? If yes, please include relevant details.	

Section 6: 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)
6A	What communication facilities and provider do you have to communicate with your on-call, standby and other staff, in particular during a major supply disruption (e.g. landline, mobile and/or satellite phone - separate telephone facilities using independent telecommunications service providers)?	
6B	What communication facilities do you have to communicate with AEMO, TNSP and DNSP?	

Part B

Section 7: Restarting embedded generator 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)
7A	Does the embedded generator have capability to restart and form an island supplying local load or area?	
7B	If an island can be formed, are there facilities for the island to be synchronised to the transmission network at a later stage?	
7D	If you can provide an SRAS (refer to SRAS guidelines), can you operate under the conditions supplying auxiliary loads while absorbing Mvars?	

Part C

Section 8: Asynchronous Generator restart capabilities

For generation facilities with multiple modes of operation please include information for all relevant modes. For example, pumping for asynchronous pumped hydro storage systems and charging mode for battery energy storage systems.

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	kW-Time requirements for auxiliaries (non-SRAS)	
8B	Local auxiliary supply (where the generation facility can provide black start capability)	
8C	SCR withstand capability and the connection point	
8D	Any other known limitations when operating during system restoration e.g. X/R?	
8E	Reactive power capability chart as function SCR and X/R (if applicable)	
8F	Voltage and frequency withstand capability during abnormal conditions	
8G	The time which the generation facility can operate with minimum loading requirements while system load is being restored including providing dynamic reactive power support	
8H	Any switchover required between control modes between system intact, islanding and restoration conditions	
8I	If so whether these parameters are automatically changed, e.g. gain reduction, or needs user intervention?	
8J	Where applicable, please specify details of islanding operation capability	

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)
8K	Local and remote communications capability	
8L	Are there any other procedures or arrangement to restart and connect the asynchronous generating units to the power system?	

Part D

Section 9: 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)
9A	Number of generating units capable of tripping to house load (TTHL):	
9B	Are there any limitations on TTHL?	e.g. units are unlikely to successfully TTHL if any of the following apply • operating below xx MW • (any other conditions)
9C	The duration of time the generator is capable of stable operation on house load?	
9D	If there is a time limit for stable operation following trip to house load, what factors determine this time limit?	
9E	What load blocks are required? (include details of time-frames)	
9F	Are there any other requirements for stable operation supplying house load, until the required load blocks are provided?	

Section 10: 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)
10A	What are the triggering mechanisms of the TTHL capable generating units? (include details of the levels, durations, and rates of change of frequency and voltage, and power swings)	
10B	Are the TTHL units fully or partially automated? Is any form of manual intervention required for the generating unit to trip to house load?	
10C	Are there any likely conditions that trip generating units prior to tripping to house load?	

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)
10D	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?	

Part E

Section 11 Use of Pumped Hydro 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)
11A	Number of generating units capable of operating in pump mode. Please indicate if the generation facility is single or dual mode operation (pure pumping station or generating & pumping system).	
11B	If there are multiple generating units with pump mode capability, how many units are normally enabled for pump mode? What strategy is used in selecting the number of generating units for pump mode?	
11C	Are there any limitations or dependencies on pump mode operation? Any other known limitations when operating during system restoration e.g. X/R?	e.g. units are unlikely to successfully operating in pump mode if any of the following apply: • operating below/above xx MW load requirement • water level to be between x and y • short circuit ratio or X/R ratio required for stable operation • number of units operating in parallel or single operation • booster pump • (any other conditions)
11D	Restart in pump mode during system black possible? If not, what is necessary or required to make the unit restart capable (e.g. plant modification, load requirement etc.)?	
11E	The duration or time the generator is capable of stable operation in pump mode? For example, time restrictions, temperature dependencies, cooling, other units to operate in generation mode etc.	
11F	Are there any other requirements for stable operation in pump mode that have an impact on system security or stability?	
11G	Does the generation facility have voltage or frequency control capability in pump mode?	

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)
	• Frequency stabilisation or frequency regulation in pump mode • Primary frequency control, range and setpoints in pump mode • Voltage control mode, range and setpoints in pump mode	
11H	Pleas provide time frames/switch over rates of mode changes for various concepts: • Standstill – Generator mode • Standstill – Pump mode • Condenser – Generator/pump mode • Generator – Pump mode (vice versa)	
11I	Are load ramp rates customizable for the generation facility in pump mode? If not, please indicate the load blocks of the generation facility in pump mode?	
11J	Change in operating range between different modes?	
11K	Is the generation facility capable of voltage or power factor control in pumping mode?	
11L	Can the generation facility follow a specific load target during restart?	
11M	Considering the starting moment required for pumped hydro, is this a limitation during pump mode operation under system black?	
11N	What are the trip and triggering mechanisms of the pump mode capable generating units? (include details of the levels, durations, frequency and voltage range, rates of change of frequency and voltage, and power swings)	
11O	Are the pump mode units fully or partially automated? Is any form of manual intervention required for the generating unit to operate in pump mode?	

Part F

Section 12: Black start capability options

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)
12A	If the generating units or generation facility are not currently black start capable, please summarise the modifications to equipment, controls or any other relevant changes that need be implemented to provide SRAS (refer to SRAS guidelines).	