

Environmental Sustainability: Solar Deployment Toolkit

Importance of Solar Power in Singapore



Solar Power

The most promising source of renewable energy



Geothermal Energy

Not possible as Singapore does not have access to these sources.



Wind Turbine

Not practical due to land scarcity, coupled with the low average wind speed of 2 m/s.



Hydroelectricity

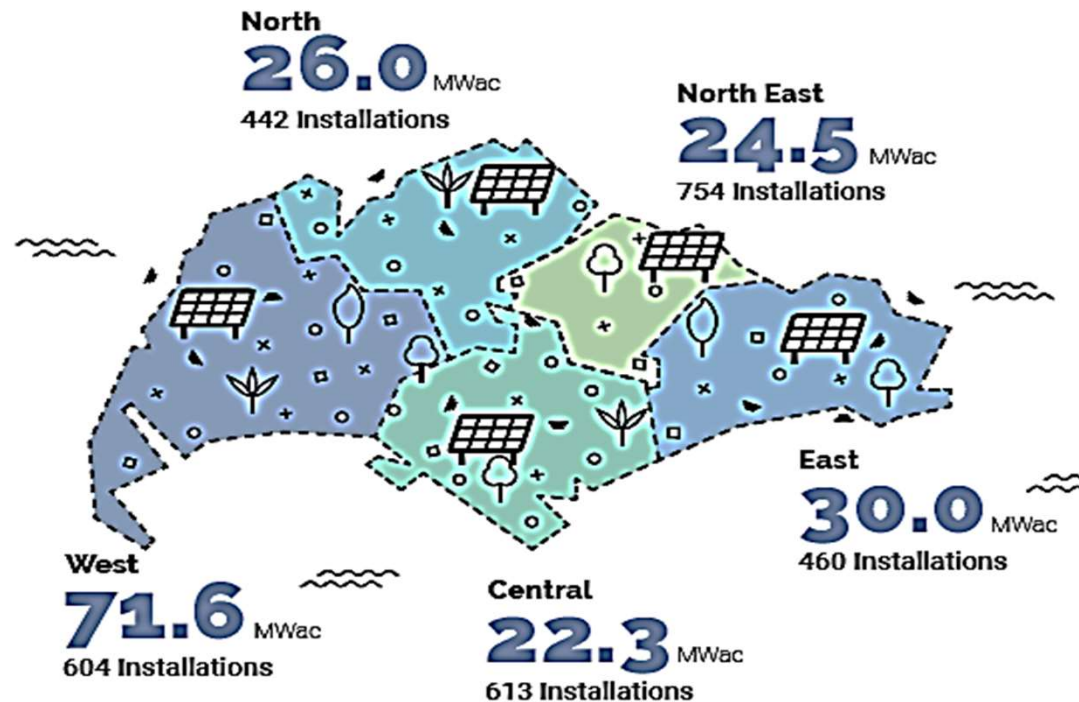
Not feasible given our relatively flat geography and lack of large rivers.

Credits: With reference from Ministry of Water and Environmental Resources (MWER)

Singapore's Solar Landscape



Total **174.3** MWac
2,873 Installations



- Solar power requires conversion from direct current (dc) to alternating current (ac).
- MWac is a measure of power output from solar installations after the output of the PV panels have been converted to ac via inverter devices. (1.2MWp = 1 MWac)

Credits: Image from EMA 2019

Solar Deployment in Singapore



CapitaLand is putting over 20,000 solar panels on 6 of its buildings – that’s enough power for 2,300 HDB flats a year

Jonathan Loh

July 9, 2019



The combined solar panel facility installed atop the six properties will collectively generate more than 10,000 megawatt hours of energy every year. CapitaLand

Thousands of solar panels are slated to be installed atop six of CapitaLand’s Singapore properties by end 2019, forming what could potentially be the largest combined rooftop solar facility in the country by a real estate company.

By 2030, Singapore wants to ramp up its solar capacity by more than seven times from current levels, and increase the current 260 megawatt-peak (MWp) of installed solar capacity to 2 gigawatt-peak (GWp).

ST PUBLISHED OCT 29, 2019, 9:30 AM SGT

Singapore to ramp up solar energy production to power 350,000 homes by 2030



1 of 4 - Solar panels on the rooftop of a block in Ang Mo Kio. Currently, solar energy contributes less than 1 per cent to Singapore's total energy mix. (ST PHOTO: JONATHAN LOH)

PUBLISHED: OCT 28, 2019, 9:30 AM SGT | UPDATED: OCT 30, 2019, 5:06 AM



Judrey Tan Environment Correspondent

SINGAPORE - The Republic is stepping up its drive to soak up more energy from the sun, amid growing global awareness on how fossil fuels are contributing to climate change.

By 2030, Singapore wants to ramp up its solar capacity by more than seven times from current levels, and increase the current 260 megawatt-peak (MWp) of installed solar capacity

Tengeh Reservoir to house one of world's largest floating solar panel systems



Solar panels at Tengeh Reservoir in Tuas in a photo taken on Oct 21, 2019. PHOTO: The Straits Times

by VANESSA LIU
THE STRAITS TIMES | Jun 06, 2019

SINGAPORE - One of the world's largest single floating solar photovoltaic (PV) systems might soon find a home in the waters of Singapore's Tengeh Reservoir.

Types of Solar Deployment Business Models

Solar Roofs

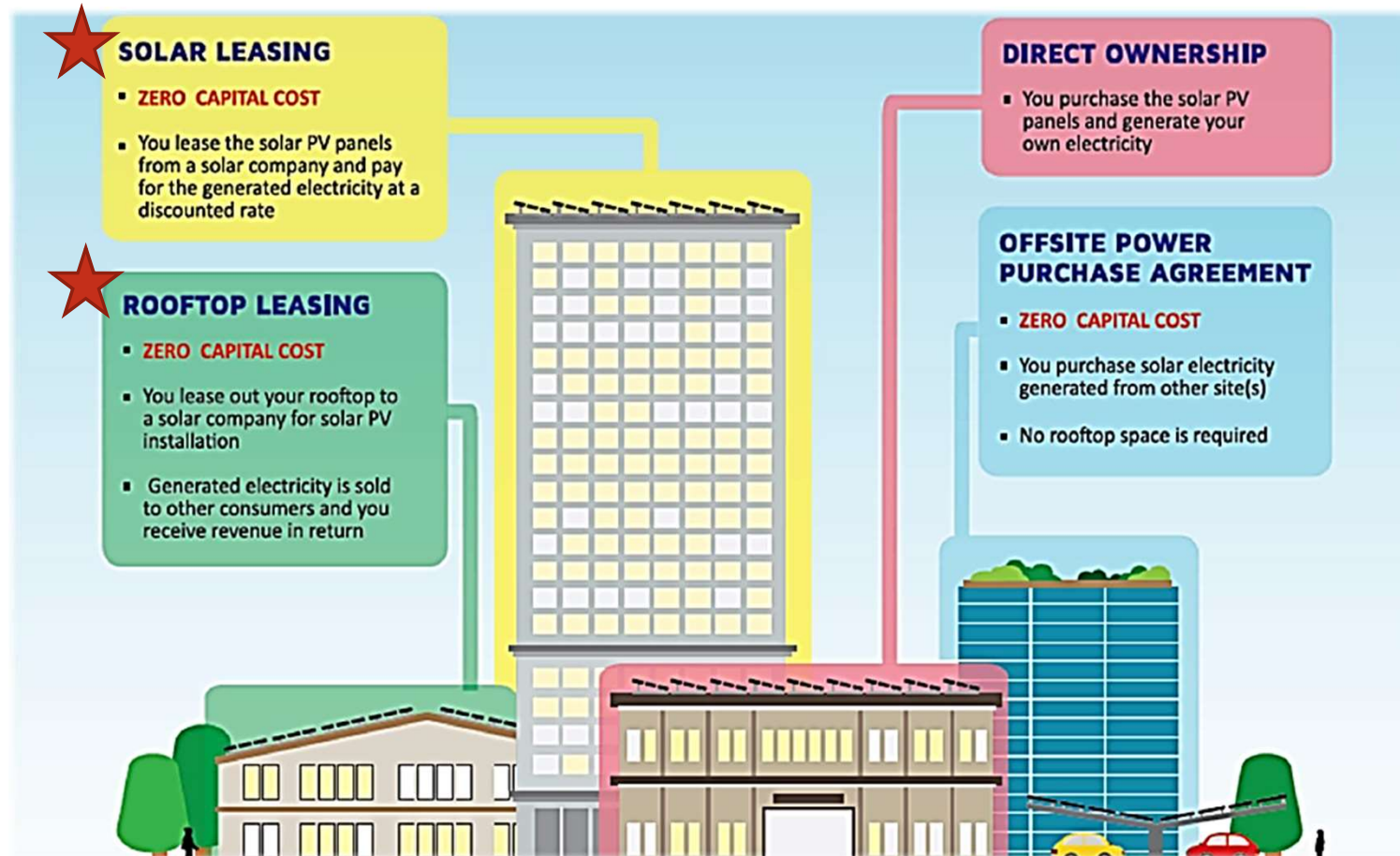


	Property owners' rooftop	Property owners do not have rooftop
Interest in using generated solar electricity	<p>1. Direct ownership</p> <p>★ 2. Solar leasing</p>	<p>4. Offsite Power Purchase Agreement</p>
Low or no interest in using generated solar electricity	<p>★ 3. Roof Leasing</p>	<p>Conventional electricity</p>

★ Models included in JTC's SolarRoof Tender

Credits: Image from Singapore Green Building Council (SGBC)- NEA: Industrial Sharing Slides

Types of Solar Deployment Business Models



★ Models included in JTC's SolarRoof Tender

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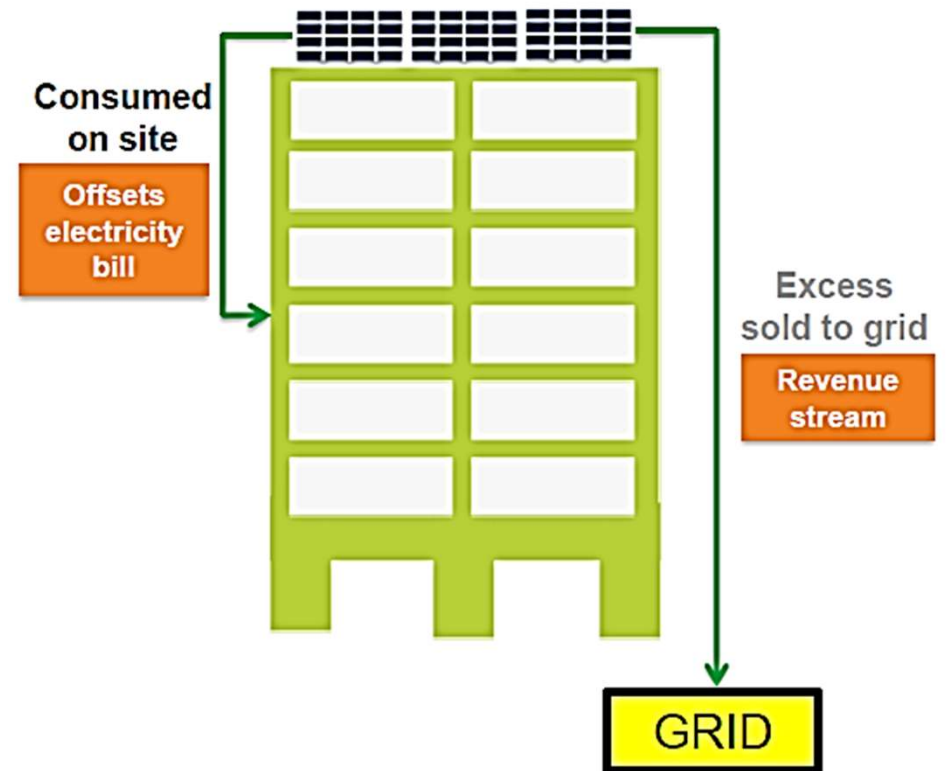


Types of Solar Deployment Business Models

1. Direct Ownership

Property Owner

- Property owners purchase and own solar panels; bear upfront capital cost of solar panels (~\$1.5K to \$2.5K per KWp).
- Generated solar electricity helps to offset a portion of the electricity bill.
- As the generated solar electricity may not fully support property owners' operations, the electrical system will still be connected to the grid for conventional electricity.
- Excess solar electricity (if any) is sold to grid and revenue goes to property owner.
- Responsible for regulatory submission and maintenance costs. Property owner may choose to sign a separate maintenance contract with solar vendors.



Credits: Image from Singapore Green Building Council (SGBC)- NEA: Industrial Sharing Slides



Types of Solar Deployment Business Models

2. Solar Leasing [on-site Power Purchase Agreement (PPA)]

Requirements

- Length of contract to be negotiated between solar vendors and property owners.
- Solar electricity to be consumed by property owners on site.

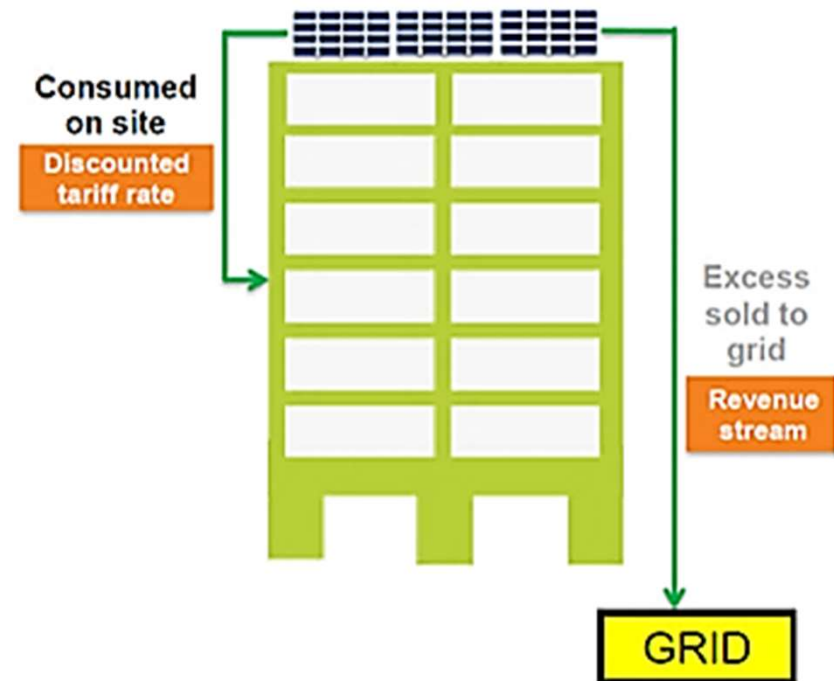
Property Owner

- Zero capital installation costs.
- Pays discounted rates for generated electricity.
- As the generated solar electricity may not fully support property owners' operations, the electrical system will still be connected to the grid for conventional electricity.

Solar Vendor

- Owns and installs solar panels at property owners' rooftops.
- Excess solar electricity (if any) is sold to grid and this revenue goes to solar vendors.
- Responsible for regulatory submissions and maintenance costs.

Credits: Image from Singapore Green Building Council (SGBC)- NEA: Industrial Sharing Slides



Types of Solar Deployment Business Models

3. Rooftop Leasing

Requirements

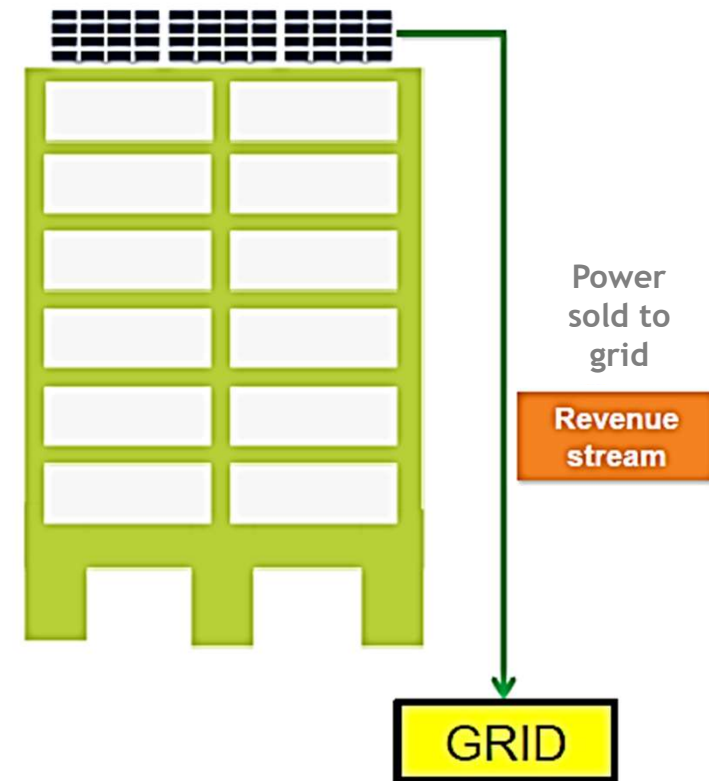
- Length of contract to be negotiated between solar vendors and property owner.
- Suitable for property owners with low demand or do not need generated solar electricity.

Property Owner

- Zero capital installation costs.
- Property owner uses conventional electricity and this installation would not affect existing electricity contract and electricity supply.
- Receives revenue for leasing out rooftop space to solar vendors.

Solar Vendor

- Generated electricity is sold to the grid and revenue goes to solar vendors.
- Responsible for regulatory submissions and maintenance costs.



Credits: Image from Singapore Green Building Council (SGBC)- NEA: Industrial Sharing Slides



Types of Solar Deployment Business Models

4. Power Purchase Agreement (off-site PPA)

Requirements

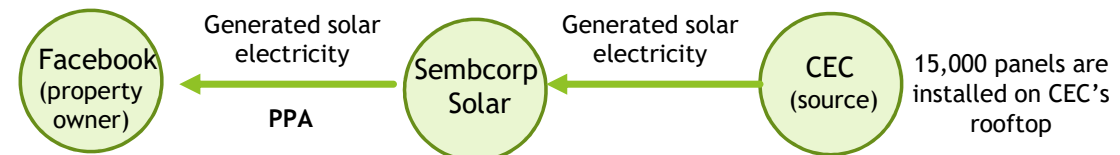
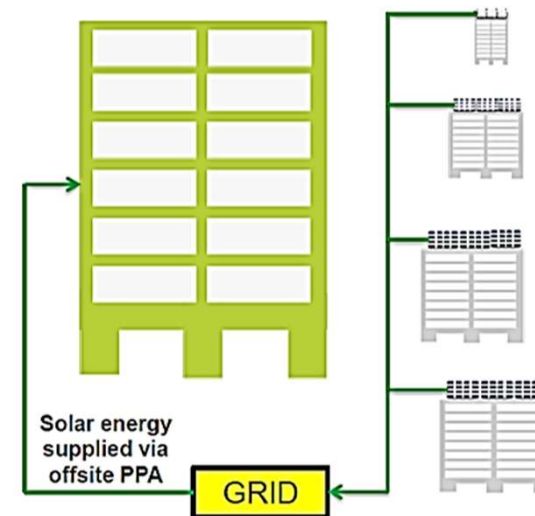
- Length of contract to be negotiated between solar vendors and property owners.

Property Owner

- Property owner purchases solar electricity generated from other sites.
- As the generated solar electricity may not fully support property owners' operations, the electrical system would still be connected to the grid for conventional electricity.
- Do not need to purchase or own solar panels, no leasing of rooftop space required.

Solar Vendor

- Solar vendor signs PPA with property owners and provides generated solar electricity.



Credits: Image from Singapore Green Building Council (SGBC) - NEA: Industrial Sharing Slides

<https://www.semcorp.com/en/media/media-releases/energy/2018/september/semcorp-signs-20-year-deal-to-supply-solar-power-to-support-facebook-s-singapore-operations/>

<https://www.businesstimes.com.sg/companies-markets/semcorp-to-install-operate-over-15000-rooftop-solar-panels-at-changi-exhibition>

Alternative Method To Go Green Renewable Energy Certificates (REC)



One (1) REC means 1 MWh of electricity was generated from an eligible renewable energy source (e.g. solar panels, wind turbines etc.) and delivered to the grid. RECs are also known as “green” credits.

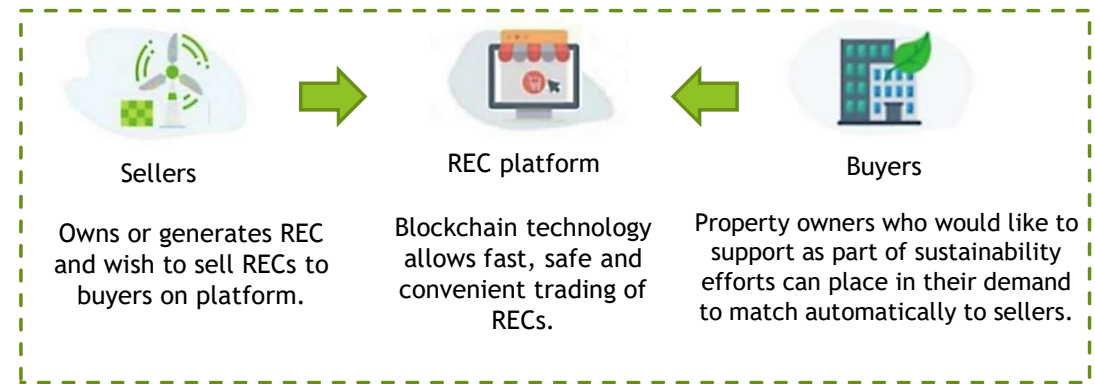
Requirements

- May need to purchase generated green energy at a premium price.

Property owners

- Property owner uses conventional electricity and this installation would not affect existing electricity contract and electricity supply.
- Do not need to purchase or own solar panels, no leasing of rooftop space required.
- RECs expand consumers’ electricity service choices, verify that property owners’ purchases of electricity are from low or zero emission source and supports renewable electricity development.
- Examples of local companies who have signed up to use SP Group digital marketplace include DBS and City Developments Limited (CDL).

SP Group has launched a REC digital marketplace, which is a platform powered by blockchain technology to link up buyers and sellers.



1 MWh can power a 4-room HDB flat for 2.5 months.

Credits: Image from SP Group

<https://www.straitstimes.com/singapore/easier-for-small-producers-to-sell-green-credits>

JTC's Solar Targets



Reducing Carbon Footprint



Generating Renewable Energy

Solar Land	105** MWp	By 2030
Solar Roof	20** MWp	By 2030
Solar Linkway	2** MWp	By 2030

WOG target for 3 types of solar deployment ~2GWp.

***The above numbers are only for JTC owned and managed properties, and exclude property owners' (lessees') buildings.*



JTC's Solarising Efforts: Past, Present and Future



JTC Space@TBP



JTC Space @ Gul



Jurong Town Hall



Tuas South SF

- JTC called the first solar rooftop tender in 2015 for installation of solar panels on JTC's developments.
- Appointed solar vendor leased rooftop space and paid rental to JTC. Solar vendor earns revenue from the sales of generated electricity sold to grid. JTC currently has approximately 1 MWp of solar panels installed on its properties.
- This year, JTC will call another tender for a solar PV vendor to install solar panels on other JTC's properties:
 - Opportunity for property owners to tap on JTC's tender for economies of scale
 - Property owners will contract directly with new solar PV vendor

Examples of Property Owners Who Have Deployed Solar Panels

Greenpac



Solar capacity (Rooftop) : 0.45 MWp (2,900 sqm, 1,780 panels)

Direct Ownership model

Started in 2013

Avg annual savings: S\$107K (50% of total energy bill)

Rolls Royce



Solar capacity: 2.8 MWp, [28,500 sqm, 12,000 panels]

- Rooftop: 2.1 MWp, 19,000 sqm
- Carpark shelters: 0.7 MWp, 9,500 sqm

Solar Leasing model

Solar vendor: LYS Energy Solutions Pte Ltd

Committed 20 years from 2015

Avg annual savings: N.A

Financial Schemes Available: UOB's U-Solar Programme

Application Process

Step 1: Consultation, assessment and site visit

Step 2: Accept solar partner's proposal and UOB's financial scheme

Step 3: Installation

<https://www.uobgroup.com/u-solar-sg/business.page#howtoapply>



Save up to 25% on your electricity bill

Use solar energy and achieve significant reductions off your electricity bill immediately.



Cut your carbon footprint

Reduce 780 tonnes of carbon emissions - the equivalent of a car driving 70 revolutions around the earth.



Enjoy a one-stop solar solution

UOB's solar partners will handle the assessment, installation and maintenance of the solar system so you can enjoy a hassle-free experience.



Be recognised as a green company

Enjoy the enhanced reputation of employing green solutions.

UOB Solar Partners





Thank You