Smart Energy, Sustainable Future

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

INFORMATION PAPER

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1 Background

1.1 Intermittent Generation Sources ("IGS") typically comprise renewable energy generation such as solar photovoltaic (PV) and wind energy, where the power output fluctuates depending on weather and environmental factors. Based on current technologies, solar PV offers the greatest potential for deployment in Singapore. Solar PV brings about multiple benefits, as it generates zero carbon emissions and requires no fuel imports. This will contribute towards meeting Singapore's overall climate change goals. Recognising these benefits, the Government plans to raise the adoption of solar power to 1 GWp beyond 2020.

1.2 The Energy Market Authority ("EMA") supports greater solar PV growth in Singapore, while also keeping to our core principle of pricing energy right to ensure fair and sustainable growth with long term benefits to consumers. To this end, the EMA has been making several regulatory enhancements to facilitate the entry of solar PV into the electricity market of Singapore. These include streamlining regulations and reducing compliance costs, such as through the implementation of the Enhanced Central Intermediary Scheme ("ECIS") and the use of Solar Generation Profile.

1.3 However, solar PV is intermittent in nature as its generation is affected by weather conditions. This can cause a sudden drop in the amount of electricity generated over a short period of time, which can affect the stability of our power system. As such, with the increasing deployment of solar PV, the amount of solar PV energy that can be expected reliably needs to be accounted for in our planning to ensure that there is sufficient generation capacity in the power system to meet peak demand.

1.4 EMA will also revise the definition of solar PV nameplate capacity for the calculation of licensing threshold as the current definition does not take into account situations with oversized inverter capacity. This may result in an over-declaration of the nameplate capacity.

2 Licensing Definition for Solar PV

2.1 In the Final Determination Paper for Intermittent Generation Sources launched in 2014[1], EMA clarified the licensing threshold and requirements for IGS:

2.1.1 The aggregate Alternating Current ("AC") capacity of IGS at the point of connection to the grid[2] will be used to determine the threshold for licensing requirements. For solar PV systems, the aggregate AC capacity of the inverters will be used. This is because the solar electricity generated has to be converted from Direct Current ("DC") to AC by the inverters, before being exported to the grid.

2.1.2 If the aggregate AC capacity of the IGS at the point of connection is 1 MWac or more but less than 10 MWac, the owner of the system will need to apply for a wholesaler (generation) licence from EMA. If the aggregated AC capacity of the IGS at the point of connection is 10 MWac or more, the owner of the system will need to apply for a generation licence from EMA.

2.2 However, for consumers who sized their inverter capacity bigger than the solar PV panel (i.e. AC capacity is greater than DC capacity), this would result in over-declaration of the solar PV capacity.

2.3 To accurately reflect the installed capacity of the solar PV system, the licensing definition will be revised to the **solar PV system's maximum generation AC output**. This means that it would be determined based on either the solar PV system total installed nameplate capacity or the aggregate AC capacity of the inverters, whichever is the lower.

2.4 The licensing threshold and requirements remain unchanged.

[1] Details of the Final Determination Paper can be found here: https://www.ema.gov.sg/cmsmedia/Consultations/Electricity/Proposed%20Modifications%20to%20the%20Transmission%20Code/1July2014Final_Determination_Intermittent_Generation_Sources_-_1_July_2014_Final_.pdf

[2] The point of connection refers to the point at which the AC output of the IGS facility is connected directly or indirectly to SP PowerAssets ("SPPA") substation.

3 Solar PV Effective Capacity

3.1 Solar energy is intermittent in nature and hence not all of its nameplate capacity can be relied upon, unlike conventional generators.

3.2 As solar PV deployment increases, the amount of solar energy that can be expected reliably (i.e. the solar PV effective capacity) needs to be accounted for in EMA's Generation Capacity Planning to ensure there is sufficient generation capacity in the power system to meet peak demand. The solar PV effective capacity used in the Generation Capacity Planning will also be published in the annual Singapore Energy Market Outlook (SEMO).

3.3 Based on International Energy Agency (IEA)'s Capacity Credit[3] methodology and historical solar irradiance data in Singapore, EMA has assessed the solar PV effective capacity to be around 27%.

3.3.1 For example, based on solar PV effective capacity of 27%, a minimum output of 2.7 MWac can be reliably expected from a 10 MWac solar PV unit, during the system peak demand period[4].

3.3.2 "Reliably expected" refers to 84% of the time (or 84th percentile, i.e. within 1 standard deviation from the average) during the system peak demand period.

3.4 The solar PV effective capacity of 27% will be used to estimate the reliable solar PV output for 2019's Generation Capacity Planning and published in SEMO, and it will be reviewed annually.

[3] Capacity Credit methodology can be found here: https://www.iea.org/media/weowebsite/energymodel/Methodology_CapacityCredit.pdf

[4] The system peak demand in Singapore typically occurs between 2pm to 2.30pm.