Register of completed embedded generation projects greater than 200kw

2023

PowerWater

Contents

Version history		**2**
1.	**Introduction**	**3**
2.	**Purpose of register**	**3**
3.	**Details included in the register**	**3**
4.	**Project register**	**4**
5.	**Single line diagram**	**16**

Version history

Version	EDMS reference	Date	Comments
1.0	D2019/538917	31/12/2019	Initial version
2.0	D2022/073570	18/02/2022	2020 Version
3.0	D2022/073572	21/02/2022	2021 Version
4.0	D2022/515243	12/12/2022	2022 Version
5.0	D2023/272762	5/7/2023	2023 Version

1. Introduction

This register of completed embedded generation projects has been developed to provide information on projects that have been successfully connected[1] to Power and Water Corporation's (Power and Water) distribution network.

2. Purpose of register

It is a requirement under Chapters 5 and 5A of the Northern Territory National Electricity Rules (NT NER) that Power and Water publish a register of completed embedded generation projects (i.e. for systems with a generating capacity greater than 200kW).

For projects greater than 2MW, this register:

- includes details of all embedded generation projects completed within the preceding five year period
- is to be updated annually for all completed projects in the 5 year period preceding the review date.

For projects between 200kW and 2MW, this register:

- includes details of all embedded generation projects completed since 1 July 2019
- is to be updated annually for all completed projects in the 5 year period preceding the review date.

3. Details included in the register

The register of completed embedded generation projects includes, but is not limited to:

- technology of generating unit (e.g. synchronous generating unit, induction generator, photovoltaic array, etc.) and it's make and model
- maximum power generation capacity of all embedded generating units comprised in the relevant generating system
- contribution to fault levels
- the size and rating of the relevant transformer
- a single line diagram of the connection arrangement
- protection systems and communication systems
- voltage control and reactive power capability
- details specific to the location of a facility connected to the network that are relevant to any of the details above.

[1] To form a physical link to or through a transmission network (including to a network connection asset or through a dedicated connection asset that is physically linked to that transmission network) or distribution network.

4. Project register

S. No	PWC Ref. No	Year Completed (connected)	Location	Technology of the Generating Unit(s)	Generating units Details (Make and Model)	Maximum Power generation capacity of all embedded Generating Units (kW)	Contribution to Fault Levels (kA)	Size and rating of relevant transformers (voltages & kVA)	Single Line Diagram of the connection arrangement (PDF)	Protecting System and Communication Systems	Voltage Control and Reactive power capability	Details relevant to the specific location of the facility
1	LEG1	2020	Katherine	Solar PV Array and BESS	RSM 144-6-340P/5BB 1500 Solar PV Panel 9 x SMA Sunny Central (SC)3000-EV - Inverter 6 x 1.053MVA GPTech BESS (3MWD3-V450 BESS)	25000+6318	9.4	3 x 22/0.665 kV, 6MVA	SLD -2	● Anti-Islanding, Inter-tripping, synch check, differential protection scheme between KSPS and KZS. ● Local protection and control operation of KSPS. ● SCADA link.	● The default voltage control mode is droop control with reference voltage of 1.0pu and 4.0% droop on 10.8Mvar base. ● The generating system, while not supplying or absorbing reactive power under an ancillary services agreement will draw electricity with a power factor in the range 0.9 lead to 0.9 lag.	Katherine Solar Power Station (KSPS) is a solar generating plant near Katherine Zone Substation in Northern Territory.

S. No	PWC Ref. No	Year Completed (connected)	Location	Technology of the Generating Unit(s)	Generating units Details (Make and Model)	Maximum Power generation capacity of all embedded Generating Units (kW)	Contribution to Fault Levels (kA)	Size and rating of relevant transformers (voltages & kVA)	Single Line Diagram of the connection arrangement (PDF)	Protecting System and Communication Systems	Voltage Control and Reactive power capability	Details relevant to the specific location of the facility
2	EG225	2021	Humpty Doo	Solar PV Array	637 kWp solar array and 490 kVA inverter bank	600	N/A	N/A	SLD -1	Anti-islanding Auto-Synchronising Reconnection Time Overcurrent protection Under voltage Trip Pick Up Over voltage Trip Pick Up Under Frequency Trip Pick Up Over Frequency Trip Pick Up System Ramp Up Rate System Ramp Down Rate The EG User is to provide Power and Water with aggregated generation information in the form specified by Power and Water in order to monitor the operation of the generating system and for the EG User to demonstrate compliance with the ramp rate control requirement.	The EG User must maintain the power factor presented to the network between 0.9 and 1.0 (lagging) at all times.	1105 ANZAC Parade, Middle Point 0836

S. No	PWC Ref. No	Year Completed (connected)	Location	Technology of the Generating Unit(s)	Generating units Details (Make and Model)	Maximum Power generation capacity of all embedded Generating Units (kW)	Contribution to Fault Levels (kA)	Size and rating of relevant transformers (voltages & kVA)	Single Line Diagram of the connection arrangement (PDF)	Protecting System and Communication Systems	Voltage Control and Reactive power capability	Details relevant to the specific location of the facility
3	LEG2	2021	Batchelor	Solar PV Array	Longi 435Wp Mono PERC HC Solar PV Panel 4 x SMA Sunny Central (SC)3000-EV - Inverter	10000	4.864	2 x 22/0.665 kV, 6MVA	SLD -2	● Anti-Islanding, Inter-tripping, synch check, differential protection scheme between BJPS and BAZSS. ● Local protection and control operation of BJPS. ● SCADA link.	● The default voltage control mode is droop control with reference voltage of 1.0pu and 4.0% droop on 4.8Mvar base. ● The generating system, while not supplying or absorbing reactive power under an ancillary services agreement will draw electricity with a power factor in the range 0.9 lead to 0.9 lag.	Batchelor Solar Power Station (BJSPS) is a solar generating plant near Batchelor Zone Substation in the Northern Territory.
4	LEG3	2021	Manton	Solar PV Array	4 x SMA Sunny Central (SC)3000-EV - Inverter	10000	5.968	2 x 22/0.665 kV, 6MVA	SLD -2	● Anti-Islanding, Inter-tripping, synch check, differential protection scheme between MTPS and MTZSS. ● Local protection and control operation of MTPS. ● SCADA link.	● The default voltage control mode is droop control with reference voltage of 1.0pu and 4.0% droop on 4.8Mvar base. ● The generating system, while not supplying or absorbing reactive power under an ancillary services agreement will draw electricity with a power factor in the range 0.9 lead to 0.9 lag.	Manton Solar Power Station (MTSPS) is a solar generating plant near Manton Zone Substation in the Northern Territory.

S. No	PWC Ref. No	Year Completed (connected)	Location	Technology of the Generating Unit(s)	Generating units Details (Make and Model)	Maximum Power generation capacity of all embedded Generating Units (kW)	Contribution to Fault Levels (kA)	Size and rating of relevant transformers (voltages & kVA)	Single Line Diagram of the connection arrangement (PDF)	Protecting System and Communication Systems	Voltage Control and Reactive power capability	Details relevant to the specific location of the facility
5	LEG4	2021	Batchelor	Solar PV Array	JINKO 465W Solar PV Panel 4 x SMA Sunny Central (SC)3000-EV - Inverter	10000	4.872	2 x 22/0.665 kV, 6MVA	SLD -2	● Anti-Islanding, Inter-tripping, synch check, differential protection scheme between BSF and BAZSS. ● Local protection and control operation of BSF. ● SCADA link.	● The default voltage control mode is droop control with reference voltage of 1.0pu and 4.0% droop on 4.8Mvar base. ● The generating system, while not supplying or absorbing reactive power under an ancillary services agreement will draw electricity with a power factor in the range 0.9 lead to 0.9 lag.	Batchelor Solar Power Station (BPS Co) is a solar generating plant near Batchelor Zone Substation in the Northern Territory.

S. No	PWC Ref. No	Year Completed (connected)	Location	Technology of the Generating Unit(s)	Generating units Details (Make and Model)	Maximum Power generation capacity of all embedded Generating Units (kW)	Contribution to Fault Levels (kA)	Size and rating of relevant transformers (voltages & kVA)	Single Line Diagram of the connection arrangement (PDF)	Protecting System and Communication Systems	Voltage Control and Reactive power capability	Details relevant to the specific location of the facility
6	LEG5	2021	Hudson Creek	Thermal generation power station	Caterpillar - 5 x G3520H Generating Units (GU).	12000	29.97	2 x 66/11kV, 15/20 MVA	SLD -2	● Control and monitoring of the generator connection circuit breaker and isolators. ● Tripping the generator connection due to overcurrent, line differential, under voltage and ground fault protections. ● Check synchronisation. ● Inter-trips. ●additional overvoltage and frequency protection function in relays. ●SCADA links.	PWC will send a DNP3 pulse specific to each mode. These pulses will be translated at the power station into an integer register for processing by the PLC, as follows 0: Voltage control mode. 1: Reactive power control mode. 2: pf control mode Reactive Power: -4.75 MVAr to 4.75 MVAr -0.93 pu (absorbing) to 1.0 pu to 0.93 pu (exporting).	Hudson Creek Power Station (HCPS)) is a gas generator plant near Hudson Creek Terminal Station in the Northern Territory.

S. No	PWC Ref. No	Year Completed (connected)	Location	Technology of the Generating Unit(s)	Generating units Details (Make and Model)	Maximum Power generation capacity of all embedded Generating Units (kW)	Contribution to Fault Levels (kA)	Size and rating of relevant transformers (voltages & kVA)	Single Line Diagram of the connection arrangement (PDF)	Protecting System and Communication Systems	Voltage Control and Reactive power capability	Details relevant to the specific location of the facility
7	LEG6	2021	Robertson Barracks, Darwin	Solar PV Array and BESS	Solar System A 2 x 2.75MVA SMA Sunny Central 2750-EV System B 1 x 2.75MVA SMA Sunny Central 2750-EV System C 1 x 2.75MVA SMA Sunny Central 2750-EV BESS Pack: • System A: 16X57.14Kwh BOL Samsung 198S P3 Racks. • System B: 10X57.14Kwh BOL Samsung 198S P3 Racks. • System C: 12X57.14Kwh BOL Samsung 198S P3 Racks. Battery Inverter • System A- 15x87.67kVAABB PCS100 D-Type • System B - 8 x87.625kVA ABB PCS100 D-Type • System C - 8 x87.625kVA ABB PCS100 O-Type.	10000	System A - 0.42 kA System B - 0.22 kA System C - 0.22 kA	System A 1 x BESS, 1.5 MVA, 11/0.375kV, YNd1 coupling tx 2 x PV inverter 2.75MVA, 11/0.385kV, Dy11, ONAN tx System B 1 x BESS, 1.2 MVA, 11/0.375kV, YNd1 coupling tx 1 x PV inverter 2.75MVA, 11/0.6kV, Dy11, ONAN tx System C 1 x BESS, 1.2 MVA, 11/0.375kV, YNd1 coupling tx 1 x PV inverter 2.75MVA, 11/0.6kV, Dy11, ONAN tx	SLD -2	● DNP3 SCADA interface standard.	System A.± 1.975MVAr (Pf. 0.9 lead to 0.9 lag) System B : ± 0.9875 MVAr (Pf. 0.9 lead to 0.9 lag) System C. ± 0.9875 MVAr ((Pf. 0.9 lead to 0.9 lag))	Robertson Barracks- Northern Territory

S. No	PWC Ref. No	Year Completed (connected)	Location	Technology of the Generating Unit(s)	Generating units Details (Make and Model)	Maximum Power generation capacity of all embedded Generating Units (kW)	Contribution to Fault Levels (kA)	Size and rating of relevant transformers (voltages & kVA)	Single Line Diagram of the connection arrangement (PDF)	Protecting System and Communication Systems	Voltage Control and Reactive power capability	Details relevant to the specific location of the facility
8	LEG7	2021	RAAF Darwin	Solar PV Array and BESS	Solar • 2 x 2200kVA SMA Sunny Central MPS BESS Pack • 12 x56.5kWH Samsung 198S P3 Racks Battery Inverter • 10x87.7kVA ABB PCS100 D-Type	3200	1.76kA	1 x BESS, 1.2MVA, 11/0.375kV, YNd11 coupling tx 2 x PV inverter 2MVA, 11/0.385kV, Dy11, ONAN tx	SLD -2	● DNP3 SCADA interface standard.	± 1.264MVAr Pf. 0.9 lead to 0.9 lag	RAAF Darwin-Northern Territory
9	EG650	2023	Leanyer	Solar PV Array	[250kW DC/225kVA AC] • 736 x JAM6(L) 340W • 9 x SE25K-AUS	225	4.65	11/0.4kV, 1MVA	SLD-1	● Inverter-integrated anti-islanding. ● Generator Protection Relay.	● Volt_VAr. ● No reactive power control.	Multiple systems installed by multiple businesses on the Hibiscus Shopping Centre roofs, Leanyer
10	EG699	2022	Palmerston	Solar PV Array	400kW of PV • 905 x JinKO JKM440M-6H14 44OW 350kVA of Inverters • 7 x Fronius Tauro Eco 50-3-D 50kW	350	21.35	11/0.4kV, 750kVA	SLD-1	● Inverter-integrated anti-islanding. ● Generator Protection Relay.	● No voltage management. ● Constant PF 0.98 lagging.	Large generating systems on the Palmerston Shopping Centre roof

S. No	PWC Ref. No	Year Completed (connected)	Location	Technology of the Generating Unit(s)	Generating units Details (Make and Model)	Maximum Power generation capacity of all embedded Generating Units (kW)	Contribution to Fault Levels (kA)	Size and rating of relevant transformers (voltages & kVA)	Single Line Diagram of the connection arrangement (PDF)	Protecting System and Communication Systems	Voltage Control and Reactive power capability	Details relevant to the specific location of the facility
11	EG146	2023	Alice Springs	Solar PV Array and BESS	Research PV Systems • 263kW of various PV modules BESS • mtu EnergyPack QS/6 300kVA/356kWh	263+300	14.54	PV: 22/0.4kV, 315kVA BESS: 22/0.4kV, 500kVA	SLD-2	● Inverter-integrated anti-islanding. ● Generator Protection Relay. ● High-speed data recorder linked to System Control. ● DER Control Device.	PV ● Constant PF 0.98 lagging. BESS ● The default voltage control mode is droop control with varying characteristics as research for BESS C-FCAS support. ● The generating system, while not supplying or absorbing reactive power under an ancillary services agreement will draw electricity with a power factor in the range 0.9 lead to 0.9 lag.	DKA Solar Research Facility plus BESS supplying FCAS behind separate transformers
12	EG179	2020	Alice Springs	Solar PV Array	345kW of PV • 1123 x WINAICO WST310P6 310W 350kVA of Inverters • 7 x Fronius Tauro Eco 50-3-D 50kW	350	19.75	11/0.4kV, 750kVA	SLD-1	● Inverter-integrated anti-islanding. ● Generator Protection Relay.	● Volt_VAr. ● No reactive power control.	Large generating system on roof of the Central Land Council building in Alice Springs. Replacement of old broken system.

S. No	PWC Ref. No	Year Completed (connected)	Location	Technology of the Generating Unit(s)	Generating units Details (Make and Model)	Maximum Power generation capacity of all embedded Generating Units (kW)	Contribution to Fault Levels (kA)	Size and rating of relevant transformers (voltages & kVA)	Single Line Diagram of the connection arrangement (PDF)	Protecting System and Communication Systems	Voltage Control and Reactive power capability	Details relevant to the specific location of the facility
13	EG183	2021	Alice Springs	Solar PV Array	350kW of PV 300kVA of Inverters	300	6.75	2 x 22/0.4kV, 1MVA	SLD-2	● Inverter-integrated anti-islanding. ● Generator Protection Relay.	● Volt_VAr ● Power factor correction unit	Large generating system with backup generator at the Roe Creek borefields
14	EG857	2017	Palmerston	Solar PV Array	478.32kW of PV 450kVA of Inverters	450	NR	11/0.4kV, 1MVA	SLD-1	● Inverter-integrated anti-islanding. ● Generator Protection Relay.	● No voltage management. ● Constant PF 0.98 lagging.	Large generating systems on the Oasis Shopping Centre roof, Palmerston
15	EG911	2019	Alice Springs	Solar PV Array	309.69kW of PV 300kVA of Inverters	300	NR	22/0.4kV, 1MVA	SLD-1	● Inverter-integrated anti-islanding. ● Generator Protection Relay.	● No voltage management. ● Constant PF 0.98 lagging.	Large generating system on shop roof, Alice Springs
16	EG756	2017	Bakewell	Solar PV Array	389.76kW of PV 360kVA of Inverters	360	NR	11/0.4kV, 100kVA	SLD-1	● Inverter-integrated anti-islanding. ● Generator Protection Relay.	● No voltage management. ● Constant PF 0.98 lagging.	Large generating system on shop roof, Bakewell, Palmerston

S. No	PWC Ref. No	Year Completed (connected)	Location	Technology of the Generating Unit(s)	Generating units Details (Make and Model)	Maximum Power generation capacity of all embedded Generating Units (kW)	Contribution to Fault Levels (kA)	Size and rating of relevant transformers (voltages & kVA)	Single Line Diagram of the connection arrangement (PDF)	Protecting System and Communication Systems	Voltage Control and Reactive power capability	Details relevant to the specific location of the facility
17	EG831	2015	Karama	Solar PV Array	297.44kw of PV 303.6kVA of Inverters	300	NR	11/0.4kV, 1MVA	SLD-1	● Inverter-integrated anti-islanding. ● Generator Protection Relay.	● No voltage management. ● Constant PF 0.98 lagging.	Large generating system on shop roof, Karama
18	EG585	2017	Coolalinga	Solar PV Array	297.86kw of PV • 1124 x QCELLS Q.PRO-G3 265 297kVA of Inverters • 11 x ABB TRIO-27 6-TL	300	NR	22/0.4kV, 750kVA	SLD-1	● Inverter-integrated anti-islanding. ● Generator Protection Relay.	● No voltage management. ● Constant PF 0.98 lagging.	Large generating system on shop and carpark roof, Coolalinga
19	EG544	2016	Woolner	Solar PV Array	[System 1] 400kW of PV • 1536 x TRINA SOLAR 260W 400kVA of Inverters • 16 x SMA STP 25000TL [System 2] 236kW of PV • 11 x ABB TRIO-27 6-TL 236kVA of Inverters • 8 x Fronius ECO 27kW • Fronius SYMO 20kW	636	NR	11/0.4kV, 1MVA	SLD-1	● Inverter-integrated anti-islanding. ● Generator Protection Relay.	● No voltage management. ● Constant PF 0.98 lagging.	Large generating system on shop roof, Woolner

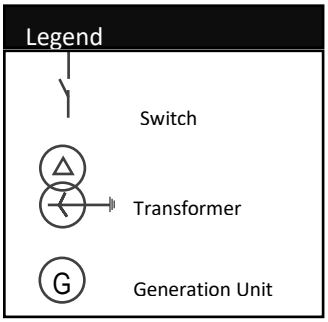
S. No	PWC Ref. No	Year Completed (connected)	Location	Technology of the Generating Unit(s)	Generating units Details (Make and Model)	Maximum Power generation capacity of all embedded Generating Units (kW)	Contribution to Fault Levels (kA)	Size and rating of relevant transformers (voltages & kVA)	Single Line Diagram of the connection arrangement (PDF)	Protecting System and Communication Systems	Voltage Control and Reactive power capability	Details relevant to the specific location of the facility
20	EG654	2016	Alice Springs	Solar PV Array	326kW of PV • 1126 x JA Solar – JAM6 60 290 PR 285kVA of Inverters • 16 x Fronius SYMO	285	NR	11/0.4kV, 1MVA	SLD-1	● Inverter-integrated anti-islanding. ● Generator Protection Relay.	● No voltage management. ● Constant PF 0.98 lagging.	Large generating system on shop roof, Alice Springs Other smaller systems on same property, different connection points.
21	EG541	2019	Braitling	Solar PV Array and BESS	[System 1] 100kW of PV 85kVA of Inverters [System 2] 375kW of PV 250kVA of Hybrid Inverters 250kVA BESS	350	NR	11/0.4kV, 750kVA	SLD-1	● Inverter-integrated anti-islanding. ● Generator Protection Relay.	● 120kVAr Power Factor Correction Unit in 5kVAr intervals. ● No voltage management. ● Constant PF 0.98 lagging.	Large Generating System on shop roofs, Braitling. Both systems behind the same meter
22	EG878	2023	Palmerston	Solar PV Array	48 * 27kW Fronius Eco27.0.3-S 3721 x 400 W REC 400 TWIN PEAK	1488.4	NR	11/0.4kV, 1.5MVA	SLD-1	● Inverter-integrated anti-islanding. ● Generator Protection Relay.	● No voltage management except for over Voltage and under-Voltage trips. ● Constant PF 0.9 lagging and supplying reactive power.	Large Generating system on Rooftop of Gateway shopping centre

S. No	PWC Ref. No	Year Completed (connected)	Location	Technology of the Generating Unit(s)	Generating units Details (Make and Model)	Maximum Power generation capacity of all embedded Generating Units (kW)	Contribution to Fault Levels (kA)	Size and rating of relevant transformers (voltages & kVA)	Single Line Diagram of the connection arrangement (PDF)	Protecting System and Communication Systems	Voltage Control and Reactive power capability	Details relevant to the specific location of the facility
23	LEG8	2016	Darwin	Solar PV Array	23 x 60 kW SMA Sunny tri Power Inverters (1.3MW) 60*60 kVA Sunny Tri power 60-10 15000 x Hanwha Q-Cells Q.PRO G4.1 265 5750*265W Q cells	5498.75	NR	11/0.4kV	SLD-2	● Inverter-integrated anti-islanding. ● Generator Protection Relay.	● No voltage management except for over Voltage and under-Voltage trips. ● Constant PF 0.98 lagging.	Large Solar Farm located at 40 Henry Wrigley Drive. This farm is adjacent to Nautilus Aviation.

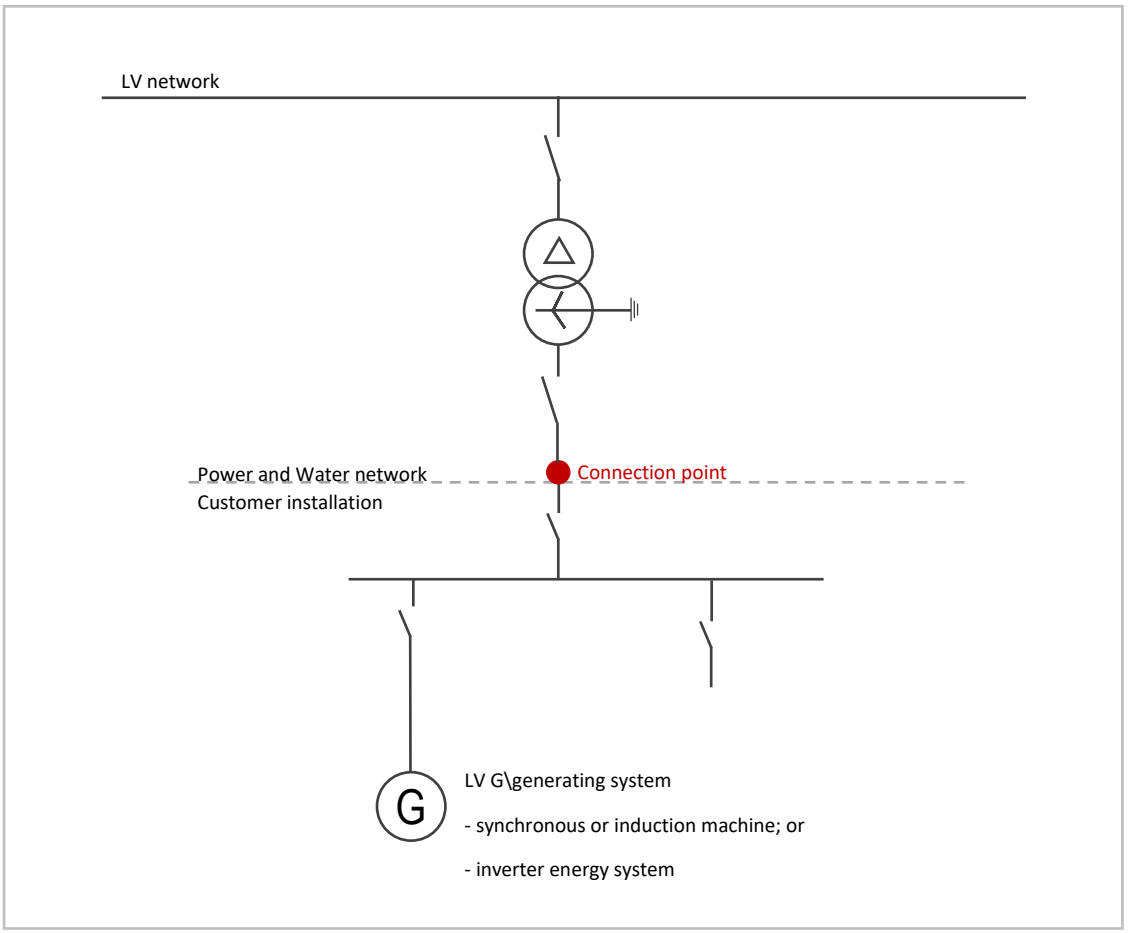
5. Single line diagram

The following single line diagrams depict typical connection arrangements for embedded generators connecting to the Power and Water distribution network.

These diagrams are used as a reference for connection arrangements listed in the register.

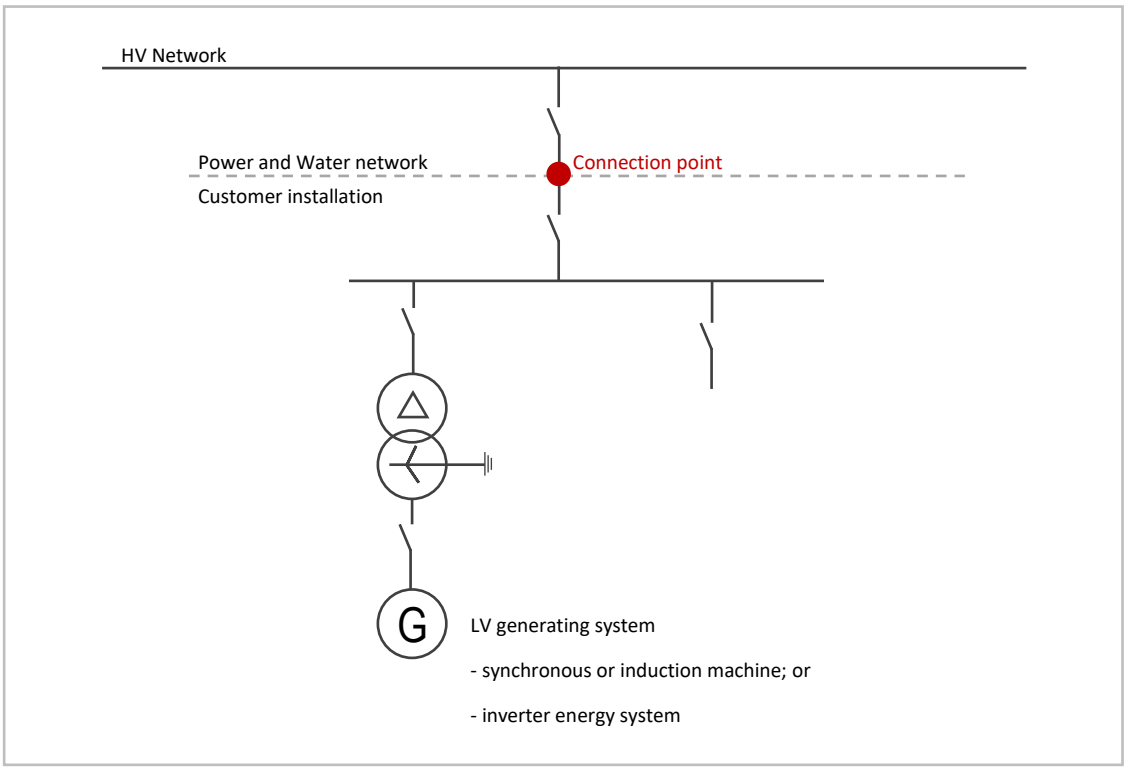


SLD 1 – Low voltage connection with low voltage generating system (synchronous or induction machine, or inverter energy system)



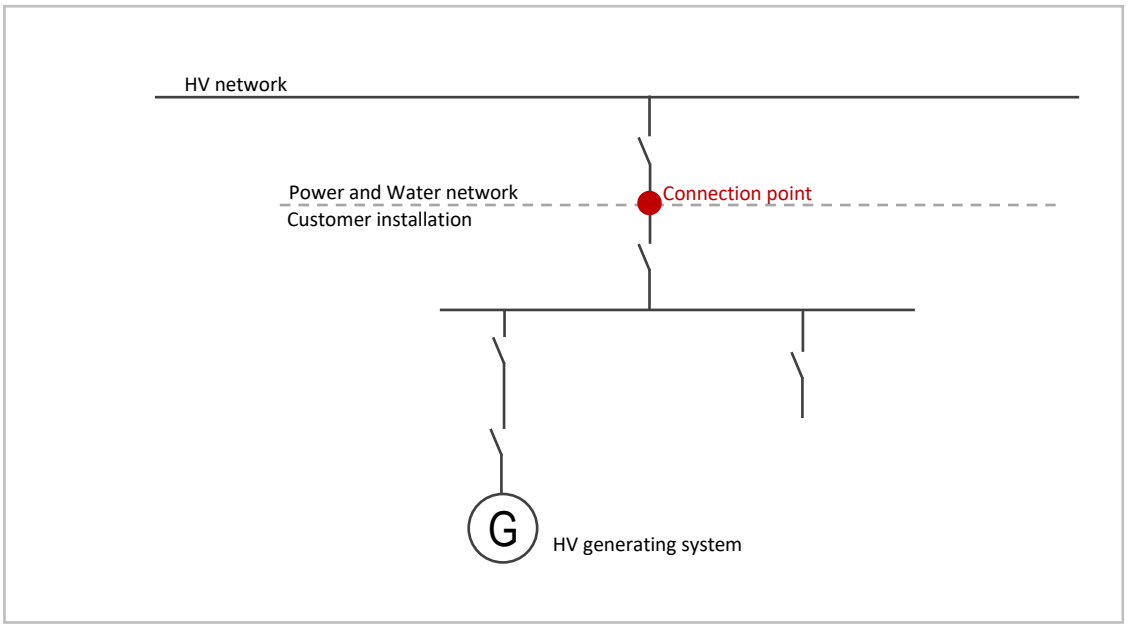
SLD 2 – High voltage connection with low voltage generating system

(synchronous or induction machine, or inverter energy system)



SLD 3 – High voltage connection with high voltage generating system

(synchronous or induction machine)



Contact

For more information about the embedded generation project, please contact us.
Email networkdevelopmentandplanning.pwc@powerwater.com.au
Phone 1800 245 092

powerwater.com.au

PowerWater