



Smart Energy, Sustainable Future

DECISION PAPER

PROPOSED MODIFICATIONS TO THE METERING CODE

5 MAR 2018

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1 Background

- 1.1 Since 9 December 2015, consumers with embedded Intermittent Generation Source (IGS) of 1 MWac or more who do not wish to sell excess electricity into the grid can choose not to have the relevant metering arrangement ("M1 meters") at each generation point (refer to Annex 1 for illustration). They can instead adopt an alternative arrangement to be approved by the Energy Market Authority ("EMA") to determine the IGS output for the financial settlement of the relevant wholesale market charges. An example of such an alternative arrangement is to use an estimated Solar Generation Profile that is approved by the EMA, obviating the need for such consumers to install M1 meters. This streamlining of existing processes seeks to facilitate the entry of IGS.
- 1.2 Consumers will still be paid for the actual generation sold back to the grid and will pay for the actual electricity consumed from the grid based on the actual meter readings at the intake point ("M2 meter").

2 Extending the option of the Solar Generation Profile

- 2.1 In 2017, the EMA has further facilitated the entry of IGS by introducing the following two new initiatives. These initiatives will also allow contestable consumers ("CCs") with embedded IGS to choose the Solar Generation Profile (without the need for installing physical meters) determined by EMA for the purpose of paying applicable market charges:
 - (i) **Enhanced Central Intermediary Scheme ("ECIS")**¹. Under the ECIS, CCs with embedded generation (both IGS and non-IGS) below 10 MW are not required to register with the Energy Market Company ("EMC") as a Market Participant ("MP") to get paid for injecting its embedded IGS output into the grid. The payment will be made through SP Services ("SPS") at the prevailing half-hourly wholesale energy price. Such CCs with embedded IGS can choose to have their output estimated based on the Solar Generation Profile for the purpose of paying applicable market-related charges (e.g. Allocated Regulation Prices ("AFP") charges).
 - (ii) **Streamlined market registration for consumers with embedded IGS below 10 MWac who will not be selling their excess electricity output ("IGS MP (Non-exporting)")**². CCs with embedded IGS below 10 MWac

¹ More information can be found at:

<https://www.ema.gov.sg/cmsmedia/Enhanced%20Central%20Intermediary%20Scheme%20-%20Final%20Determination.pdf>

² More information can be found at:

<https://www.ema.gov.sg/cmsmedia/Consultations/Electricity/Determination%20paper%202017%20-%20Enhancements%20to%20the%20regulatory%20framework%20vf.pdf>

who will not be selling any electricity back to the market can undergo a streamlined MP and Generation Facility (“GF”) registration, and pay EMC an estimated fixed charge determined by the EMA. This fixed charge will be determined based on the estimated IGS generation (according to the Solar Generation Profile determined by the EMA), and the historical average rates of the respective charges. This fixed charge will be revised periodically to reflect updated market conditions.

- 2.2 In addition, CCs with embedded IGS (regardless of size) can also opt to use the Solar Generation Profile, or continue to install physical meters, when they register with EMC as a MP.

3 Proposed Modifications and Public Consultation

- 3.1 Pursuant to Section 1.7 of the Metering Code, EMA conducted a public consultation on the proposed modifications to Metering Code to implement the above enhancements to extend the option of Solar Generation Profile. At the close of consultation on 28 Feb 2018, written representations from Energetix, Sembcorp Power (on behalf of Sembcorp Solar), SPS and Sun Electric were received.
- 3.2 **Appendix 1 and Appendix 2** respectively sets out the modifications to the Metering Code taking into account the written comments, and EMA’s response to those comments.

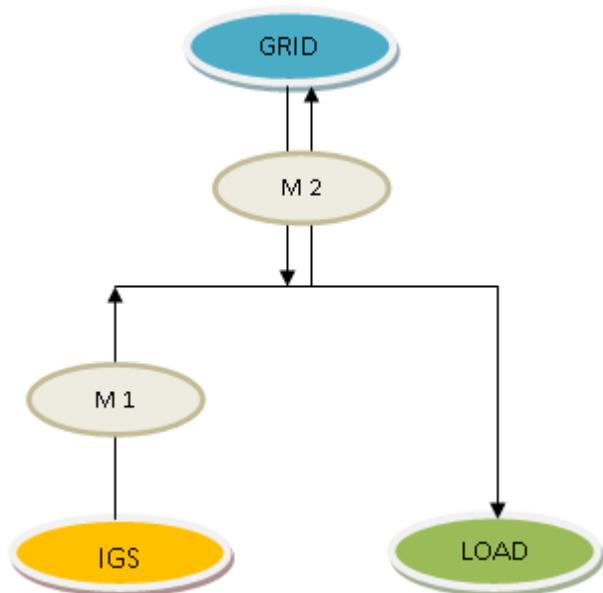
4 EMA’s Decision

- 4.1 EMA has decided to modify the Metering Code as set out in **Appendix 1**. The Code modifications will take effect on 19 March 2018.

~ End ~

Annex 1

Diagram 1: Illustration of metering set up for a typical consumer with embedded IGS



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Appendix 1

PROPOSED MODIFICATIONS TO THE METERING CODE

Modification Ref. No.	Clause	Original text	Modified text or addition	Reason for modification
MC/2018/1	1.4 Definitions	Nil	“Solar Generation Profile” means the estimated generation for a contestable consumer with embedded solar photovoltaic generation facility across each half-hour interval, commencing at 0:00 hours as determined by the Authority;	To extend the use of Solar Generation Profile by contestable consumers with embedded solar photovoltaic generation facility.
MC/2018/2	1.4 Definitions	Nil	“Solar Generation Profiling” means the metering option chosen by a contestable consumer with embedded solar photovoltaic generation facility where its generation is determined based on the Solar Generation Profile;	
MC/2018/3	2.4.14 [New]	Nil	Section 2.4.8 to 2.4.10 and 2.4.12 do not apply to intermittent embedded generation facilities on Solar Generation Profiling.	

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Modification Ref. No.	Clause	Original text	Modified text or addition	Reason for modification
MC/2018/4 [Modification will not be implemented as there is no need to specify the meter reading frequency for intermittent generation facilities.]	4.2.1	Nil	<p>Type of Metered Entity or Meter Installation <u>Intermittent Generation Facility</u> <u>(Including installation meter connected to the transmission system)</u></p> <p>Meter Reading Frequency <u>Every business day</u></p>	To clarify the meter reading frequency for Intermittent Generation Facility.
MC/2018/5	4.6.4	For metering data from meters associated with an intermittent generation facility, if any interval is not valid or missing, the MDM shall estimate the usage of all meters associated with the intermittent generation facility for the interval to zero and reconcile the usage after actual readings are obtained.	For metering data from meters associated with an intermittent generation facility <u>that is not on Solar Generation Profiling</u> , if any interval is not valid or is missing, the MDM shall estimate the usage of all meters associated with the intermittent generation facility for the interval to zero and reconcile the usage after actual readings are obtained	To clarify on the treatment of missing and non-valid metering data for both intermittent generation facility and embedded generation facility.

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Modification Ref. No.	Clause	Original text	Modified text or addition	Reason for modification
MC/2018/6	4.6.5 [New]	Nil	<p>For each intermittent generation facility that is on Solar Generation Profiling, the MDM shall calculate the generation of the intermittent generation facility based on the nameplate rating of the facility and the Solar Generation Profile. For metering data from meters associated with such facility on Solar Generation Profiling, if any interval is not valid or is missing, the MDM shall estimate the gross generation and usage of all meters associated with such facility for the interval to zero and reconcile the generation and usage after actual readings are obtained.</p>	To clarify on the treatment of missing and non-valid metering data for both intermittent generation facility and embedded generation facility.

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Modification Ref. No.	Clause	Original text	Modified text or addition	Reason for modification
MC/2018/7	4.6.6 [New]	Nil	For metering data from meters associated with an embedded generation facility for which payment is made by the Market Support Services Licensee for its net injection into the transmission system, if any interval is not valid or is missing, the MDM shall estimate the usage of all meters associated with the embedded generation facility for the interval to zero and reconcile the usage after actual readings are obtained.	
MC/2018/8	4.6.8 [Will be renumbered to 4.6.10]	The MDM for a meter installation shall apply the procedures delineated in sections 4.6.1 through 4.6.7 until all data elements required for settlement purposes have been determined.	The MDM for a meter installation shall apply the procedures delineated in sections 4.6.1 through 4.6.7-4.6.9 until all data elements required for settlement purposes have been determined.	To update the reference to include the two new clauses (i.e. 4.6.5 and 4.6.6).

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Modification Ref. No.	Clause	Original text	Modified text or addition	Reason for modification
MC/2018/9	4.6.10 [Will be renumbered to 4.6.12]	For invalid or missing data for which the MDM has applied data estimation procedures, as described in sections 4.6.1 to 4.6.9, the intervals shall be deemed valid for future validation and estimation procedures, and considered to be settlement-ready data	For invalid or missing data for which the MDM has applied data estimation procedures, as described in sections 4.6.1 to 4.6.9 <u>4.6.11</u> , the intervals shall be deemed valid for future validation and estimation procedures, and considered to be settlement-ready data	To update the reference to include the two new clauses (i.e. 4.6.5 and 4.6.6).
MC/2018/10	1.4 Definitions	“Intermittent generation facility” means any generation facility whose power output, in the course of its ordinary and proper operation, cannot be predicted or be directly controlled or varied at will;	“Intermittent generation facility” means any generation facility whose power output, in the course of its ordinary and proper operation, cannot be predicted or be directly controlled or varied at will. <u>This includes solar photovoltaic generation facility;</u>	To provide clarity that intermittent generation facility include solar photovoltaic generation facility
MC/2018/11	1.4 Definitions	2.4.11 Nothing in this Code shall apply with respect to any generating unit or generating generation facility that has a name-plate rating of less than 1MW, and is not (i) a GRF or (ii) a GSF or (iii) comprised in a GSF registered by the market support services licensee.	2.4.11 Nothing in this Code shall apply with respect to any generating unit or generating generation facility that has a name-plate rating of less than 1MW, and is not (i) a GRF or (ii) a GSF or (iii) comprised in a GSF registered by the market support services licensee.	To clarify that the codes will also not apply to the relevant generation facility/unit not registered under the Enhanced Central Intermediary Scheme.

EMA's RESPONSE TO INDUSTRY FEEDBACK

No.	Modification Ref.No	Clause	Industry Comments	EMA's response
1.	MC/2018/1	1.4 Definitions	<p>Sembcorp Power Pte Ltd on behalf of Sembcorp Solar Pte Ltd</p> <p>As the Solar Generation Profile will be used for settlement purposes, we would like to request that EMA make available the approved Solar Generation Profile publicly. For transparency, it would be useful for EMA to make available the methodology adopted to determine the Solar Generation Profile, frequency of reviewing the methodology and frequency of updating the figures.</p> <p>Below is the proposed amendments:</p> <p>“Solar Generation Profile” means the average generation for a contestable consumer with embedded intermittent generation facility across each half-hour interval, commencing at 0:00 hours <u>make available to the public as determined in accordance with the methodology published by the Authority</u></p>	<p>As per the EMA's Addendum on Enhancements to the Regulatory Framework for Intermittent Generation Sources published on 9 Dec 2015, consumers with embedded IGS can use an alternative arrangement to be approved by EMA to determine the IGS output for the settlement of the relevant market charges.</p> <p>EMA notes and will review Sembcorp's request to publish the Solar Generation Profile. EMA will update the Solar Generation Profile from time to time as it deems necessary.</p> <p>The Solar Generation Profile is derived based on factors such as the historical average solar irradiance in Singapore, from 7am – 7pm, and will be standardised for all IGS installations.</p>

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No.	Modification Ref.No	Clause	Industry Comments	EMA's response
2.	MC/2018/1	1.4 Definitions	<p>SPS</p> <p>SPS wish to highlight that intermittent generation facilities include renewable sources of energy such as solar energy and wind energy. The Solar Generation Profile is designed to estimate the generation of embedded solar photovoltaic generation facilities only. Hence, SP would like to propose the following change in the definition for Solar Generation Profile.</p> <p>“Solar Generation Profile” means the <u>per unit estimated generation</u> across each half-hour interval commencing at 0:00 hours as approved by the Authority of a contestable consumer’s embedded <u>solar photovoltaic</u> generation facility;</p>	For clarity, EMA will include “estimated” and “solar photovoltaic” in the definition of the “Solar Generation Profile”. Please refer to Appendix 1 for the revised definition.

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No.	Modification Ref.No	Clause	Industry Comments	EMA's response
3.	MC/2018/2	1.4 Definitions	<p>SPS</p> <p>SPS wish to highlight that intermittent generation facilities include renewable sources of energy such as solar energy and wind energy. However, the option of Solar Generation Profiling should only be applicable to contestable consumers with embedded solar photovoltaic generation facilities only.</p> <p>Hence, SP would like to propose the following change in the definition for Solar Generation Profiling.</p> <p>“Solar Generation Profiling” means the metering option chosen by a contestable consumer with embedded <u>solar photovoltaic</u> generation facility where its generation is determined based on the Solar Generation Profile;</p>	For clarity, EMA will include “solar photovoltaic” in the definition of Solar Generation Profiling. Please refer to Appendix 1 for the revised definition.
4.	MC/2018/3	2.4.14 [New]	<p>SPS</p> <p>As Solar Generation Profiling is only applicable to embedded intermittent generation facilities, SPS would like to propose the following change.</p> <p>Section 2.4.8 to 2.4.10 and 2.4.12 do not apply to <u>embedded</u> intermittent generation facilities on Solar Generation Profiling.</p>	For clarity, EMA will include “embedded”. Please refer to Appendix 1 for the revised definition.

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No.	Modification Ref.No	Clause	Industry Comments	EMA's response
5.	MC/2018/4	4.2.1	<p>SPS</p> <p>An intermittent generation facility is also classified as a Generation Facility. SPS would like to suggest amending the proposed clause as follow for consistency with embedded generation facility.</p> <p><u>Embedded</u> Intermittent Generation Facility (Including installation meter connected to the transmission system)</p>	<p>EMA has assessed and the current definition of Generation Facility and Embedded Generation Facility in the metering code encompass Intermittent Generation Facility and Embedded Intermittent Generation Facility. Hence, EMA will not amend clause 4.2.1. as it already states the relevant meter reading frequency for Intermittent Generation Facility and Embedded Intermittent Generation Facility follows the same meter reading frequency as Generation Facility and Embedded Generation Facility respectively.</p>

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6.	MC/2018/5 & MC/2018/6	4.6.4 & 4.6.5	<p>SPS</p> <p>SPS would like to highlight that the estimation rule in clauses 4.6.4 and 4.6.5 is applicable only for consumers with embedded intermittent generation facilities. Non-embedded intermittent generation facilities will be treated as generation facilities.</p> <p>Hence, SPS would like to propose the following changes.</p> <p>For 4.6.4:</p> <p>For metering data from meters associated with an <u>embedded</u> intermittent generation facility that is not on Solar Generation Profiling, if any interval is not valid or missing, the MDM shall estimate the usage of all meters associated with the embedded intermittent generation facility for the interval to zero and reconcile the usage after actual readings are obtained</p> <p>For 4.6.5:</p> <p>For each embedded intermittent generation facility that is on Solar Generation Profiling, the MDM shall calculate the generation of the <u>embedded</u> intermittent generation facility based on the <u>consumer's declared generation capacity and</u> Solar Generation Profile. For metering data from meters associated with such facility on Solar Generation Profiling, if any</p>	<p>For clarity, EMA will include "embedded" in clauses 4.6.4 and 4.6.5 accordingly. For consistency on the terms, EMA will use "nameplate rating of the facility" instead of "consumer's declared generation capacity" to be consistent with market rules</p>
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No.	Modification Ref.No	Clause	Industry Comments	EMA's response
			interval is not valid or missing, the MDM shall estimate the gross generation and usage of all meters associated with such facility for the interval to zero and reconcile the generation and usage after actual readings are obtained.	
7.	MC/2018/6	4.6.5	<p>Sembcorp Power Pte Ltd on behalf of Sembcorp Solar Pte Ltd</p> <p>When the intermittent generation facility is using Solar Generation Profile, it states that if any interval is not valid or missing, the MDM shall estimate the gross generation for the interval to zero and reconcile the generation after actual readings is obtain.</p> <p>We would like to understand how the MDM determine the actual readings for the generation in such a situation to reconcile.</p>	To clarify, the actual readings mentioned in the clause refer to meter reading data from the M2 meter. In the event that any interval is not valid or is missing, the MDM will set metering readings from the M2 meter to be zero. Once the MDM obtained actual readings from M2 Meter, MDM will use the actual readings and the Solar Generation Profile to determine the gross generation/consumption.
8.	MC/2018/5 MC/2018/6 MC/2018/7	4.6.4, 4.6.5, 4.6.6	<p>Energetix</p> <p>To avoid confusion of meaning, suggest changing “...if any interval is not valid or missing...” to “...if any interval is not valid or is missing...” or to “...if any interval is missing or not valid...”</p>	EMA has included “is” accordingly.

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No.	Modification Ref.No	Clause	Industry Comments	EMA's response
9.			<p>SPS</p> <p>SPS would like to clarify for the following sections in the Consultation paper.</p> <ul style="list-style-type: none"> • Section 2.1.1(i): The option of Solar Generation Profiling (SGP) is only applicable for embedded intermittent generation facilities with solar photovoltaic facilities. • Section 2.2: Solar Generation Profiling is intended for settlement of regulation charges and calculation of maximum demand for facilities with embedded <u>solar photovoltaic</u> generation facilities. <p>IGS consumers on SGP will be charged and paid based on the net withdrawal or export of energy measured by the consumption meters.</p>	EMA notes this feedback. The modifications in Appendix 1 reflects that the use of Solar Generation Profiling is for consumers with embedded solar photovoltaic generation facility.
10.	MC/2018/8	4.6.8	<p>SPS</p> <p>SPS would like to highlight that the existing clause should be renumbered to 4.6.9</p>	The proposed modifications (including renumbering) is with respect to the latest version of the metering code (dated April 2016) to allow readers to appreciate the proposed modifications (including the order of the clauses).
11.	MC/2018/9	4.6.10	<p>SPS</p> <p>SPS would like to highlight that the existing clause should be renumbered to 4.6.11</p>	As there are concurrent modifications proposed to the Metering Code for the implementation of the Open Electricity Market, the final numberings will be adjusted to take into account all final modifications.

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No.	Modification Ref.No	Clause	Industry Comments	EMA's response
12.	N.A	2.4.11	<p>SPS</p> <p>The current clause 2.4.11 exempts generating units or facilities with generation capacity less than 1MW and not registered with EMC from the requirements in the Metering Code. However, with the implementation of the Enhanced Central Intermediary Scheme, consumers with embedded generating units less than 1MW can choose to be paid by MSSL for their net injections into the transmission system. Such consumers should still be subjected to the requirements in the Metering Code for their generating units.</p> <p>Hence, SPS would like to propose the following changes for clause 2.4.11.</p> <p>2.4.11 Nothing in this Code shall apply with respect to any generating unit or generating generation facility that has a name-plate rating of less than 1MW and is not a GRF or GSF <u>or is not paid by a Market Support Service Licensee for net injections into the transmission system.</u></p>	<p>EMA notes the feedback and will include the following modification i.e.MC/2018/11 in Appendix 1.</p> <p>2.4.11 Nothing in this Code shall apply with respect to any generating unit or generating generation facility that has a name-plate rating of less than 1MW and is not (i) a GRF or (ii) a GSF <u>or (iii) comprised in a GSF registered by the Market Support Services Licensee.</u></p>

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<p>13.</p> <p>N.A.</p>	<p>Energetix</p> <p>Deriving and applying the solar generation profile</p> <p>Please explain how EMA plans to derive its solar generation profile, and give an example of how it will apply this to determine the market-related charges of an IGS in case of:</p> <ul style="list-style-type: none"> a) An IGS that injects to the grid and elects to get paid. b) An IGS that either does not inject to the grid or does inject but elects not to receive payment for such injection. <p>Will EMA use a single solar generation profile for all of Singapore, or will it use a number of regional profiles?</p> <p>Will EMA use a dynamic solar generation profile, ie one that is scaled in real time according to each IGS's capacity relative to the profile source?</p>	<p>The Solar Generation Profile is derived based on factors such as the historical average solar irradiance in Singapore, from 7am – 7pm, and will be standardised for all IGS installations. EMA will update the Solar Generation Profile from time to time as it deems necessary.</p> <p>To clarify, the Solar Generation Profile will be used to estimate the meter readings for M1 meter. The MDM will utilise the following meter readings to determine the respective quantities</p> <ul style="list-style-type: none"> • Actual readings from M2 meter will be used to determine the consumer's net generation/net consumption. Hence, a consumer will still be paid/charged for actual generation/consumption from the grid. • A combination of estimated readings for M1 meter and actual readings from M2 meter will be used to determine the consumer's gross generation/gross consumption. This is for the purpose of paying applicable market-related charges (e.g. AFP charges). <p>A consumer with embedded IGS can still choose to install M1 meter at each generation point and pay the relevant market charges based on actual metered IGS generated if he does not wish for his generation to be estimated.</p>
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No.	Modification Ref.No	Clause	Industry Comments	EMA's response
14.	MC/2018/1 and MC/2018/2 and MC/2018/3 and MC/2018/6	1.4 Definitions and 2.4.14 [New] and 4.6.5 [New]	<p>Sun Electric</p> <p>1) Removing meters may create complications in billing and settlement</p> <p>2) For carbon tax, this might confuse consumers who would be interested in obtaining direct readings consistent with providing their generation amount</p> <p>3) Modifications should harmonise with Treaties adopted for climate change pacts, and removing meters could challenge consistency in Singapore with other jurisdictions whom have signed these Treaties.</p> <p>4) Estimations on solar profile may cause inconsistencies among combustion generation and IGS in respect of facilitating bilateral contracts wherein estimated profile is inconsistent with physical power production (ie. Supply of power) of the IGS</p>	<p>As part of the Addendum on Enhancements to the Regulatory Framework on Intermittent Generation Sources published on 9 Dec 2015, EMA had carefully considered industry feedback and streamlined the M1 metering requirements for consumers with embedded IGS. In this way, the compliance costs will be reduced, which will further facilitate IGS deployment in Singapore.</p> <p>EMA will ensure that our regulations are in line with our international commitments.</p> <p>The use of Solar Generation Profiling should not confuse consumers as the carbon tax will be applied upstream on large emitters, including power stations and large industrial facilities, producing 25,000 tonnes or more of greenhouse gas emissions in a year. This excludes generation from solar photovoltaic generation facilities.</p> <p>The Solar Generation Profile is an additional option made available for consumers with embedded IGS to manage their commercial costs. The consumer can still choose to install M1 meter at each generation point and pay the relevant market charges based on actual metered IGS generated if he does not wish for his generation to be estimated.</p>

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No.	Modification Ref.No	Clause	Industry Comments	EMA's response
15.	N.A.	Other	<p>Sun Electric</p> <p>5) new arrangements for payment of production under Profiling methods should be provided for metered facilities as well (eg. As stated in the following phrase : <i>"In addition, CCs with embedded IGS (regardless of size) can also opt to use Solar Generation Profile when they register with EMC as a MP to get paid for injecting its embedded IGS output into the grid.</i></p>	EMA welcomes feedback on other possible alternative arrangements.