



**Asia-Pacific
Economic Cooperation**

2017/EWG/EGNRET48/018

Facilitating the Deployment of Solar Photovoltaic in Singapore

Purpose: Information
Submitted by: Singapore



**48th Expert Group on New and Renewable Energy
Technologies Meeting
Jeju, Korea
29-30 March 2017**

Facilitating the Deployment of Solar PV in Singapore

48th EGNRET

29 March 2017

Solar PV offers **greatest deployment potential** for Singapore

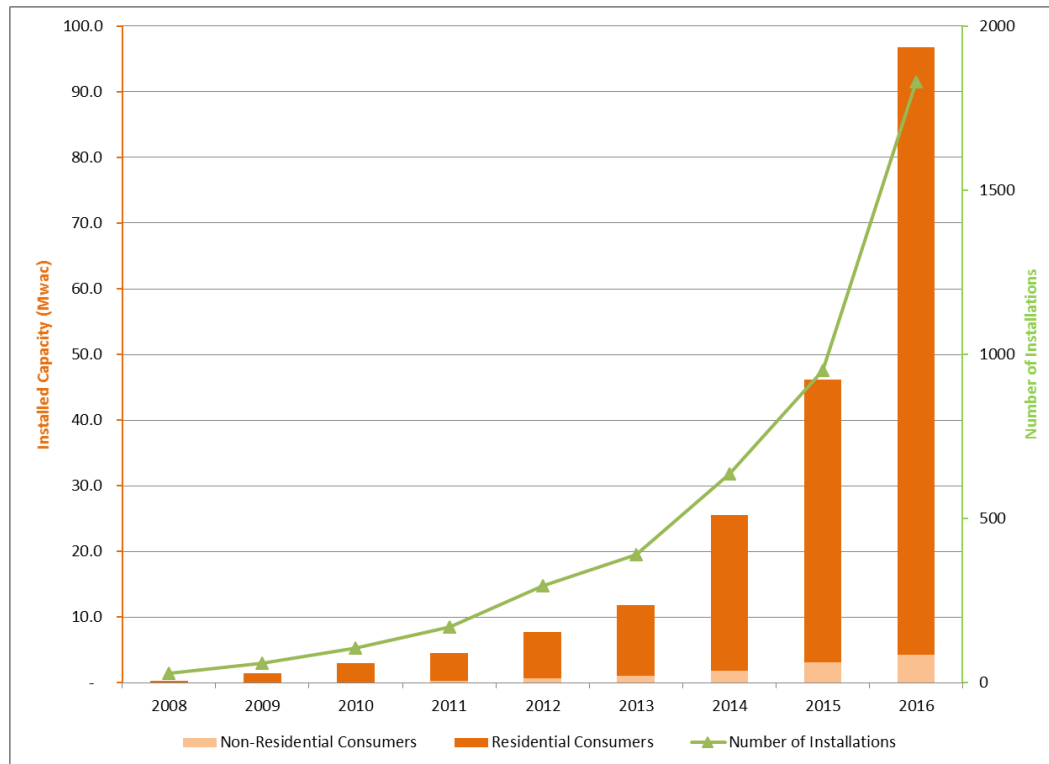
- Due to our physical constraints, Singapore has **limited renewable energy options** –

Renewable Energy	Our Constraints
Hydro	Singapore's terrain is relatively flat
Tidal	Tidal range in Singapore is generally low and our waters are relatively calm
Wind	Singapore has low average wind speeds

- Nonetheless, Singapore is located in the tropical sunbelt with good irradiance. Hence, amongst the renewable energy technologies, **solar generation offers the greatest deployment potential.**

Steady growth in solar PV deployment in Singapore

- **Market interest in solar has been growing in Singapore.** Since 2008 to end 2016:
 - ✓ The number of installations has increased from **30 to 1,840**;
 - ✓ The installed capacity has increased from **0.3 MWac to 96.8 MWac**.
- The take-up is expected to accelerate over the next few years, as prices fall and technology continues to improve.



Singapore Fully Supports the Use of Solar Energy

Solar energy will benefit Singapore when it becomes commercially viable

- Environmental Sustainability
- Energy Security
- Price Competitiveness

There are also challenges that we need to address

- Intermittent in nature and fluctuates based on weather conditions, cloud cover and shadows
- Requires reserves from conventional power sources to ensure system stability

We have taken proactive steps to facilitate the entry of solar energy

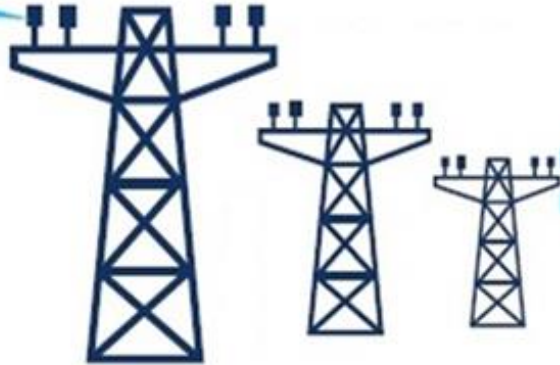
- Enhance market and regulatory framework
- Streamline deployment processes
- Simplify payment procedures

Emerging Paradigm of “Prosumers”

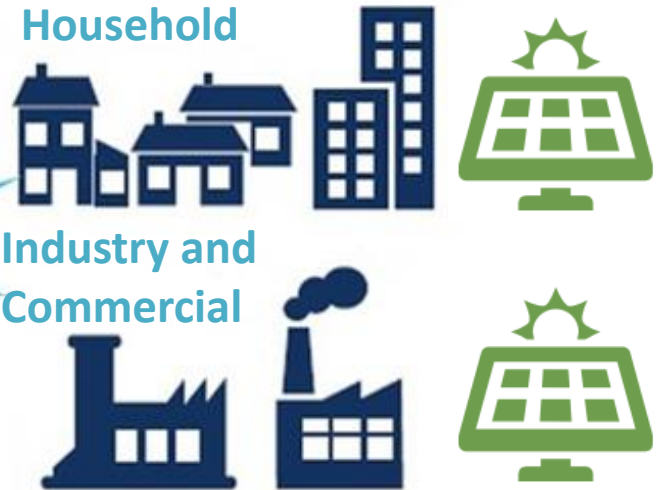
Power
Generation



Transmission
and Distribution



Consumption
and Production

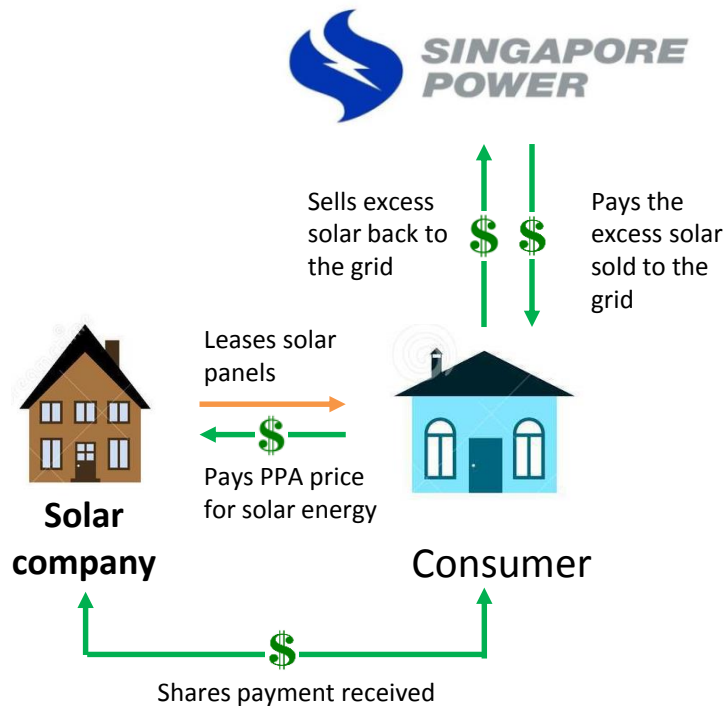


- Previous status quo: either a producer or consumer, where electricity and revenue flow in single directions
- New paradigm: emergence of “prosumers”, where electricity and revenue can flow in both directions

Emerging business models in Singapore's solar landscape add vibrancy to the retail market

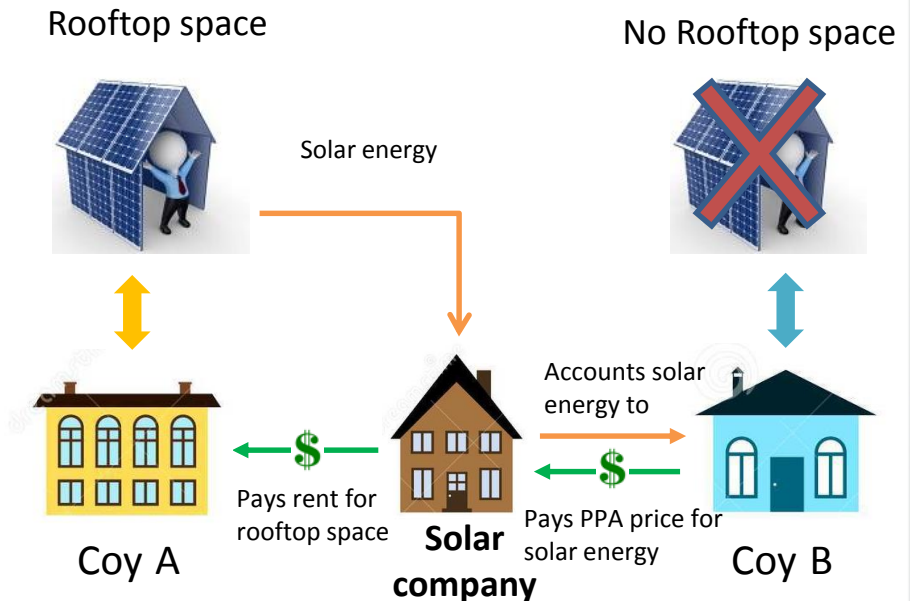
Solar leasing model

Consumers can enjoy green electricity with no upfront cost.



Rooftop rental model

Companies without rooftop space to buy solar energy from intermediaries who lease rooftop space for solar panels



Furthermore, with the **Electricity Futures Market**, solar independent retailers could offer a blend of green retail contracts to suit consumers' needs.

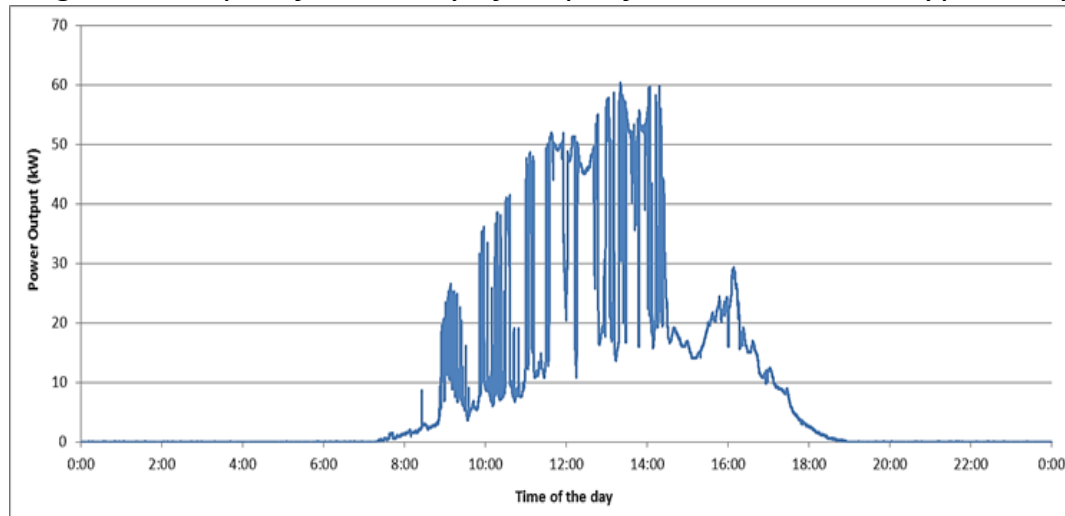
Managing Solar Intermittency to Ensure that our Power System Remains Reliable

At the system-level, solar has intermittency issues because the network needs to ensure that there is sufficient back-up capacity available when weather conditions change.

In the case of Singapore, solar installations tend to be mostly small but can be large collectively, which imposes a burden on the system.

We are reviewing the reserves cost allocation framework to better recognise the characteristics and impact of solar on our power system.

Figure. Example of variability of output from solar PV on a typical day



Facilitating the Entry of Energy Storage Systems in Singapore

- There has been growing interest to deploy Energy Storage System (ESS), in part because of the increased adoption of solar PV deployment and the growing awareness of the potential for demand-side management.

Industry Consultation

- EMA released a consultation paper to seek views from stakeholders on the regulation, licensing and market framework for energy storage
- This will help our regulations keep pace with developments in ESS technology in order to support evolving business models and innovations

Energy Storage Programme

- EMA has also launched the Energy Storage Programme to build capabilities and solutions in grid-scale energy storage, suited for Singapore's weather condition, to deal with intermittency and to facilitate the deployment of solar energy.

THANK YOU