INFORMATION GUIDE

FOR EMBEDDED GENERATION

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1 Introduction

1.1 Embedded generation ("EG") refers to the onsite generation and supply of electricity primarily for internal use. A consumer with embedded generation facilities is allowed to connect his load facilities to the power grid for additional and/or backup electricity supply. The consumer can also sell their excess generation in the wholesale electricity market.

2 Eligibility Conditions for Embedded Generation

2.1 A consumer is allowed to embed generation and supply electricity directly to his load facilities provided that he meets the following conditions:

a. The embedded generating units are located on land which is contiguous to the load facilities; and

b. The embedded generating units, load facilities and land are majority (i.e. at least 50%) owned by the same consumer.

c. The consumer may install embedded generating units on land that is non-contiguous with his load facilities if

i. There is insufficient contiguous land available for the consumer to accommodate the embedded generating units and load facilities;

ii. The load facilities and the land on which the load facilities and embedded generating units are located (i.e. including the non-contiguous land) must be majority owned by the same consumer; and

iii. There is a point-to-point (i.e. dedicated) electrical connection between the embedded generating units and load facilities.

d. The consumer may outsource the embedded generating units by engaging third parties to develop, own and operate the embedded generating units, provided that such outsourcing does not create market power or add to the existing market power of the third party.

3 Settlement Methodology

3.1 <u>Exporting Electricity into the Power Grid</u>

3.1.1 A non-contestable consumer ("NCC") with EG of unit generation capacity below 1 MW can apply to SP Services Ltd ("SPS") for the Credit Scheme. The Credit Scheme allows the NCC to get paid for exporting electricity into the grid without registering with and participating in the wholesale electricity market. For the amount of electricity exported, the NCC will be paid at the rate of regulated tariff less grid charges and the payment will be itemised as a "credit" in his monthly electricity bills from SPS.

3.1.2 For a Contestable Consumer ("CC") with EG of unit generation capacity below 1 MW, he will need to register with Energy Market Company Pte Ltd ("EMC") as a market participant ("MP") if he wishes to get paid for electricity exported into the power grid (Refer to Section 5 for more information on Market Participation). He will be paid by EMC at the prevailing energy spot price in the wholesale electricity market in respect of the export quantities.

3.1.3 Where the EG capacity is 1 MW or above, the consumer (CC or NCC) is required to be registered with EMC as a MP (Refer to Section 5 for more information on Market Participation).

3.2 Net Treatment for Non-Reserve Market Charges

3.2.1 The reserve charges and non-reserve market charges, namely EMC fees, Power System Operator ("PSO") fees, Monthly Energy Uplift Charge ("MEUC") and Market Support Services ("MSS") fees applicable to generation and load facilities are set out in Table 1 below.

Table 1: Market (Reserve and Non-Reserve) Charges Applicable to Generation and Load Facilities

<table>
<tr><th>Market Charges</th><th>Generation Facilities</th><th>Load Facilities</th></tr>
<tr><td colspan="3">Reserve Charges</td></tr>
<tr><td>Regulation</td><td>Levied on up to the first 5 MWh of gross generation output for each half-hour period</td><td>Levied on gross consumption</td></tr>
<tr><td>Primary, Secondary and Contingency Reserves</td><td>Levied on gross generation output above 5 MWh for each half-hour period.</td><td>Not applicable</td></tr>
<tr><td colspan="3">Non-reserve market charges</td></tr>
<tr><td>EMC fees</td><td rowspan="2">Levied on gross generation unless granted net treatment</td><td rowspan="3">Levied on gross consumption unless granted net treatment</td></tr>
<tr><td>PSO fees</td></tr>
<tr><td>MEUC</td><td rowspan="2">Not applicable</td></tr>
<tr><td>MSS fees</td></tr>
</table>

3.2.2 The consumer whose EG is registered with EMC is eligible for net treatment for non- reserve market charges if he consumes at least 50% of the total electricity generated on an annual basis, as specified in Chapter 2 Section 5.5.9 of the Market Rules. Net treatment for non-reserve market charges means that the charges are levied, where applicable, on the net amount of electricity exported into the power grid, and the net amount of electricity imported from the power grid (instead of gross generation and gross load), i.e. the charges are not levied on the amount of electricity generated and consumed onsite.

3.2.3 Worked examples illustrating the net treatment of non-reserve market charges:

Example 1:
A consumer who owns an EG, generated 12 MWh of electricity, and consumed 9 MWh of electricity for a given half-hour period (i.e. injected 3 MWh of excess electricity into the power grid). Table 2 and Table 3 show the allocation of non-reserve market charges for the consumer without and with net treatment respectively.

Table 2: Non-Reserve Market Charges without Net Treatment (Net injection)

Non-reserve market charges	Allocation (in terms of MWh)	
	Generation	Load
EMC fees	12	9
PSO fees	12	9
MEUC	-	9
MSS fees	-	9

Table 3: Allocation of Non-Reserve Market Charges with Net Treatment (Net injection)

Non-reserve market charges	Allocation (in terms of MWh)	
	Generation	Load
EMC fees	3	0
PSO fees	3	0
MEUC	-	0
MSS fees	-	0

Example 2:
A consumer who owns an EG, generated 9 MWh of electricity and consumed 12 MWh of electricity for a given half-hour period (i.e. imported 3 MWh of electricity from the power grid). Table 4 and Table 5 show the allocation of non-reserve market charges for the consumer without and with net treatment respectively.

Table 4: Allocation of Non-Reserve Market Charges without Net Treatment (Net Withdrawal)

Non-reserve market charges	Allocation (in terms of MWh)	
	Generation	Load
EMC fees	9	12
PSO fees	9	12
MEUC	-	12
MSS fees	1	12

Table 5: Allocation of Non-Reserve Market Charges with Net Treatment (Net Withdrawal)

Non-reserve market charges	Allocation (in terms of MWh)	
	Generation	Load
EMC fees	0	3
PSO fees	0	3
MEUC	-	3
MSS fees	-	3

3.2.4 Consumers who wish to be granted the net treatment for non-reserve market charges can apply to EMA by submitting the 'Application for Embedded Status' form: Application for Embedded Generation Facility Status | FormSG

4 Electricity Licensing Requirements

4.1 An Electrical Installation Licence is required for the operation of an EG. In some cases, a Wholesaler (Generation) or Generation Licence may also be required.

4.2 Wholesale (Generation) or Generation Licence

4.2.1 A consumer with EG of unit generation capacity 1 MW or more but less than 10 MW is required to apply to EMA for a Wholesaler (Generation) Licence. For unit generation capacity of 10 MW or more, he has to apply for a Generation Licence.

4.2.2 Table 6 provides an overview of the licensing requirements for EGs.

Table 6: Licensing Requirements for EGs

Name-plate rating of generating unit	Connected to the power grid?	Type of licence[1]
Below 1 MW	Yes	Exempted
	No	
1 MW or more but less than 10 MW	Yes	Wholesaler (generation) Licence
	No	Exempted
10 MW or more	Yes	Generation Licence
	No	

4.2.3 Application forms for the Wholesaler (Generation) Licence and Generation Licence are available at the GoBusiness Licensing portal: GoBusiness Licensing

4.2.4 Existing Wholesaler (Generation) Licensees and Generation Licensees, including their respective licences are available the following EMA website: EMA | Licensees Directory

[1] The consumer will need an Electrical Installation Licence regardless whether he is required to hold a Wholesaler (Generation) Licence or a Generation Licence.

4.2.5 Wholesaler (Generation) Licensees and Generation Licensees are required to comply with the Market Rules and the relevant codes of practice.

The Market Rules can be found at the following EMC website:
Market Rules (emcsg.com)

The various codes of conduct can be found at the following EMA website:
EMA | Regulatory Publications

4.3 Electrical Installation Licence

4.3.1 An Electrical Installation ("EI") Licence is required to use or operate any electrical installation, including an embedded generation facility. For more information on EI Licence, consumers can refer to the "Handbook for Application of Electrical Installation Licence", available at the following EMA website:
https://www.ema.gov.sg/content/dam/corporate/resources/educational-materials/handbook/handbook-pdfs/english/EMA-Resources-Educational-Materials-Handbook-Application-Electrical-Installation-Licence.pdf

4.3.2 Consumers will need to appoint the appropriate class of Licensed Electrical Worker ("LEW") to take charge of the electrical installation, and submit an application for EI Licence through the appointed LEW. Consumers can search for LEWs via EMA website:
EMA ELISE | Licensed Workers

5 Market Participation

5.1 All Generation Licensees and Wholesaler (Generation) Licensees are required to register with EMC as MPs and comply with the Market Rules.

5.2 Generation facilities at the same generating station have to register as generation registered facilities ("GRF") if their aggregate generation capacity is 10 MW or more. GRFs are subject to dispatch by PSO. If the aggregate capacity is 1 MW or more but below 10 MW, they have to register as generation settlement facilities ("GSF") which are not subject to dispatch by PSO, or GRFs if they wish to be subject to dispatch by PSO.

5.3 Table 7 summarises the market registration requirements.

Table 7: Market Registration Requirements

Aggregate name-plate Rating at the Same Generating Station	Registration Required?	Registered as GSF or GRF?
Below 1 MW	Optional	Can be GSF or GRF, but typically as GSF
1 MW or more but less than 10 MW	Mandatory	
10 MW or more		GRF

5.4 EGs which are registered as GRF are required to inform EMC and PSO, on an ex-ante basis, the half-hourly generation quantities for on-site consumption. Such generation quantities will be treated as 'must-run' quantities in scheduling dispatch by EMC's Market Clearing Engine. In addition, the GRF is required to bid into the wholesale electricity market (by submitting price-quantity offers to EMC) to secure dispatch by the PSO for the quantities to be injected into the power grid. A GSF, on the other hand, is not subject to dispatch by PSO and there is no requirement to inform EMC/PSO or submit bid offers in respect of their generation output.

5.5 Further information on the application procedures for market participation registration and for generation facility registration are set out in the "Market Administration Market Manual – Registration and Authorisation", available at the following EMC website:
Market Manuals (emcsg.com)

6 Connection to the Grid

6.1 Consumers intending to connect and operate embedded generation facilities in parallel with the power grid will have to consult SP PowerGrid Ltd ("SPPG") on the connection scheme and the technical requirements.

6.2 The following documents set out the detailed consultation process and technical requirements:

a. SPPG's handbook "How to Apply for Electricity Connection", published at the following SP Group website:
https://www.spgroup.com.sg/dam/jcr:66289889-80d2-4559-a479-a804d5323f19/How%20to%20Apply%20for%20Electricity%20Connection.pdf

b. The Transmission Code and Metering Code, published at the following EMA website:
EMA | Regulatory Publications

7 Summary

7.1 Table 8 provides an overview of the regulatory requirements for EG.

Table 8: Overview of Regulatory Requirements for EGs

Individual name-plate rating of generating unit	**Below 1 MW**	**1 MW or more but less than 10 MW**	**10 MW and above**
Type of electricity licence required?	Exempted	Wholesaler (Generation) Licence	Generation Licence

Aggregate name-plate rating of generating units at the same generating station	**Below 1 Mw**		**1 MW or more but less than 10 MW**	**10 MW and above**
	NCC	**CC**	**CC**	**CC**
Required to register with EMC as MP?	No. NCC is eligible for Credit Scheme (administered by SPS) to get paid for excess electricity injected into the power grid without participating in the wholesale electricity market.	Optional. The CC will only need to register as MP if he wishes to sell (in order to get paid for) excess electricity injected into the power grid.	Yes	Yes
Register EG facility as GSF or GRF?	Not applicable	Applicable only if the CC is a MP. Either GSF or GRF	Either GSF or GRF	GRF

8 FAQ

8.1 What is the price paid to EGs for excess electricity injected into the power grid?

For EGs registered with EMC, the electricity injected into the power grid will be paid at the prevailing energy spot price. Energy spot price is determined for every half-hour trading period, and fluctuates depending on the prevailing supply and demand conditions.

NCCs with EG below 1 MW generation capacity can apply to SPS for the Credit Scheme to be paid at the regulated tariff less grid charges.

8.2 Is there a limit to how much excess electricity an EG can inject into the power grid?

No. However, EGs registered with EMC are required to consume at least 50% of the total electricity they generated on an annual basis to be eligible for net treatment for non-reserve market charges, as specified in Chapter 2 Section 5.5.9 of the Market Rules.

8.3 What are the grid charges that EGs have to pay?

For a consumer taking supply at high-tension, the grid charge consists of mainly a fixed component called the Contracted Capacity charge, and a variable component called the “kWh charge”. The Contracted Capacity charge is a monthly charge payable in any month based on the Contracted Capacity (in kW) at each metered intake supply point of a consumer. The kWh charge is a monthly charge payable based on the energy (in kWh) supplied to the consumer’s premises in that month.

Such consumers with EGs have to choose one of the following three schemes: (1) Summation Scheme; (2) Capped Capacity Scheme; or (3) Extended Capped Capacity Scheme, depending on the type of backup supply required (i.e. full backup or partial backup). More details on the grid charges and the schemes are available at the following SP Group website:
Resources (spgroup.com.sg)

8.4 Can EGs lower their contracted capacity?

For a new connection, consumers are subject to a binding period of 5 years. During this 5-year binding period, no reduction to the contracted capacity is allowed. For new HT, EHT and UHT connections, the minimum Contracted Capacity for each metered intake supply point is as follows:

HT with 1 or 2 feeders	1,700 kW
HT with 3 or more feeders	12,750 kW
EHT	25, 500 kW
UHT	85,000 kW

For new connections, a request may be made for intermediate steps before the full Contracted Capacity is implemented during the first year of the 5-year binding period. The first step shall be at least one quarter of the consumer's requested full Contracted Capacity at each metered intake supply point.

After the 5-year binding period, the consumer may, by giving one month's notice in writing to SPPA, reduce his Contracted Capacity at each metered intake supply point subject to the following minimum values:

HT with 1 or 2 feeders	850 kW
HT with 3 or more feeders	6,375 kW
EHT	750 kW
UHT	42,500 kW

Any such reduction in Contracted Capacity shall be subject to a 1-year binding period, i.e. the consumer shall not be entitled to make any further reduction in the Contracted Capacity within one year following any such reduction.

Upward revision of the Contracted Capacity may be allowed during the validity of either the 5-year or 1-year binding period. The revised Contracted Capacity shall in such cases commence from the first day in which it is effective and shall apply for the remainder of the initial 5-year period or for a minimum period of 1 year, whichever is the greater, provided SPPA is not required to install new or additional equipment. A consumer whose revised Contracted Capacity requires SPPA to install new or additional equipment shall be considered as receiving a new supply with a new 5-year binding period.

8.5 What is the rationale for having a 5-year binding period?

The 5-year binding period is to facilitate network planning. SPPG has to plan ahead and as such require commitment from its customers. The grid investments are depreciated over 30 years.

8.6 Current grid charges are dominated by the fixed charge component (i.e. Contracted Capacity charges). What is the rationale for having a fixed component in the grid charges? Can the variable charge component make up a greater proportion of grid charges instead?

SPPA's network investments are driven by capacity requirement and SPPA plans and builds the network capacity based on the contracted capacity requested by its customers. The fixed charge component encourages consumers to declare their Contracted Capacity according to their load profile and to commit to the Contracted Capacity declared to ensure efficient utilisation of network assets which will benefit consumers over time in terms of lower grid charges.

8.7 Can a group of companies co-invest and operate an EG facility together to supply to their respective load facilities at different locations?

A generation facility can supply electricity directly (i.e. without going through the power grid) to load facilities where the load facilities, and the land on which the load facilities and generation facility are located, are majority-owned by the same legal entity. Outside this framework, the generation facility cannot be considered an EG facility, as it is essentially a commercial generator to generating and selling electricity to third parties. All commercial generators are required to compete in the wholesale electricity market to sell and inject electricity into the power grid.