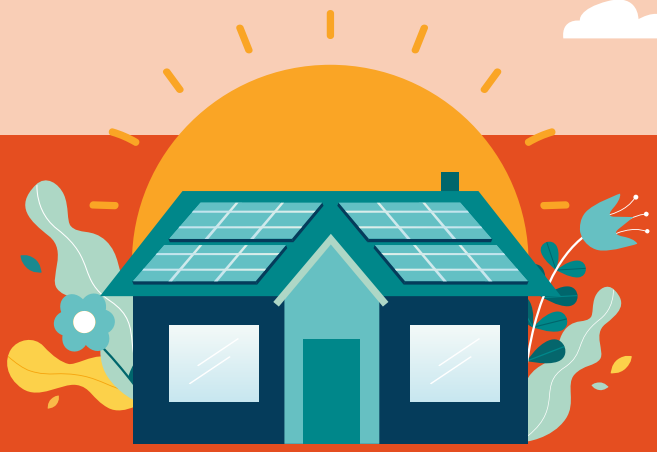
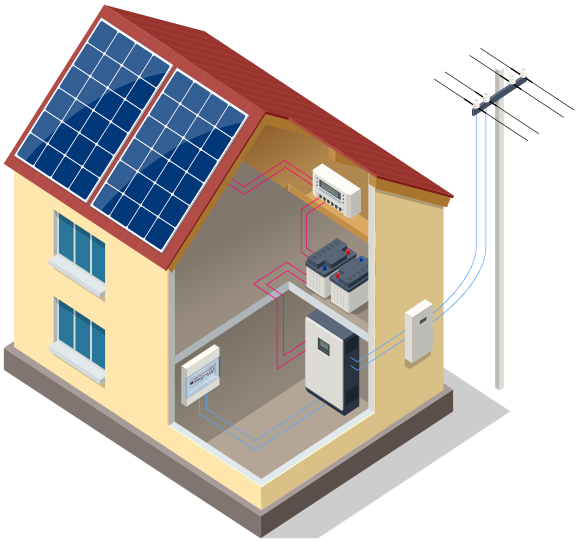
Solar Photovoltaic Systems



Moreland City Council has an objective to achieve a zero carbon community by 2040. This guideline assists with incorporating Solar Photovoltaic (Solar PV) renewable energy systems into the design of new development.



What is a Solar PV system?

Solar Photovoltaic (PV) is technology that converts sunlight into electrical energy. The complete combination of individual elements such as panels, mounting, wiring, safety switches and inverters make up a solar PV system.

What factors influence a Solar PV system's performance?

The output of a solar PV system will vary depending on several factors such as climate, roof pitch, roof orientation, shading or obstruction, the system size and the quality of the installation. Each of these elements will affect the solar system's performance and the potential renewable energy benefits.

What are the benefits of including a Solar PV system in the initial design of a development?

The design and location of solar PV interrelates with other planning and design considerations directly or indirectly, such as visual amenity, spatial constraints, passive design and overshadowing. Incorporating on-site solar PV systems during the planning approval stage therefore elevates issues that can arise later in the building stage that can impact the efficiency of a system. This includes considering roof design by ensuring sufficient space and area, shape and orientation of the solar PV panels, and overshadowing of the solar PV panels by structures or trees. Considering such elements will also ensure that the design of the solar PV system does not have a negative impact on the overall aesthetics of the building to help create attractive streetscapes.

Will including a Solar PV system achieve a net zero carbon emissions building?

While renewable energy is an important element to achieve net zero emission development, another imperative element is energy efficiency. Regardless of how many solar panels can be installed, if energy efficiency is not at the core of the development, net zero emissions may never be realised.

With good thermal performance, energy efficient services and behavioural awareness, the medium density development (townhouses, units and dual occupancies) have the potential to achieve net zero emissions from the proposed metric.

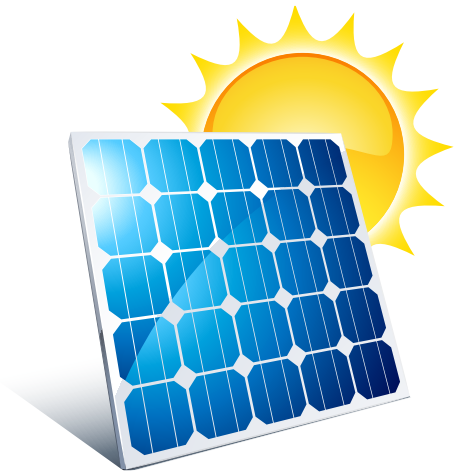
Apartment buildings however may not achieve net zero emissions from on-site renewable and energy efficiency alone. Off-site renewable energy purchasing may be required to complement the metric proposed to achieve a net zero emissions building.

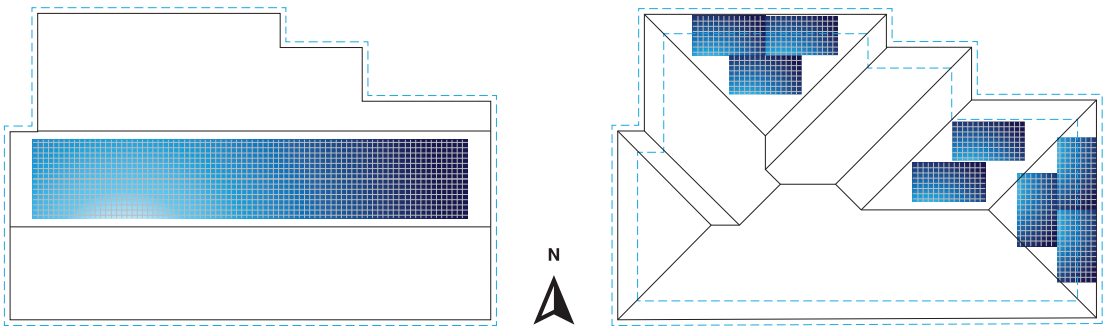
Industrial development very much depends on its usage and whether any energy intensive process would be taking place, but generally, and due to a large roof area, many warehouses can potentially achieve net zero emissions from on-site renewable energy generation.

Moreland Solar PV Metrics

Supported by Moreland City Council's zero carbon agenda, new development within the City of Moreland are encouraged to include on-site renewable energy in the form of solar PV systems.

The size, design and location of the solar PV system differs depending on the building typology. Therefore, 3 various solar PV metrics have been developed to assist new development with incorporating solar PV systems.



METRIC 1: **Medium Density Development (townhouse and standalone dwellings)**	
Metric Specifications	Provide the following solar PV system for each dwelling: • A minimum 3 kW for each 1-2-bedroom dwelling; and • An additional 1 kW for each additional bedroom
Design Guidance	Roof design is the most critical element in the dwelling's design to achieve the solar PV metric for medium density development. A solar friendly roof design includes: • Pitched and flat roofing to allow the solar panels to be placed continuously facing North, East or West (or any direction in between). • Panels placed on no more than two roof orientations (A). • A roof that includes large amounts of valleys and changes in direction cannot accommodate enough solar PV modules to achieve the metric (B).  A. B.
Elements to include on plans	• A roof plan showing the location of the solar PV panels • The pitch angle of all roofs. • Spatial provision for any future battery storage solutions in accordance with AS/NZS 5139:2019.

METRIC 2: **Apartments**	
Metric Specifications	• Provide a solar PV system with a capacity of at least 25 W per square meters of the development's site coverage*; or • 1 kW per dwelling. *Capacity of solar PV system in kW = $\frac{\text{Site coverage (m}^2\text{) x 25 (W/m}^2\text{)}}{\text{1,000 (W/kW)}}$
Design Guidance	The solar PV system must be located: • On a suitable roof, balcony or other area that can facilitate substantial energy generation from solar PV panels. • Within areas that will not be shaded by adjacent structures and positioned so not to self-shade. • In an area other than a void or lightwell, skylight, green roof, roof terrace, mechanical plant, drone landing pad, or other plant to be installed (unless the solar panels are installed over part of the green roof, roof terrace or plant). This can include the top of the lift shaft (lift overrun) and stair shafts, where suitable. • Be readily accessible for cabling. A pergola may also be used, on top of a roof terrace, that assists with balancing competing outcomes. Solar modules may also be located in areas other than the roof such as vertical solar PV panels on walls and building integrated PV (BiPV) systems.
Elements to include on plans	A roof plan that includes: • The roof area in metres square (m^2). • The location of the solar PV panels, dimensions, tilt angle and capacity. • Green roof or roof terrace. • Mechanical and other plant equipment. • The pitch angle of all roof forms. • Spatial provision for any future battery storage solutions in accordance with AS/NZS 5139:2019.

METRIC 3: **Industrial**	
Metric Specifications	• All roofs must be structurally designed to be able to accommodate full solar PV coverage, excluding areas set aside for plant equipment or areas significantly shaded by other structures; and • Include a solar PV system that is: – Sized to meet the energy needs of the building's services (lightning, air-conditioning, industrial processes); or – Maximised based on the available roof area; or – Where no industrial process is proposed, a minimum of 1.5 kW per tenancy plus 1 kW for every 150 m^2 of gross floor area.
Design Guidance	• Within areas that will not be shaded by adjacent structures and positioned to minimise self-shading. • In an area other than a void or lightwell, skylight, green roof, roof terrace, mechanical plant, drone landing pad, or other plant to be installed (unless the solar is installed over part of the green roof, roof terrace or plant) and can include the top of lift and stair shafts where suitable. • Be readily accessible for cabling
Elements to include on plans	A roof plan that includes: • The location of the solar PV panels, dimensions, tilt angle and capacity. • Green roof or roof terrace. • Mechanical and other plant equipment. • The pitch angle of all roof forms.

Source: Solaris (2021)

Other Design Guidance for all PV systems

Solar PV layout and angles

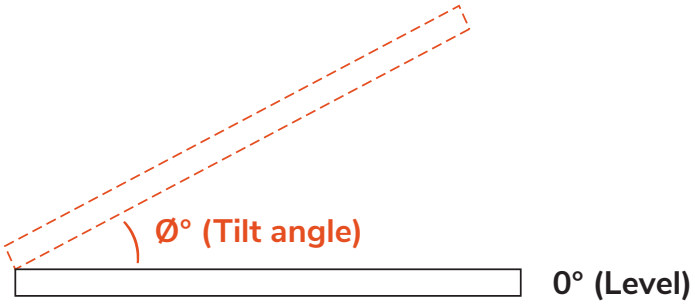
When designing the roof and placing the solar PV panels, a 1050 x 1700 mm sized solar PV module with a power rating output of 340 W can be assumed. Larger panels of 1050 x 2100 mm with a power rated output of 400 W may be utilised however will need to be specified within the design and annotated on plans. Manufacturer specifications can differ and it is encouraged to request information regarding a panel's size, power rating output, effective capacity, and installation requirements and limitations (e.g. racking and cabling on a roof).

Smaller buildings, such as townhouse developments, should place panels to face 1-2 different directions only (e.g. East and West) and therefore generally operate with only one inverter. When panels are facing two directions the inverter must have two Maximum Power Point Terminals (MPPTs). System designs with more than two directions will require micro-inverters installed at the back of each panel.

Please note that modules in series will have the electrical current of the least productive module whereby strings in parallel will have the same voltage as the least productive string. For this reason, the above has been specified.

Large developments, such as apartment and industrial buildings can have a larger solar PV system that may require multiple inverters. When multiple inverters are used, the solar PV system can accommodate panels facing more than two directions.

The tilt angle, being the angle between the horizontal plane and the panel, must be at least 10 degrees to allow for self-cleaning. In Melbourne, a tilt angle equal to the latitude (38 degrees) results in the highest annual energy production.



The system however may be designed to suit different requirements, limitations and usage profile.

Shading

Solar PV panels should not be shaded. Partial shading may impact the energy output of the system. Shading can be caused by trees, nearby buildings, and structures on the rooftop.

Self-shading is inflicted when the tilt of the front row of the solar PV panels overshadow the rear solar PV panels behind them. Therefore, clearance (a gap) between the strings (the rows of panels) must be considered and be appropriate for the tilt angle to improve the solar PV system's performance.

Alternative solutions

Where it is demonstrated that a metric cannot be met, an alternative solution and design approach may be appropriate. The alternative solution will need to be discussed on a case-by-case basis and must be supported by Council Officers.

Further Information

For additional guidance and details, please refer to:

Moreland City Council Renewable Energy Standard (Moreland City Council, 2021)

Moreland Zero Carbon Planning

Moreland City Council 90 Bell Street, Coburg 3058 **www.moreland.vic.gov.au**

Moreland Language Link

廣東話 9280 1910
Italiano 9280 1911
Ελληνικ 9280 1912

عربي 9280 1913
Türkçe 9280 1914
Tiếng Việt 9280 1915

हिंदी 9280 1918
普通话 9280 0750
ਪੰਜਾਬੀ 9280 0751

All other languages
9280 1919