Supporting Information:

Model Assumptions:

- Model Timeframe: 2013 to 2040.
- Total electricity demand in Singapore is equal to the total electricity supplied.
- Levelized Cost of Electricity: 100 S$/MWh in 2019. Average of 73.3 S$/MWh for 1MWp industrial rooftops and 125 S$/MWh for 10kWp residential rooftops.
- Total effect on installation rate: From 2013 to 2019, the effect on installation rate is referenced from EMA statistics. From 2019 onwards, this effect is dependent on the levelized cost of electricity (LCOE).
- Initial Land available for PV:
    - $4km^2$ (Floating PV)
    - $34km^2$ (Rooftop PV)
- Initial Installation Rate for PV:
    - Floating PV: Assume that the floating PV installations begin in 2020. Referencing the PV system installed in Tengah Reservoir, with a size of "*45 football pitches*", which equates to 45 * 7140 = 321300 m^2/year, is installed in the first year.
    - Rooftop PV: Assume that rooftop PV installations begin from 2013. Based off EMA statistics, from Q12012 to Q12013, capacity increased from 6.8 to 12.0MWp, which is 5200kWp. Assuming 18% PV module efficiency and using SolarGy's online solar energy calculator, this amounts to an initial installation rate of 28888.89 sqm/year.
- Module Degradation Rate: 1% of installed area per annum.
- Average Temperature: Take an average temperature of 30°C, 2 degrees below the mean high of 32°C.
- Panel Efficiency: 18% in 2013, 23% in 2020, 25% in 2030.
- Average Air Pollution: Assume a constant PSI of 50 in Singapore.
- Annual Irradiance: Average annual irradiance is 1580 kWh/m^2/year.
- Base Gross Domestic Product (GDP) Growth Rate: Assume long term growth rate of Singapore's GDP of 3 percent per year.
- Energy Conservation and Appliance Efficiency Factor: Assume that efforts in conserving energy and more efficient electric appliances lead to 1% savings in electricity demand every year. Value of 0.99.
- Total Electricity Demand in Singapore: Initial Value of $4.8*10^7$ MWh/year based on full year consumption in 2013.
- Initial Solar Capacity 2013:
    - Floating PV: Assume no capacity from floating PV in 2013.

- Rooftop PV: Based on the capacity of 12.0MWp in Q1 2013, it is assumed that the initial area installed is 66666.7sqm, based off calculations at 18% efficiency.

- Government Expected Peak Solar Capacity: From 2013 to 2019, expected capacity follows EMA statistics. To achieve the government's goal of 2GWp in 2030 from 232.1MWp in Q1 2019, there is needs to be an annual growth in capacity of roughly 21.63% (232.1 * 1.2163^11 = 2000MWp).
- Carbon emissions per MWh electricity by natural gas: Based on 2013 emissions intensity of the grid - 0.4388 tonnes CO2 per MWh electricity.
- Energy used to manufacture solar panels: 0.55774 MWh/m^2, based on data from data in Malaysia's production plants.

Short-term Solar Production Forecasting Model

Table 7
Power conversion guidelines and execution steps for a PV system in a tropical environment, taking low wind influence into account.

Step	Formula	Recipe	Remark
1	Perez model	Generate G_{mod} values based on global horizontal irradiance readings	As demonstrated in (Yang, Dong et al., 2013, Khoo, Nobre et al., 2014) Skip step 1 if G_{mod} is known
2	$T_{mod} = T_{amb} + \gamma G_{mod}$	Choose $\gamma = 0.032\ Cm^2W^{-1}$ for metal and $\gamma = 0.025\ Cm^2W^{-1}$ for concrete rooftops	Skip step 2 if T_{mod} is known
3	$\eta_{mpp}(G_{mod},T_{mod}) = \eta_{mpp,25}(G_{mod})$ $[1 + \alpha\,(T_{mod}-25\ ^\circ C)]$	Choose $\alpha = -0.0045\ ^\circ C^{-1}$ for crystalline wafer-based systems	Adjust α based on known specification sheet of solar modules
4	$\eta_{mpp}(G_{mod},T_{mod}) = \eta_{mpp}(G_{mod},T_{mod})$ $^*\,(sh)$	Choose value of "shading coefficient" (sh) according to shading severity Use $sh = 0.10$ for hard shade Use $sh = 0.45$ for soft shade	Assessment in shading condition at specific times of the day/year to be considered
5	$\eta_{mpp}(G_{mod},T_{mod}) = \eta_{mpp}(G_{mod},T_{mod})$ $^*\,(1 + deg)$	Choose value of "degradation rate" (deg) according to system age Use $deg = -1.2\%$ per annum for tilt angles $< 10^\circ$ Use $deg = -0.8\%$ per annum for tilt angles $> 10^\circ$	Special attention to be given in knowing the start performance baseline of a PV system
6	$\eta_{mpp}(G_{mod},T_{mod}) = \eta_{mpp}(G_{mod},T_{mod})$ $^*\,(air)$	Choose value of "air pollution" (air) according to condition at hand $air = 0.80$ for PSI > 200 $air = 0.85$ for $150 <$ PSI < 200 $air = 0.90$ for $100 <$ PSI < 150 $air = 0.95$ for PSI > 70	PSI = Pollutant Standards Index, air pollution metric for Singapore, see (Velasco and Roth 2012; Liu, Nobre et al., 2014)

Figure A1. Forecasting model based on environmental variables