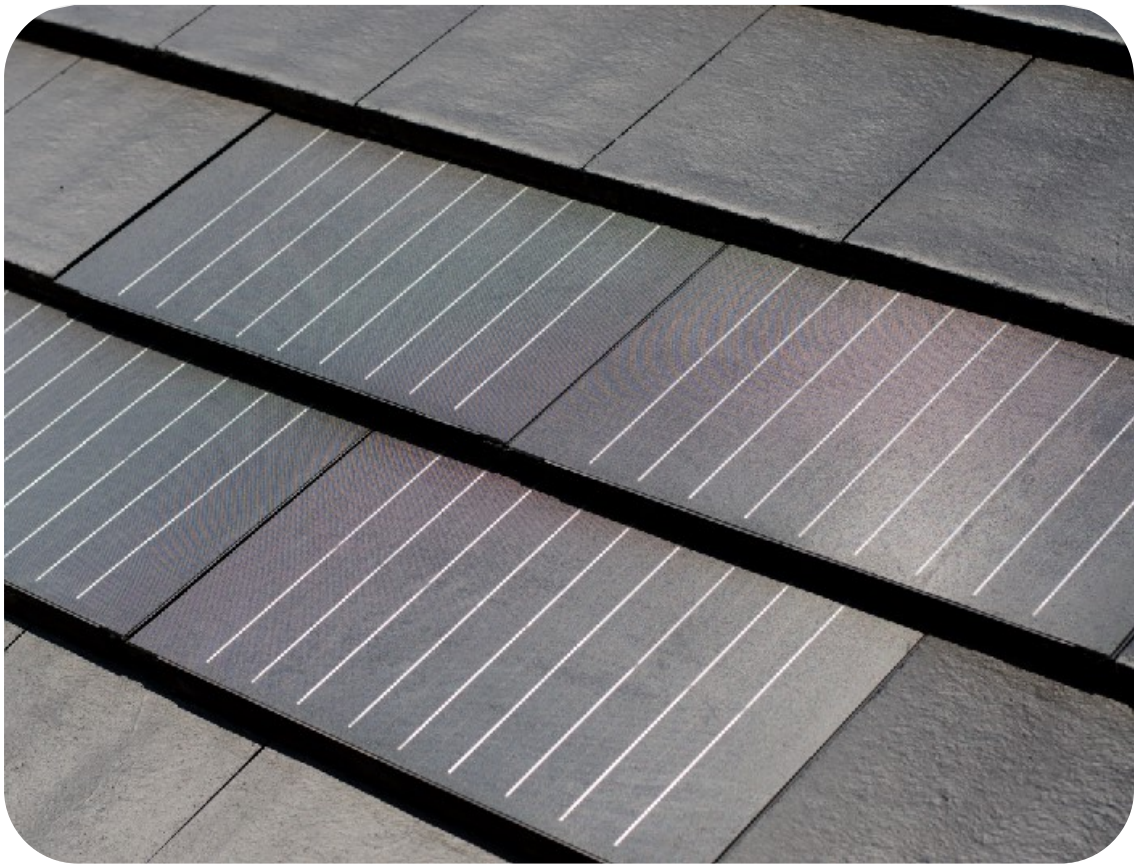
Marley SolteQ PV (photovoltaic) Solar Tile System

A stylish and revolutionary integrated solar solution that delivers outstanding aesthetics, long lasting durability and a high energy efficiency output that is economical, profitable and clean.



MarleyRoofing

PRODUCT DESCRIPTION:

The Marley SolteQ Integrated PV Solar tile is a flat double interlocking profile with six integrated photo voltaic cells. This PV tile can only be installed with the Marley Modern Flat Interlocking Concrete tile, to produce a stylish integrated solar roofing solution.

QUESTION AND ANSWER SECTION:

Q: Why should I consider the Marley SolteQ PV (Photo Voltaic) Solar System?

- An elegant integrated aesthetic

  The Marley SolteQ PV Solar Tile fits perfectly with Marley's Modern Flat Interlocking Concrete Tile to produce an integrated aesthetic that is much more pleasing than that of a conventional Solar Panel System.

- Maximum and efficient use of the roof space

  When compared to conventional solar panels – the Marley SolteQ PV Tile system is much more effective for complex roof designs where the available roof space does not allow for the installation of conventional solar panels e.g. Roof with multiple dormers, hips and valleys. As an example, a 5kW solar system may produce enough energy to power your home, but you may not have enough roof space for a system of that size. Solar panels for households typically come in the standard dimensions of 1.70m x 1.00m, that's around 1.7m2 for every panel installed. However, the wattage output (W) of the panels will likely vary between 250W and 330W for a more efficient module. As a guide, you'll need 4 x 250W panels, or 3 x 330W for every 1kW of your solar system. If you're considering a 5kW system, that's between 15 and 20 solar panels that will require anywhere between 25.5 – 34m2 of roof space.

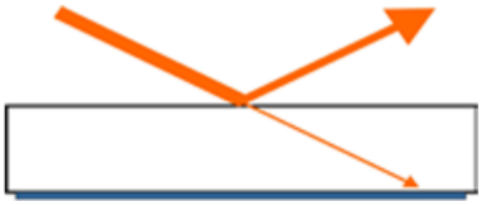
To produce the equivalent power output using the Marley SolteQ PV Tiles, you will need more or less the same roof space - 33.81m2 (169 tiles) - though the difference is that the full roof area can be used.

- Unparalleled efficiency when compared to a Standard-PV-Module – the Marley SolteQ PV Tile will start generating power earlier in the morning and longer during twilight whilst a conventional solar panel is still "sleeping" or "shutting down"

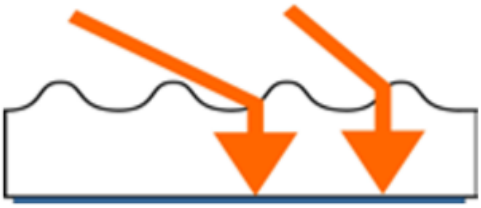
The optimal power generation of the Marley SolteQ PV Tile in low-light conditions are between 2% and 10% more efficient when compared to standard PV-solutions.

The prismatic glass structure of the PV Cell has a, "trap-effect" for incoming light beams. Once the light hits the glass, it remains there, dropping directly onto the cells. As a result, the high efficiency monocrystalline cells improve the ability of the tiles to continue generating power in low light conditions/twilight - extending power generation for longer periods within a day and making it suitable for east or west installation to compliment the primary power generation of North facing tiles – hence morning and evening consumption during winter months are also optimised.

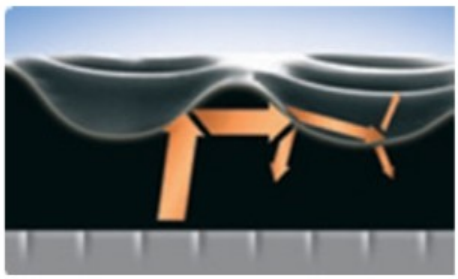
Shadows and shading are problematic for conventional solar panels, but do not pose any problems for the Marley SolteQ PV Tile. The optimizer function within our tiles - use of a bi-pass diode - ensures overall system performance is maintained.



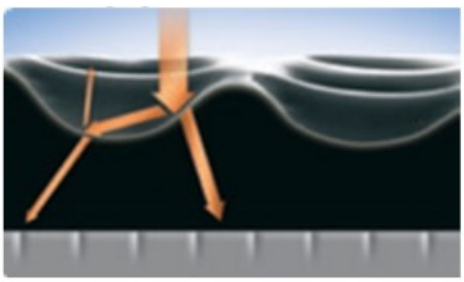
Standard-PV-Module = high reflexion



SolteQ surface traps light to use 100% of the incoming light



Light-Trap-Effect



Low reflexion at the air/glass

- Supreme durability against extreme weather conditions

  - the high quality toughened glass is impervious to cracking as a result of frost damage and meets the requirements of the Swiss Hail Protection Class 3 Standard. As a result, the glass can withstand the most severe hail storms. *

  - on the back of each tile is fitted a storm clip which ensure the tiles are held firmly in place at all times and in particular during extreme storm conditions.

  - 100% Water and rainproof system – when the tiles are used in conjunction with an *under-tile waterproof membrane * Radiant barriers will subject the solar tiles to higher temperatures resulting in a drop of efficiency, it is therefore recommended to use an undertile membrane and ventilated ridge tiles – for more information contact Marley Roofing.

- Superior strength

  Capable of with-standing loads of up to 850kg per m² and wind load/tensile force of 50kg suction load per tile.

- Light and easy installation

  The Marley SolteQ PV tiles hang directly onto the wooden battens and perfectly interlocks with the Marley Modern Concrete Roof Tile without any need for further fixing or costly substructure support.

- Exceptional life-time range and guaranteed

  Marley Roofing together with SolteQ Africa offers a 22-year product warranty for electrical and mechanical functions for normal environmental conditions.

  The high-quality silicon and glass will not rot and yellow in 100 years, ensuring long lasting efficiency.

15-year performance guarantee of 90% nominal power.
25-year performance guarantee of 85% nominal power.
40-year performance guarantee of 80% nominal power.

Any of the above guarantees are only valid if the Marley SolteQ PV Tile has been installed by an approved Marley SolteQ Solar Installer together with a Marley Approved Truss & Fit Roofing Contractor.

- Great return on investment

  Increase the resell value of your home and initial onset cost can be recouped within * + - 8 years. *dependant on grid tied or battery system, size of system and additional accessories, contact Marley for ROI calculation based on your roof design and consumption requirements.

- A clean source of energy and recyclable

  100% clean energy production without emissions or pollution due to burning oil or coal. All components of the Marley PV Tile can be recycled.

- Conforms, and in some cases, exceeds international standards
  *see certification section

BASIC EXPLANTION OF STANDARD SOLAR VALUES:

Each solar manufacturer provides the values Voc, Vmpp, Impp, and Wmpp for each of the PV-solutions (solar panels, tiles, slates). These are standard conditions the industry has defined to ensure that the different pv-solutions from different manufacturers can be compared with one another.

- Voc - stands for open circuit voltage and is exactly what the name implies. That is, with no load (zero current being delivered), the array will generate this amount of DC voltage.
- Wmpp, Vmpp and Impp - In the case of a solar cell, the amount of power being delivered will simply be the voltage multiplied by amperage:

power (in watts) = voltage x amperage

This point where the most power is delivered is denoted by **Wmpp, or maximum power point watts**. It's also sometimes called just **Pmax or maximum power.** The voltage and current at this point are called Vmpp and Impp for maximum power point voltage and maximum power point current, respectively.

- **Solar Efficiency -** Solar cell efficiency refers to the portion of energy in the form of sunlight that can be converted via photovoltaics into electricity.

  The efficiency of the solar cells used in a photovoltaic system, in combination with latitude and climate, determines the annual energy output of the system. For example, the Marley SolteQ PV Tile offers a 21.24% efficiency and an area of 1m² will produce 147.9Wp at Standard Test Conditions.

- **Wp (Watt peak) -** Solar panels are given a power rating in Watts, based on the amount of electricity they can produce in one hour of peak sunlight

Q: What are the factors that affect the efficiency and output of a solar solution?

1. **Manufacturers output tolerance** – most Photovoltaic systems have an output tolerance +/- 3%, which means that the manufacturers pv-module will perform within 3% of its Watts rating.

2. **Dirt build on PV Cells** - Dirt and grime also affect the efficiency of a PV Cell. This varies from pv-solution to the next, however, because of the frameless design and rounded structures of the surface glass of the Marley PV Tile, dust and pollution will be washed away by rainwater. Though during extended times of less rain, it is recommended to clean panels regularly with light water pressure to ensure best performance.

3. **Temperature derating** - Temperature has an effect on the efficiency and maximum pv output of a pv solar system. The hotter a pv panel/tile or slate gets, the less power it generates. The ambient temperature,

temperature coefficient of the actual panel/tile/or slate and the type of installation are all factors that affect the yield potential of a solar power system.

a. Temperature coefficient - Every solar panel/tile/slate will have a temperature coefficient. The temperature coefficient represents the rate at which the panel will underperform at each increase in degree Celsius (°C). Most panels have a temperature coefficient of between -0.2% /°C to -0.5%/°C, when tested under standard laboratory conditions, where ambient temperature is set to 25°C. The closer the temperature coefficient is to zero, the better the panel will perform when the temperature rises. All solar panel/tile/slate manufacturers are required to provide the temperature coefficient figure. See technical detail for Marley's Temperature coefficient.

b. Ambient Temperature – This is dependent on the temperature range of any given location. In many instances, a solar cell can get as hot as 65°C, causing the cell to become less efficient and therefore produce less power. If a pv-model with a temperature coefficient of -0.4%/°C were to reach an extreme heat of 65°C, it would reduce output by as much as 26% (-0.4% x 65). However, there are more variables involved than simply the coefficient value, and the equation becomes a little more complicated.

c. Type of installation - The type of pv-solution and its installation also has an effect on the temperature of the pv-module. As an example, when solar panels are installed on a rooftop, they experience far greater temperatures than the current ambient temperature. Panels that are fixed parallel to the roof with little to no airflow between the rooftop and panel are the least efficient and experience the greatest rise in temperature (35°C). A typical rack-type installation will allow for a gap of greater than 150mm between the roof surface and the panel, allowing airflow to have a cooling effect on the panel. This type of installation is more efficient than an installation fixed parallel to the roof and typically

leads to a 30°C rise in panel temperature. However, the best scenario is where the solar panel is pole-mounted in a free-standing frame (25°C). Each of these installation types has an effect on the temperature of the panel, and therefore the output of the panel.

With the Marley SolteQ PV Tile being part of the roof and having the roof cavity below it, allows for enough air circulation over and under the tile for the pv cells to be less impacted by ambient temperatures. The cooling of the tiles can be further improved by the use of a ventilated dry-ridge system and counter-battening the roof, thereby increasing the ventilation air gap under the tiles.

4. Roof tilt and orientation - The direction that pv cell face, and the angle that they are mounted, also have an effect on the output of the panel/tile/slate. If they are not positioned at the optimum angle and direction, then a conventional pv solution will not produce rated output for that location. This is a must when accurately calculating solar output.

    a. Direction - The direction a solar pv-module should ideally face for optimum sun exposure, varies depending on location. For South Africa, solar power yields are higher when a pv-module faces north. Hence, the direction solar installation face, along with their angle, or tilt, at that orientation; are vital inputs in order to accurately calculate the solar power potential for a property. These two inputs, along with the location of the property, are needed to calculate solar energy at a given site.

    If you reside in South Africa, and your solar installation doesn't face north, your property may still be suitable for generating solar energy. If your property faces east or west, a conventional pv-module can still generate some-what good yields. Depending on your location and roof pitch, you're going to lose somewhere between 10 – 20% efficiency as a result of not having your pv solution facing in a due north direction. If you have the option to place the pv-module in more of a north-east, or north-west

direction, it is recommended. This will increase sun exposure to the pv-module and therefore increase the system's ability to generate solar power.

If your property is constructed in such a way that you are only able to face a conventional pv-module in a southerly direction, then you will lose further capacity, as compared to a north facing system.

Shading may be an issue to the east or west side of your property. If it is, and it blocks daylight sun to a conventional solar system such as, solar panels at any time of day, then it will result in a loss of solar energy generation. If just one side, east or west, is exposed to shading conditions, then consider placing the panels on the opposing side.

Though due to the higher efficiency output of the Marley SolteQ PV tile at lower light levels and being able to still generate in shaded areas, makes it the perfect solution for a property that does not offer ideal circumstances.

b. Electricity consumption and orientation - When your building consumes most of its electricity is important when determining the orientation of your solar solution. If your household or business uses most of its electricity during the late afternoon hours, then you're probably better off facing the pv-module west rather than east. The added financial benefit of this, is that it coincides with the time of day when your electricity supplier will charge you peak rates to purchase power from them. Based on this premise, there may even be some cases where a lower yielding west-facing pv-module is favoured to a north-facing one. However, careful modelling should be carried out before choosing west over north. If on the other hand, your electricity consumption is greater during morning daylight hours, then you may be better off positioning the pv-module to face east rather than west. Again, the renewable energy you generate will save you from peak morning electricity rates.

c. Angle - The angle and orientation of your roof, along with the location of your property, will have an impact on how much solar power your pv solution can generate. Solar pv solutions generate maximum power when they are positioned perpendicular to the sun, so that the sun's rays hit the panel/tile/slate on a 90° angle. In South Africa, and the southern hemisphere, rooftops that face the north sun perform best and generate the most energy. However, to accurately calculate solar power, the rooftop orientation and angle of the roof need to be combined to measure the solar output potential of the pv solution, at the property location.

   i. Optimum angel for year-round solar exposure for solar pv installations - The ideal angle for solar pv installations in South Africa is usually equal to the latitude angle of the location of the property. This means that for best results, the roof pitch of your property should ideally be equal to the latitude angle, with the pv solution mounted at the same angle as the roof. For example, if you reside in Pretoria, a roof pitch of 26° would be considered ideal, as this is virtually equal to the latitude angle (25.7°) of Pretoria. Our professional approved solar installers will consult with you and determine ideal placement of the Marley SolteQ Solar tiles according to your location and circumstances.

   ii. Optimum angle for winter months - The ideal angle for your pv-module can vary depending on your solar objectives. For example, if you are seeking to maximise solar generation during winter months, be it for an off-grid system or higher energy consumption levels, you would ideally want to angle your pv-module at a greater tilt for maximum exposure to the low winter sun. The general rule of thumb is that a pv-module angled at the latitude angle, plus 15°, is best to maximise winter sun exposure.

5. Inverter efficiency - the inverter converts Direct Current (DC) into Alternate Current (AC), so that the energy produced by a solar pv-module can be used to power your home's electricity. This process is not 100% efficient. Whilst inverter efficiency technology is improving, it can still account for as much as an 8% loss in efficiency.

6. Battery inverter efficiency - If you have a hybrid system with a solar battery, your battery will not operate at its rated Wattage. Inverter efficiency for batteries is in the realm of 92%, representing an 8% loss.

7. DC and AC Cable loss - There may be a small voltage drop between the solar panel system and the inverter, this can account for efficiency losses of around 1-2%. Likewise, connection between the inverter and the electricity switchboard of the property, may experience a drop in voltage leading to a small loss in the efficiency of the system.

Q: What are solar batteries?

Essentially, a solar battery is a storage device for excess solar energy. During the day, you may only use a fraction of the available solar energy that your system generates. Without some external way to capture all of this unused solar energy, you are either throwing it away or selling it back to the electricity grid – please consult with your Marley SolteQ Solar Installer as most municipalities may not offer this option!

Q: What are the benefits of solar batteries?

- Use at night - rather than losing out on all of the potential energy you collect throughout the day, using a solar storage device allows you to hang on to that power for later use. They may cost extra at set-up, but the cost savings they can provide in the long term can make up for the upfront expenditure.

- Emergency power - one of the major benefits of a solar battery is peace of mind. Simply knowing that you have a back-up, should your power fail due to inclement weather or any number of other reasons.

Having solar energy stored means that you are prepared for anything and will be able to keep the lights on when your neighbours may be scrambling for flashlights.

Q: What types of solar batteries are available?

- Lithium ion battery – 4500 cycles on average * Plyontech @90% discharge
  Traditionally, solar storage has used lead acid battery technology. Lithium ion has advantages in that it is smaller in size and mass. As a commodity, lithium is more expensive than lead, which is perhaps why lead acid batteries are more prevalent.

- Lead acid battery – 5 to 10 cycles on average
  Most solar batteries use lead acid technology (not unlike the kind commonly found in vehicles). Lead-acid batteries are capable of producing high currents and have been in use since the 1800s, meaning that the technology has had enough time to develop into something reasonably efficient and not outrageously expensive. The Energy Information Institute in the US indicates that lead-acid batteries are generally up to 90% efficient when it comes to storing energy.

- Deep Cycle Batteries – 1600 cycles on average * Trojan @50% discharge
  One of the main requirements of a solar battery is that it can be relied upon daily. This means that, in most cases, a deep cycle battery is required. Deep cycle solar batteries are preferred, because they can handle a high level of discharge. This means that you can regularly use a large amount of stored energy from the battery – as much as 80% in one shot, but regularly up to 40% – without ruining it.
  Where solar batteries really differ from your typical car battery is the cycle life. The cycle life refers to the number of times your battery can be fully discharged before it is depleted for good. Where a common lead-acid battery may survive five to ten cycles in a solar power system, a deep cycle battery can be discharged regularly over the

course of 10 years, making it an ideal storage device for a solar powered home.

- Leisure Batteries
  Leisure batteries are capable of producing the high amount of current necessary to run a solar powered home. However, their cycle lives are relatively low, so they are only suitable in instances where the battery will not be depleted much or often. These are usually the cheapest type of deep cycle battery available, but have a cycle life that measures in hundreds, rather than thousands. For this reason, leisure batteries are best suited for vacation homes or Motorhomes that don't see constant use.

Q: Grid-tied or Combination system and other considerations, which are best?

The system size required will normally be determined based on the average solar power generation potential of the property. If you are relying on the system to deliver a certain amount of power during cooler months, you need to be aware of this. For example, a bigger system will be required if you're preparing to go off-grid.

Personal preference and choosing a system to suit your lifestyle habits has a major influence on the system size you should select. You need to ask yourself, how much electricity do I want to power from solar energy?

Though the long term financial benefits of having a solar system outweighs the onset costs, the system size that you select may be determined by your budget and how much you can afford to pay upfront. So, the cost of your solar system is an important factor in selecting an appropriately sized solar system.

If you have the option to stay connected to the grid, you can choose a system size that will maximise your solar production and your financial savings. The optimal size will depend on: daylight electricity consumption, and whether or not adding a battery to your system is financially viable, and; the price you pay for electricity.

If you are planning on installing an off-grid system, your solar power system will need to generate enough electricity to power your entire home, even during

the cooler months with shorter daylight hours. You will need a larger system, in combination with battery storage, than if you were connected to the grid.

If you are considering a new solar power system, you should weigh up the potential advantages of battery storage for your situation. Battery storage allows you to store the excess solar power you generate from your pv-module. Instead of sending this solar energy back to the grid, you could choose to store your energy in a battery for later use. Without a battery, the electricity grid acts as your storage mechanism.

For off grid systems, batteries are imperative; for grid-tied systems, batteries can be financially viable and advantageous.

Q: How much power can be generated with the Marley PV System?

Each Marley SolteQ Solar PV tile has an output capacity of 29.58Wp (Watt Peak)

Output/m2 = 147.9Wp (5 Marley SolteQ Tiles are required to produce m2 output)

Number of tiles per Kilo Watt Peak requirement

1KWp = 6.76m2 or 34 tiles

2KWp = 13.52m2 or 68 tiles

3KWp = 20.28m2 or 102 tiles

4KWp = 27.05m2 or 136 tiles

5KWp = 33.81m2 or 169 tiles

Number of tiles per Kilo Watt Peak requirement with 10% LLE *Low light efficiency

1KWp = 6.15m2 or 31 tiles with 10% LLE

2KWp = 12.29m2 or 62 tiles with 10% LLE

3KWp = 18.44m2 or 93 tiles with 10% LLE

4KWp = 24.59m2 or 123 tiles with 10% LLE

5KWp = 30.73m2 or 154 tiles with 10% LLE

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Q: Size and type of system?

a. Grid tied system – only PV tiles
   Consider the following scenario: A household consumes 18kWh of electricity each day. Depending on location, you may require a 5kW solar system to generate this amount of power. However, if the household only consumes 40% of its electricity during daylight hours, there is no point installing such a large system. In this instance, a system that generates on average 7.2 kWh (40% x 18 kWh) of electricity per day would be sufficient. Therefore, a 2 kW system is likely to deliver the most cost-effective solution and achieve the best financial payback.

b. Combination system – PV Tiles with solar battery
   A solar battery can store excess solar energy generated during daylight hours for use later at night, when the sun isn't shining. If you are considering battery storage, you need to factor this into your system size equation. If we take the previous example, it may be beneficial to generate the 18 kWh of electricity it would take to power your property. If this were the case, you would need to upgrade the size of your system to 5 kW and add a battery capable of storing the excess solar power you generate during the day, for use at night, therefore storage capacity in excess of 10 kWh would be required.

Q: How much will it cost?

Due to many different variables – output requirements, having a grid-tied or combination solution, design of roof etc. one of our Marley SolteQ Approved Solar Installers would need to calculate the full cost based on the project's specific needs.

Q: What information needs to be supplied in order to cost a project?
Given the specialized nature of solar systems, it is favourable to consult with the client to establish their exact requirements and expectations. Below is

guideline of information required in order to submit an accurate as possible cost estimation for a specific project's needs, though a final quote will be subject to a site visit and consultation with client and architect to establish exact deliverables:

- Consumption requirements
  - As a guideline estimate the average consumption within a 24-hour period during winter and summer months to establish ideal consumption requirements based on the clients' needs.

  - Lifestyle/consumption habits of inhabitants
    - Period of majority consumption – morning, during the day, evenings? This will determine if a Grid-tied solution * tiles only or Combination system * tiles with batteries is required

- Budget available

  Though a personal decision and based on your current financial standing, considering the increased cost of electricity and the importance of having uninterrupted power supply, you may want to consider financing your solar system in part or in full as part of your bond or a personal loan. Please contact your bank or loan provider for more information and the options available to you.

- Location of the home

  - ideally latitude of location should match roof pitch. However due to the sun shifting angles - 15 degrees less than optimum for the winter months and 15 degrees more than optimum in the summer months – any roof pitch will be effective at a particular time of the year.

    As a result, to ensure maximum efficiency, even if the roof pitch is not ideal can be accommodated for in the design calculations.

- Plan of the building to determine;

    - Pitch of roof
    - Alignment of the home with regards to true North
    - Assessment of roof complexity

Who may purchase and install Marley SolteQ PV Tiles?

Due to the complexities and risks associated with solar installations, only recognised PV Green Card and SolteQ Approved Installers or Agents may purchase and install the Marley SolteQ PV Tiles with their own approved roofing contractors. Both certifications mean that these installers are proficient and compliant with all the relevant national and municipal electrical regulations as well as meeting SolteQ's European Standards for solar installations.

IMPORTANT!

Marley will only recognise product warranties/guarantees or entertain any claims, if the approved solar installer has issued Marley Roofing with a PV GreenCard for the project – on completion of an installation, a certified PV GreenCard installer will issue the client and Marley Roofing with both a digital and physical document that details all of the specifications of the solar PV system as well as a checklist that all of the required installation steps have been completed to the required standard. This document can in turn be used as proof of compliance for insurance, finance, and regulatory purposes.

In summary, this recognises the solar installation as legal and meeting all the requirements as set out by PV Greencard and SAPVIA (Photovoltaic Association of South Africa)

For more information on PV Green card visit: https://www.pvgreencard.co.za/

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TECHNICAL DATA

Mechanical design aspects:

Cell Material:	Monocrystalline Silicon
Cell Size:	156 x 156 mm
Module Dimensions:	420 x 580 mm
Weight:	approx.4,125 kg
Weight per m²:	approx. 14 kg
Cooling:	Single Module Cooling
Connectors:	MC 4 Compatible
Cables:	2x approx. 50 cm, 2,5mm²
Bypass Diode:	1 Diode/tile
Thickness of Glass:	4 mm, Prismatic
Mechanical Resilience:	8500 Pa (approx. 850kg/m²)
Backing:	Laminate UV- and Weatherproof
Effective cell angle range:	3° - 60°

*Ideal roof angle/pitch:

The ideal angle for solar pv installations in South Africa ranges between **20° and 30 °** and should ideally match the latitude angle of the location of the property. Hence in order to receive the maximum sun exposure, the roof pitch of your property should ideally be equal to the latitude angle of the location. E.g. in Pretoria, a roof pitch of 26° would be considered ideal, as this is virtually equal to the latitude angle (25.7°) for Pretoria. Though if your roof pitch is out between 10° - 15° on either side of the latitude angle, you will only lose between 1 – 1,5% of the maximum solar output possible at your location. Though should the angel or roof pitch not be ideal, the number of Marley SolteQ Tiles can be increased accordingly to compensate for this potential loss in KWh.

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Electrical data:

Nominal Power / Tile:	29.58 Wp
Power per m²:	147.9 Wp
Efficiency:	20.6 - 21.24 %
Tolerance/ STC:	+3%
Max. System voltage:	1000 V DC
Nominal Voltage:	3.48 V
Nominal Current:	9,6 A
Voltage without load (VOC):	3.98 V
Short Cut Current (ISC):	9,6 A
Operation temperature:	-40 ºC to +85 ºC
Estimated lifetime:	40 Years with 80% of nominal power

TEMPERATURE COEFFICIANTS All electrical data measured under standard test conditions (STC): AM1.5, 1000 W/m2, 25°C. Accuracy of all listed values is 3%. Temperature coefficients: TK(Pmpp) [%/K] = -0.43, TK(VOC) [%/K] = -0.34, TK(ISC) [%/K] = +0.05. STANDARD TESTING CONDITIONS (STC) E=1000W/m² AM=1,5 T=25ºC

Fire Class:

Front:	Solar-module Glass, Tempered, Prismatic
TPT-Foil (Rear):	PYE/PET (Polyethylene Terephthalate)
Specials:	Storm Proof Clips

Certificate-TPT-Foil:	Tested reg. ANSI/UL94 (Tests for Flammability of Plastic Materials for Parts in Devices and Appliances)

IEC60695-2-12/13 + IEC60695-10-2, IEC60112, ISO75-2, ISO527-2, ISO178, ISO179-2, ISO180

Certification:

Certificate CE, TPS Intercert (Technische Prüfstelle für Solartechnik), RETI,

IEC61215, Safety IEC EN 61730,

Salt corrosion tested IEC EN 61701

Windload DIN 1055-4

Rain proofness CEN/TR 15601

Hail class IEC 61215, Extension Switzerland: Hail resistance class 3

Protection class II, IP65

Product-Warranty 5 Years (in Europe)

Power Guarantee 90%: 12 years + 85%: 20 years

Spare parts delivery guarantee 30 Years

German standards conform to DIBt Bauaufsichtliche Regelungen and rules of roofers

Safety konform nach den Regeln der Liste der Technischen Baubestimmungen

Fire safety schwer entflammbar, Fire Class 1 gem. UNI 9177

Breaking safety: VSG-Safety glass DIN EN 12150, higher beat and burst stability, high breaking stability and strength, small glass break parts (crumb formation)

Certification of the mounting mechanism conform to CSTB Eu conditions

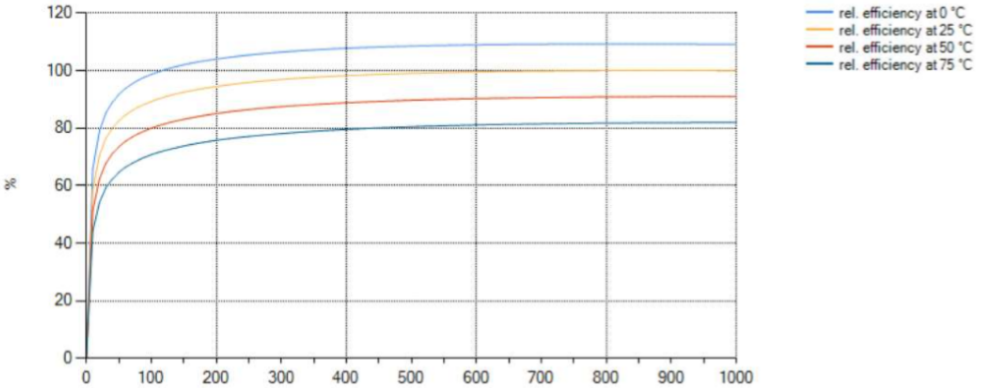
With shade light *These values are typical average measurements of historical production data. Future production data can be different. Technical changings and errors reserved.

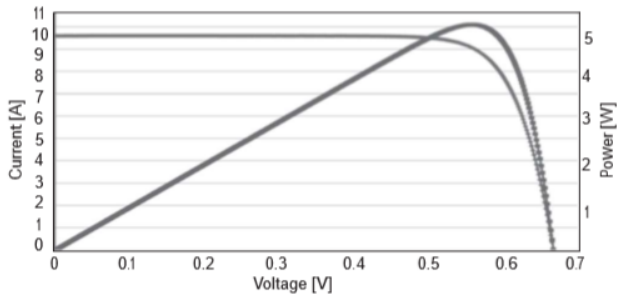
Current/Voltage and Power characteristics, spectral response

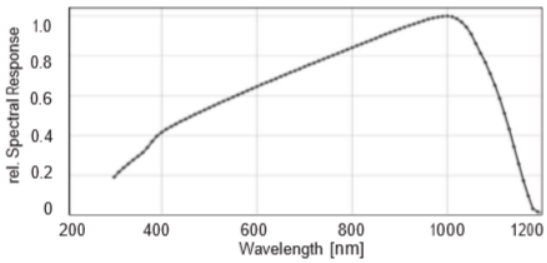
Electrical characteristics cells

Power/W	4.74	4.94	4.99	5.04	5.09
Voc [V]	0.660	0.663	0.664	0.666	0.667
Isc [A]	9.527	9.555	9.568	9.590	9.608
Vmpp [V]	0.549	0.555	0.559	0.561	0.563
Impp [A]	8.901	8.960	8.998	9.030	9.054
Pmpp [W]	4.74 - 4.94	4.94 - 4.99	4.99 - 5.04	5.04 - 5.09	5.09 - 5.19
Efficiency [%]	19.40 - 20.22	20.22 - 20.42	20.42 - 20.63	20.63 - 20.83	20.83 - 21.24

All electrical data measured under standard test conditions (STC): AM1.5, 1000 W/m², 25°C. Accuracy of all listed values is 3%.
Temperature coefficients: $T_K(P_{mpp})$ [%/K] = -0.43, $T_K(V_{OC})$ [%/K] = -0.34, $T_K(I_{SC})$ [%/K] = +0.05.







Conditions of soldering / removal force value

Tabbing ribbon basic material	Cu-EPT1
Dimension of tabbing ribbon	1-2 mm x 0.12-0.20 mm
Solder material	Sn62Pb36Ag2 or Sn60Pb40
Solder thickness	10-30 µm
Solder temperature	220-270°C
Solder time	1-2 s
Median tear force	≥ 1 N / mm

and/or home owner (existing home) - to ensure the correct number of Marley SolteQ PV tiles are provided for each individual roof design.

The Marley SolteQ PV Solar Tiles are imported hence lead time is subject to stock availability, manufacturing timelines (4-6weeks) and shipping (8-10 weeks), please contact your Marley Roofing Representative.

Marley Roofing reserves the right to change or discontinue any of the specifications or products without notification. All goods are subject to availability and the company's conditions of sale which are available on request.

> Technical advice

Marley's Technical Department provides free advice on all technical roofing matters.

CONTACT DETAILS:

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