



**ENHANCEMENTS TO THE REGULATORY FRAMEWORK FOR  
INTERMITTENT GENERATION SOURCES IN THE NATIONAL  
ELECTRICITY MARKET OF SINGAPORE**

**CLARIFICATION PAPER**

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# ENHANCEMENTS TO THE REGULATORY FRAMEWORK FOR INTERMITTENT GENERATION SOURCES IN THE NATIONAL ELECTRICITY MARKET OF SINGAPORE

## CLARIFICATION PAPER

### 1 Executive Summary

- 1.1 On 1 July 2014, Energy Market Authority (“EMA”) issued a Final Determination Paper on the ‘Enhancements to the Regulatory Framework for Intermittent Generation Sources in the National Electricity Market of Singapore’<sup>1</sup> (“Final Determination Paper”). The paper sets out several regulatory enhancements to facilitate the deployment of IGS (such as solar panel systems) in Singapore.
- 1.2 As part of EMA’s ongoing industry engagement efforts, we have received requests for clarification on some of the enhancements highlighted in the Final Determination Paper. This paper provides clarifications on the following issues:
  - 1.2.1 **Extension of deadline** for non-residential consumers with IGS to opt out of the new pricing mechanism for IGS.
  - 1.2.2 **Working examples** to illustrate the options for market participation and settlement for consumers with embedded IGS.
  - 1.2.3 **Clarification of the definition** of an embedded IGS.

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<sup>1</sup> The Final Determination Paper can be found at:

[http://www.ema.gov.sg/cmsmedia/Consultations/Electricity/Proposed%20Modifications%20to%20the%20Transmission%20Code/1July2014Final Determination Intermittent Generation Sources - 1 July 2014 Final .pdf](http://www.ema.gov.sg/cmsmedia/Consultations/Electricity/Proposed%20Modifications%20to%20the%20Transmission%20Code/1July2014Final%20Determination%20Intermittent%20Generation%20Sources%20-%201%20July%202014%20Final%20.pdf)

## 2 Extension of Deadline to Opt Out of the New Pricing Mechanism for IGS

- 2.1 Given the intermittent nature of IGS, reserves from conventional power sources are required to ensure system stability. For example, cloud cover or shadows may cause solar PV output to drop quickly, which requires the need for reserves to make up for the shortfall. Without the back-up through reserves sources, consumers are exposed to the risk of power disruptions, which happened in other countries with large amounts of IGS.
- 2.2 After the release of the previous Consultation Paper on 28 October 2013<sup>2</sup>, EMA had received industry feedback that the current approach of charging reserves cost, which is based on the fluctuating half-hourly market price, creates uncertainty for investors on the potential costs over the lifespan of solar installations. In response, EMA informed the industry through the Final Determination Paper that a further study on the new pricing mechanism would be conducted, in preparation for the next consultation or determination paper.
- 2.3 In the Final Determination Paper, EMA also informed the industry that non-residential consumers who (a) have an existing embedded IGS installed prior to 1 January 2015; or (b) submit their application to SP PowerGrid (“SPPG”) before 1 January 2015 and with a commissioning date before 1 April 2015, are eligible to opt out of the new pricing mechanism. In view of the further study on the new pricing mechanism, EMA will extend the deadline for opting out. **The revised deadline will be 6 months after the date of the release of EMA’s next consultation or determination paper on the new pricing mechanism.** In other words, all non-residential consumers who have a commissioning date for their IGS before the revised deadline will have a one-off choice to opt out of the new pricing mechanism.
- 2.4 As stated in the Final Determination Paper, eligible consumers who opt out will be subjected to the new pricing mechanism (a) when they retrofit their IGS systems such that re-commissioning by SPPG is required; or (b) after 25 years from the commissioning date of their existing IGS systems, whichever is earlier.

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<sup>2</sup> The Consultation Paper on the ‘Enhancements to the Regulatory Framework for Intermittent Generation Sources in the National Electricity Market of Singapore’ can be found at: [http://www.ema.gov.sg/cmsmedia/Consultations/Electricity/526a1e95d104b-Consultation\\_Paper\\_-\\_Enhancements\\_to\\_the\\_Regulatory\\_Framework\\_for\\_Intermittent\\_Generation\\_28\\_October\\_2013\\_FINAL.pdf](http://www.ema.gov.sg/cmsmedia/Consultations/Electricity/526a1e95d104b-Consultation_Paper_-_Enhancements_to_the_Regulatory_Framework_for_Intermittent_Generation_28_October_2013_FINAL.pdf)

### 3 Options for Market Participation and Settlement for Embedded IGS

3.1 The Final Determination Paper highlighted various options for market participation and settlement for Contestable Consumers (“CCs”) with less than 1 MWac embedded IGS:

3.1.1 **Not register their embedded IGS with the Energy Market Company (“EMC”) or with SP Services (“SPS”) under the Central Intermediary Scheme (“CIS”)**<sup>3</sup>. Under this existing arrangement, the CCs will not be paid for the excess electricity injected into the grid, and also not be subjected to the applicable market charges on the electricity generated (e.g. reserves cost, EMC fees and PSO fees). They will also not be eligible for the ‘net-settlement’ scheme, given that the embedded IGS is not registered with the EMC or under the CIS.

3.1.2 **Register their embedded IGS with the EMC.** Under this existing arrangement, the CCs will receive payments for excess electricity sold into the grid, and are subjected to the applicable market charges (e.g. reserves cost, EMC fees and PSO fees). However, the solar industry has provided feedback that the market registration process is onerous for small CCs.

3.1.3 **Register their embedded IGS with SPS under the CIS.** Under this new arrangement with the simplified registration process, the CCs will receive payments for excess electricity sold into the grid, and are subjected to the applicable market charges (e.g. reserves cost, EMC fees and PSO fees).

3.2 The industry had requested for working examples to help CCs understand each option. A summary of the market payments and charges under the respective options for CCs with less than 1 MWac embedded IGS is shown in [Table 1](#). Please see [Annex 1](#) for the details.

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<sup>3</sup> The EMA has introduced this enhancement in July 2014, taking into consideration industry feedback to simplify the market registration process for consumers with less than 1 MWac embedded IGS. This new scheme takes effect from 1 April 2015.

Table 1: Summary of the Market Payments and Charges for the Respective Options for CCs with less than 1 MWac embedded IGS

Applicable Payments / Charges	CCs with Non-Registered IGS	CCs with EMC/CIS-Registered IGS
<b>Energy Payment / Charges</b>		
<b>Energy Generation</b>	Not Eligible for Payment	Nodal Price (for CCs with EMC-registered IGS) or Weighted Average Nodal Price (for CCs with CIS-registered IGS)  (to be paid based on net export)
<b>Energy Consumption<sup>4</sup></b>	USEP + HEUC or Retail Price for Energy  (to be charged based on meter's import channel)	USEP + HEUC or Retail Price for Energy  (to be charged based on net import)
<b>Reserves Charges</b>		
<b>Spinning Reserves<sup>5</sup></b>	Not Applicable <sup>6</sup>	
<b>Regulation Reserves (i.e. AFP)<sup>7</sup></b>	Half-hourly AFP  (to be charged based on meter's import channel) <sup>8</sup>	Half-hourly AFP  (to be charged based on gross generation and gross consumption)
<b>Non-Reserves Market Charges<sup>9</sup></b>		
<b>EMC Fees</b>	Yearly revised EMC Fees  (to be charged based on meter's import channel)	Yearly revised EMC Fees  (to be charged based on net import or net export)

<sup>4</sup> For CCs who buy electricity from the market, they will be charged USEP + HEUC. For CCs who buy electricity from retailers, they will be charged based on the agreed retail price for energy.

<sup>5</sup> Spinning reserves charge is recovered from all generation facilities scheduled (less the first 5 MWh of each facility, which is allocated the cost of regulation reserve) operating in each half hour dispatch period based on the 'modified runway model'.

<sup>6</sup> Based on current spinning reserves cost allocation, they are not required to pay for any charges. However, this is subject to change, based on EMA's Final Determination on the New Pricing Mechanism Framework.

<sup>7</sup> Regulation reserves charge is recovered from all loads and the first 5 MWh of each generation facility (including all IGS generation facilities that are registered under CIS) in each half hour dispatch period.

<sup>8</sup> As CCs with non-registered IGS is not paid for energy generation, they will not be liable for any related charges. Hence, AFP will be charged based on the meter's import channel.

<sup>9</sup> As CCs with non-registered IGS is not paid for energy generation, they will not be liable for any related charges. Hence, non-reserves market charges will be charged based on the meter's import channel.

<b>Applicable Payments / Charges</b>	<b>CCs with Non-Registered IGS</b>	<b>CCs with EMC/CIS-Registered IGS</b>
<b>PSO Fees</b>	Daily revised PSO Fees  (to be charged based on meter's import channel)	Daily revised PSO Fees  (to be charged based on net import or net export)
<b>MSS Charge</b>	Yearly revised MSS Charge  (to be charged based on meter's import channel)	Yearly revised MSS Charge  (to be charged based on net import only)
<b>MEUC</b>	Monthly revised MEUC prices  (to be charged based on meter's import channel)	Monthly revised MEUC prices  (to be charged based on net import only)
<b>Grid Charges</b>		
<b>Use of System (UOS)</b>	Yearly revised UOS Charge  (to be charged based on import channel)	
<b>Uncontracted Capacity Charge (High-Tension &amp; Above Network only)</b>	Cost is dependent on type of backup required	

## 4 Definition of Embedded IGS

- 4.1 The Final Determination Paper also states that some enhancements are only applicable to consumers with embedded IGS. For example, only consumers with embedded IGS are allowed to receive 'net-settlement'<sup>10</sup> of the energy component.
- 4.2 This section provides the definition of an embedded IGS, which builds on EMA's existing Information Guide on Embedded Generators<sup>11</sup>.

### Eligibility Conditions for Embedded IGS

- 4.3 An IGS installed by a consumer is an embedded IGS if the consumer meets the following conditions:
- 4.3.1 The embedded IGS units are located on land which is contiguous to the load facilities<sup>12</sup>;
- 4.3.2 The embedded IGS units, load facilities and land are majority (i.e. at least 50%) owned by the same consumer; and
- 4.3.2.1 The consumer may outsource the embedded IGS units by engaging third parties to develop, own and operate the embedded IGS units.
- 4.3.3 The load account of the load facilities and the generation account for the embedded IGS unit belong to the same consumer.
- 4.3.3.1 For embedded IGS units registered with the EMC, the registration may be made through a third party whom the consumer has engaged to develop, own and operate the system.

### Examples of Embedded IGS

- 4.4 The examples of IGS eligible to be considered as embedded IGS are shown in Table 2.

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<sup>10</sup> 'Net Settlement' means that consumers are either charged for their net consumption or paid for their net generation within each trading period.

<sup>11</sup> The Information Guide can be found at:

<https://www.ema.gov.sg/cmsmedia/Consumers/Embedded%20Generation/GuideforEG.pdf>

<sup>12</sup> This would include IGS units situated on the consumers' premise (such as rooftop space or land which is part of the consumers' premise or load facility).

Table 2: Examples of IGS Eligible to be considered as Embedded IGS

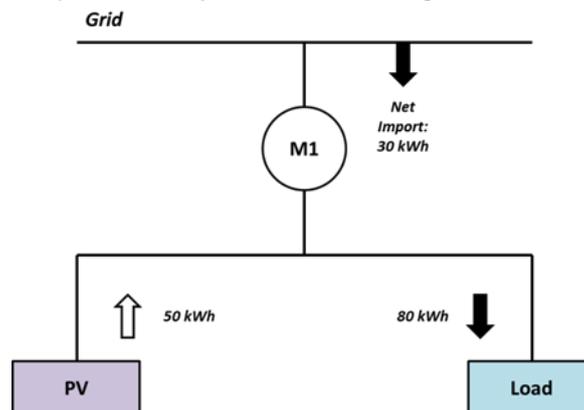
Type of Embedded IGS	Description
<p><b>Solar Self-Owned Model</b></p>	<p>Residential or non-residential consumers who <b>own and install</b> IGS systems on premises (which fulfil the eligibility conditions of paragraph 4.3) to generate electricity for their onsite load (excluding the IGS system’s auxiliary load). Only the excess electricity is sold to the grid.</p>
<p><b>Solar Leasing Model</b></p>	<p>Residential or non-residential consumers who enter into commercial agreement with a solar leasing company to <b>lease and install</b> IGS systems on premises (which fulfil the eligibility conditions of paragraph 4.3) to generate electricity for their onsite load (excluding the IGS system’s auxiliary load). Only the excess electricity is sold to the grid.</p>

## ANNEX 1: Market Settlement for CC with Non-Registered IGS and CC with EMC/CIS-Registered IGS

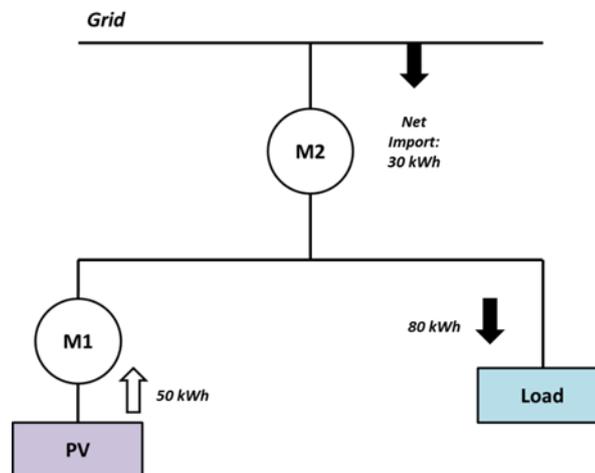
- Example 1 below provides an illustrative comparison of the market settlement between a CC with a non-registered IGS and a CC with EMC/CIS-registered IGS, when withdrawing electricity from the grid during a particular half-hour period.

### Example 1: Net Import (withdrawal) from Grid Comparison of CC with Non-Registered IGS and CC with EMC/CIS-Registered IGS

**Figure 1(a). Net import (withdrawal) of 30 kWh from grid, CC with Non-Registered IGS**



**Figure 1(b). Net import (withdrawal) of 30 kWh from grid, CC with EMC/CIS-Registered IGS**



Item	Qty (kWh)
Gross Generation	50
Net Import	30 <sup>13</sup>
Gross Consumption	80

<sup>13</sup> A positive net import quantity means that the load's consumption is more than the PV generation.

Item	Prices (per kWh) <sup>14</sup>
Energy Generation	\$0.1204 <sup>15</sup>
Energy Consumption	\$0.12153 <sup>16</sup>
AFP	\$0.00037
EMC Fees	\$0.00027
PSO Fees	\$0.00022
MSS Charge	\$0.0017
MEUC	\$0.00032
HEUC	-\$0.00104
UOS	\$0.05

Applicable Payments / Charges	CC with Non-Registered IGS	CC with EMC/CIS-Registered IGS
<b>Energy Charges</b>		
Energy Consumption	[\$0.12153 x 30 kWh <sup>17</sup> ] + [-\$0.00104 x 30 kWh] = \$3.6147	
<b>Reserves Charges</b>		
Spinning Reserves	Not Applicable	
Regulation (ie AFP)	\$0.00037 x 30 kWh <sup>18</sup> = \$0.0111	\$0.00037 x 130 kWh = \$0.0481
<b>Non-Reserves Market Charges<sup>19</sup></b>		
EMC Fees	\$0.00027 x 30 kWh = \$0.0081	
PSO Fees	\$0.00022 x 30 kWh = \$0.0066	
MSS Charge	\$0.0017 x 30 kWh = \$0.051	
MEUC	\$0.00032 x 30 kWh = \$0.0096	
<b>Grid Charges</b>		

<sup>14</sup> This is based on Q4 2014 average prices.

<sup>15</sup> This is based on the simple average nodal prices for Q4 2014. For CCs with EMC-registered IGS, the price paid will be based on the respective nodal price. For CCs with CIS-registered IGS, the price paid will be based on the weighted average nodal price.

<sup>16</sup> This is based on the average USEP prices for Q4 2014, which is charged to CCs who buy electricity from the market. For CCs who buy electricity from retailers, they will be charged based on the agreed retail price for energy.

<sup>17</sup> This is based on the assumptions that in that particular half-hour period, (a) the CC with non-registered IGS, the meter's import channel registers 30 kWh; and (b) the CC with EMC/CIS-Registered IGS has a net-import of 30 kWh.

<sup>18</sup> As the CC with non-registered IGS is not paid for excess electricity injected into the grid, they will not be subjected to the applicable market charges on the electricity generated. Hence, AFP is charged based on the meter's import channel, which assumes to be 30 kWh in that particular half-hour period.

<sup>19</sup> This is based on the assumptions that in that particular half-hour period, (a) the CC with non-registered IGS, the meter's import channel registers 30 kWh; and (b) the CC with EMC/CIS-Registered IGS has a net-import of 30 kWh.

Use of System (UOS)	\$0.05 x 30 kWh <sup>20</sup> = \$1.50	
Uncontracted Capacity Charge (High-Tension & Above Network only)	Depending on type of back-up required	
<b>Total charges to be paid by consumers</b>	<b><u>\$5.2011</u></b>	<b><u>\$5.2381</u></b>

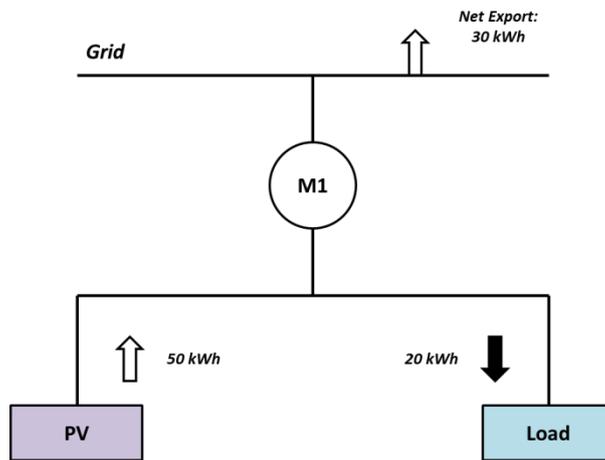
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<sup>20</sup> This assumes that in both scenarios, the meter's import channel registers 30 kWh in that particular half-hour period.

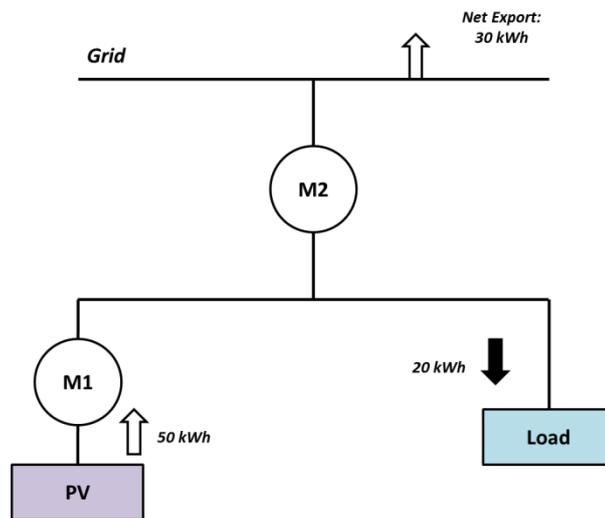
2. Example 2 below provides an illustrative comparison of the market settlement between a CC with a non-registered IGS and a CC with EMC/CIS-registered IGS, when injecting electricity into the grid during a particular half-hour period.

**Example 2: Net Export (injection) into Grid**  
**Comparison of CC with Non-Registered IGS and CC with EMC/CIS-Registered IGS**

**Figure 2(a). Net export (injection) of 30 kWh from grid, CC with Non-Registered IGS**



**Figure 2(b). Net export (injection) of 30 kWh from grid, CC with EMC/CIS-Registered IGS**



Item	Qty (kWh)
Gross Generation	50
Net Export	30 <sup>21</sup>
Gross Consumption	20

<sup>21</sup> A positive net export quantity means that the PV generation is more than the load's consumption.

Item	Prices (per kWh) <sup>22</sup>
Energy Generation	\$0.1204 <sup>23</sup>
Energy Consumption	\$0.12153 <sup>24</sup>
AFP	\$0.00037
EMC Fees	\$0.00027
PSO Fees	\$0.00022
MSS Charge	\$0.0017
MEUC	\$0.00032
HEUC	-\$0.00104
UOS	\$0.05

Applicable Payments / Charges	CC with Non-registered IGS <sup>25</sup>	CC with EMC/CIS-Registered IGS
<b>Energy Payment</b>		
Energy Generation	\$0	\$0.1204 x 30 kWh = \$3.612
<b>Reserves Charges</b>		
Spinning Reserves	Not Applicable	
Regulation (ie AFP)	\$0	\$0.00037 x 70 kWh = \$0.0259
<b>Non-Reserves Market Charges</b>		
EMC Fees	\$0	\$0.00027 x 30 kWh = \$0.0081
PSO Fees	\$0	\$0.00022 x 30 kWh = \$0.0066
MSS Charge	\$0	
MEUC	\$0	
<b>Grid Charges</b>		
Use of System (UOS)	\$0 <sup>26</sup>	

<sup>22</sup> This is based on Q4 2014 average prices.

<sup>23</sup> This is based on the simple average nodal prices for Q4 2014. For CCs with EMC registered IGS, the price paid will be based on the respective nodal price. For CCs with CIS registered IGS, the price paid will be based on the weighted average nodal price.

<sup>24</sup> This is based on the average USEP prices for Q4 2014, which is charged to CCs who buy electricity from the market. For CCs who buy electricity from retailers, they will be charged based on the agreed retail price for energy.

<sup>25</sup> As the CC with non-registered IGS is not paid for excess electricity injected into the grid, the reserves and non-reserves market charges will be based on the meter's import channel, which assumes to be 0 kWh in that particular half-hour period.

<sup>26</sup> This assumes that in both scenarios, the meter's import channel registers 0 kWh in that particular half-hour period.

Uncontracted Capacity Charge (High-Tension & Above Network only)	Depending on type of back-up required	
<b>Total Payment to Consumer</b>	<b><u>\$0</u></b>	<b><u>Energy payment less relevant charges = \$3.5714</u></b>