

# COMMERCIAL SCALE PV PROJECTS

An installers guide



# SUPPORTING YOU WITH YOUR COMMERCIAL PV PROJECTS

The construction and ongoing operation of commercial scale Solar PV systems rely on significant investment, with many factors determining the success of the project and ultimately the performance of the PV array.

This guide provides recommended processes to aid with early recognition of projects that will not develop to the application stage. Late identification of things such as infeasibility, lack of funding/support and DNO incompliance can be costly.

As one of Europe's largest suppliers of complete solar PV systems, Segen offers a full range of global leading brands ideally suited for commercial scale PV systems. This guide ensures you understand the regulations, typical project milestones and product specifics of commercial-scale solar PV. You will be able to design, specify and tender for a commercial project confidently and professionally ensuring you win that project!

For all the help and advice, just contact one of your Segen team who are on hand to support you further. Call us on 0330 9000 141.

# Services for our customers

- Dedicated team on hand to help with pre and post sales, order processing and technical support
- Commercial account management team on hand
- Online design software to configure your PV system
- Relevant product portfolio for commercial scale projects
- Commercial project pricing available
- Live 24/7 online pricing and stock availability
- Create accurate quotes, apply your margin and email a copy to your clients

**COMMERCIAL &  
INDUSTRIAL  
PROJECTS**

**HOUSING  
PROJECTS**

**EDUCATION &  
PUBLIC SECTOR  
PROJECTS**

**AGRICULTURAL  
PROJECTS**

# Project Planning Large Scale PV Installation

1

## Feasibility & Funding Analysis

The first step towards the development of a technically and financially sound solar PV installation is the feasibility study. You will need to gather together the base information required to prepare your initial feasibility study and have it available to outline the system design and initial financial model.

Information that you will require should include:

12 months of Electricity usage, Current price paid per watt, Length of energy supplier contracts.

Site Selection: Orientation, location, grid utility presence and/roof size, system size etc.

Technical Surveys: Geographical information, site dimension irradiation, supporting images.

2

## Outline PV System Design

Ensure you understand your customer's expectations of the system. What are the most important factors to them? Financial ROI, cheapest price, output, warranty cover, bankable suppliers?

Once you have the information from the feasibility study, you can design the most appropriate system, considering site suitability, specific products (modules, inverters, mounting, BOS), minimising electrical losses and the requirements of the local utility for connection. Ensure you consider the best technology for the project - e.g. bifacial modules, optimisation etc. Being clear at this stage will make completing the detailed design later, a lot easier. You will then present your client with an initial feasibility model for the proposed project. This will allow the client to assess interest in moving forward to the next stage of the project. Be prepared to explain your product choices, especially when being competitive.

The client may not progress with the project or decide to use an alternative installer. Also consider that costs and product availability may alter so any quotes you provide should reflect this.

It will be at this stage that the client should also give you full details of how the project will be financed. You must ensure that you are able to complete the project based on the finance available and arrange any additional financing that you may require in advance.

Financing is one of the most common obstacles to the progression of an installation and yet it is often not approached until near the end of the project, wasting time and money of yours and the client.

3

## Complete Onsite Survey Client Business Plan

Based on your client's acceptance of the initial feasibility study for the project. You need to complete an onsite survey. Including Base structural information, roof type, pitch, orientation, roof materials, location of electrical services, key measurements, potential areas of shading, roof or site access, scaffolding locations, staff access and health & safety issues.

4

## Detailed PV System Design

Once you are contracted to complete the project (on provision of agreed planning permission), the design and specification of the PV system should be finalised. Ensure that the final design, cost, and timeline meet the requirements and expectations of the client and is suitable for the building or land where it will be installed.

At this stage you should have a clear idea of your preferred product suppliers, considering product availability and timeframes.

It is recommended that you finalise any long-term monitoring and maintenance requirements of your client. Now is also a good time to discuss an ongoing Operation & Maintenance (O&M) contract.

When taking on any commercial scale PV project, regardless of the area of application, there is a basic 8 point plan that can be followed in order to avoid common pitfalls.

# 5

## Planning Permission

Does the project have the relevant planning permissions? Up to 8 weeks or longer dependant on the scale of the project and each DNO will vary.

Some DNO providers will charge for a DNO application based on the size of the project. You need to include expected costs into your project financial model. Refer to [page 25](#) for further information Environmental Impact Assessment (EIA)

- Local authority planning permission granted and at what level?
- Installation over 50kWp must be registered and application made to relevant electricity supplier
- Grid connection permit will need to be obtained through DNO, technical requirements adhered to in accordance with G99

At larger scale, the DNO will require some preliminary design work and protection schematics to be completed before offering a grid connection, so it is worth getting an application in early on.

# 6

## Confirm Suppliers/Products

A: Finalise your suppliers: Who will support your business/installation? Trusted/long term relationship? Will they still be around in 10 years? Product availability, held stock, lead times, price.

B: Finalise your products: What products are best suited to the system? Certificates available? Silicon Module Super League Status? Bankability of inverter/module supplier? How safe is the warranty?

You need to be aware of suppliers' time frame which may often depend on the size of the project and other market influences. Use the Segen Portal to find the most appropriate products for commercial scale installations.

# 7

## Installation & Commissioning

Ensure you complete and share with the customer the construction and build plan and include proposed time frames, key milestones, and any potential delays.

This should also cover: Site preparation, rail mounting, module installation, wiring, testing and commissioning

Testing and commissioning should include setting appropriate grid standards on the inverter along with any other required inverter/site specific settings, ensuring appropriate operation of the PV system when fully energised and verifying any ancillaries are operating and communicating correctly. You should then carry out a thorough handover of the PV system which involves providing all relevant and product warranties and or registrations.

# 8

## PV Operation & Maintenance

It is likely you will have discussed a long-term maintenance contract for the installation and agreed on a suitable monitoring solution.

You should also discuss and document the options for end-of-life of the installation. Will the system be allowed to run after 25 years, or will it need to be decommissioned? Will you look after the recycling options (PV cycle association)?

By looking at and identifying the full lifecycle of the project you can build long term relationships and maintenance contracts with your clients.

# Project Cycles

A typical project cycle for a commercial PV installation will take into account many different aspects from the start of the project through to operation (which can be up to 12 months for very large projects).



## Rules of Design

When deciding which modules and inverters you need for any large-scale PV system, it is important to understand the basic rules of designing a larger system.

The electrical principles of any PV system from a single string of a small number of modules right the way up to a multi-megawatt industrial-scale PV plant are similar, it's just the quantities and components that vary.

Where there are more than two strings wired in parallel, either in a DC string combiner or internal to the inverter, it is essential that each string has its own fuses on both polarities. These fuses will typically be inside the inverter or in the DC string combiner, depending on the manufacturer or model of inverter.

A key factor with any commercial-scale system is remote monitoring. Utilising this technology will allow you to ensure performance issues are identified immediately.

Segen recommends a 10-year warranty for all commercial-scale installations to provide peace of mind for both the consumer as well as yourself, the PV specialist with the maintenance contract.

In most instances inverters should be selected based upon the rating of the site supply. Larger or smaller inverters can be used depending on site-specific factors. Although you will not be able to connect a three-phase inverter to a single-phase supply, you can connect a single-phase inverter to a three-phase supply (or rather the individual phases of that three-phase supply).

With modules on larger systems, it is possible to make significant savings on the cost of modules by opting for panels with a higher output rating. In doing so, you can achieve the same target kWp but with a smaller amount of modules, often saving on cost of purchase, mounting, maintenance & labour.

# Structural Considerations

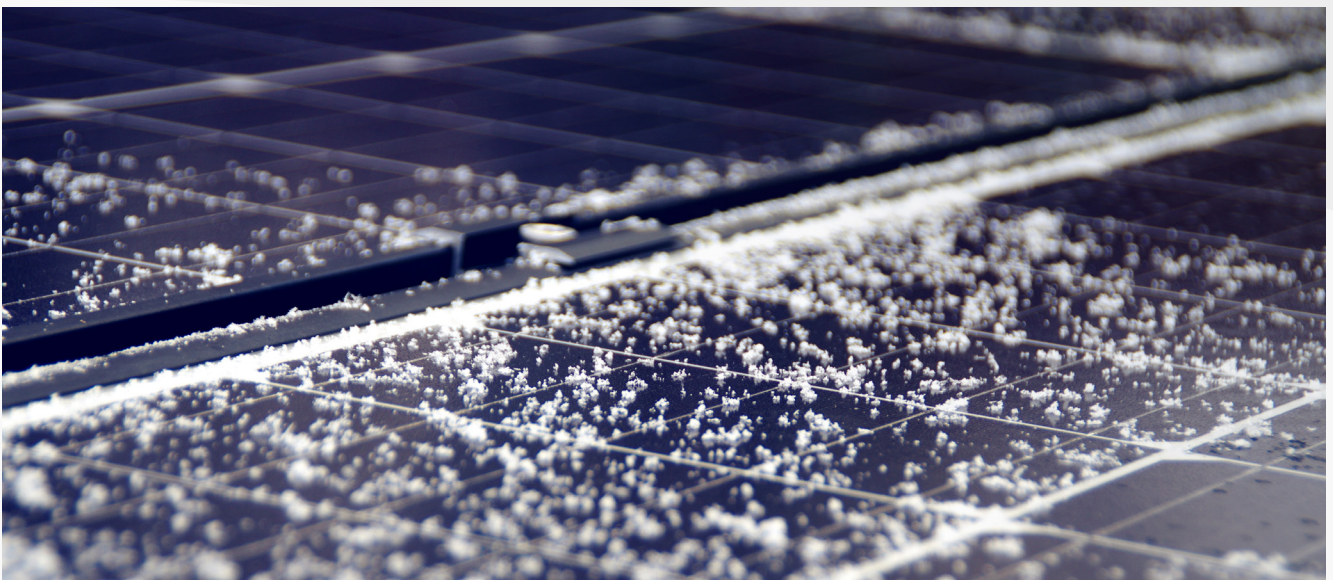
Both roof strength and wind loading calculations are specialist topics that need to be taken very seriously. The [Design Tool](#) incorporates wind loading for pitched roofs in its calculations (UK only) and will provide you with exactly how many roof anchors are required for your particular installation. The total weight of all of the on-roof system components is calculated and you will need to provide this information to a fully qualified structural engineer so that they can determine if the roof can take the increased load.

## Roof Strength

Commercial PV systems can vary greatly in terms of weight and the roof must be strong enough to support this. It is important to ensure that the existing structure is able to carry the load of the modules, mounting system and any potential ballast required – all of which will need to be checked by a structural engineer and proof supplied. If strength work to the roof is required, this can add significant cost and time to the overall project.

## Wind-loading

PV arrays should be designed to withstand wind forces as prescribed in building codes. However, there is a significant challenge in applying existing codes to commercial and industrial roof-mounting PV arrays. Wind loads (and uplift) vary by wind speed, location, orientation, pitch, positioning of panels etc, so full calculations should be completed on every project. Flat roof mountings in particular, require careful consideration to wind loading as this can directly influence ballast requirements.



## Snow-loading

The climate in the UK remains relatively mild throughout the year, occasionally however we can be subject to heavy snowfall and as a result of this we are obligated to ensure our PV installations are designed in accordance with UK regulations. The correct process to calculate snow-loading would be to cross reference a snow load map of the UK with the address of the installation and then factor in altitude and slope adjustment using the following formula.

**Snow load = Ground snow load + (Altitude – 100) / 525 \* U1**

Pitch	Adjustment (U1)
< 15 degrees	0.8
15-30 degrees	$0.8 + (0.4 * ((\text{Angle} - 15) / 15))$
30-60 degrees	$1.2 + (60 - \text{Angle}) / 30$
>= 60 degrees	0

This is the method the Segen designer adopts when calculating the mounting requirements in line with snow-loading in that area. So as long as the correct information has been entered in relation to the location of the site, the designer will provide you with the correct quantity of components.

# Modules

Advancement in module technology is moving at a faster pace than ever before and commercial PV projects are generally tendered for months in advance. It is advisable to avoid quoting a project based on a specific module brand or output. Instead, provide quotes based on a manufacturer having SMSL status (Silicon Module Super League with annual shipments of over 4GW) and quote the overall system output.

- **Supplier Stability** – This is possibly the most relevant factor when comparing module suppliers and for obtaining financing from banks and financial institutions. Consider the impact if you were to quote on a certain product and then that product, or worse, that company, is not available when it's time to purchase. It is highly likely that systems being funded by a third-party will need to use panel manufacturers that have SMSL status.
- **Efficiency** – A client will want to extract as much energy from their available roof space as possible. High efficiency modules combined with some form of Module Level Power Electronics (MLPE) to reduce the impact of shading will ensure the up-front fixed project costs are offset more quickly.
- **Price** – When comparing costs of systems, you must avoid simply looking at the £/Wp. Return on investment will be far greater if a little more is spent per Wp for the modules to ultimately achieve a lot more energy per m2. Always quote and project plan based on the kWh/m2 and NOT the cost/Wp of the modules.
- **Warranties** – Different manufacturers offer different lengths and strengths of warranties. For commercial scale projects, longer term warranties are advisable and often also insisted upon if financing is being sought for the project.



Segen supplies several modules suitable for commercial systems from manufacturers with SMSL status. Previously referred to as Tier 1 or bankable manufacturers, the SMSL was created by respected news outlet PV Tech as a guide to solar PV manufacturers that you can rely on.

At the time of going to press seven companies make up the SMSL, all meeting the criteria of achieving shipments in excess of 4GW of modules, well above all other manufacturers in the industry.

The seven companies are: Jinko Solar, Trina Solar, Canadian Solar, JA Solar, Q-Cells, GCL-SI and LONGi Solar.

# Industry Module Advancements

Technology and market changes in the middle of 2018 led module prices to reduce substantially but since, pricing has been volatile due various factors; worldwide demand increasing, Coronavirus, component shortages, explosions in Solar Panel Cell production factories.

Despite this, technology continues to advance - Mono PERC, Poly PERC, half-cell, shingle, and multi-busbar - have increased mainstream efficiencies from 340W to 385W for affordable 60 cell modules.

This move also means bifacial can now be supported for little or no extra cost and so the bifacial revolution is now underway.

The increase in module efficiency, lower electronics costs, and a greater understanding of all the benefits of Module-Level Power Electronics is driving growth of MLPE for all roof-top applications (not just where there is shading). Most manufacturers are also moving to 'large' cell (actually only a couple of mm larger but adds 5W) and multi-busbar, which adds a further 5W.

## Our Commercial Modules

Our range of commercial modules offers:

- Larger cell size, better cell efficiency and multi-busbars - 66 Cell and 72 Cell 450W to 495W modules
- Shingle technology giving near 100% coverage, significantly increasing power rating
- Bifacial modules for those who need bifacial for higher yield or who want the added life expectancy of double glass modules
- MLPE for any commercial rooftop with shading or soiling issues
- Standard Poly and Mono will not be a core part of our portfolio

Current mainstream 60 cell standard Poly is 280W and PERC (Mono or Poly) is 335W, that is...



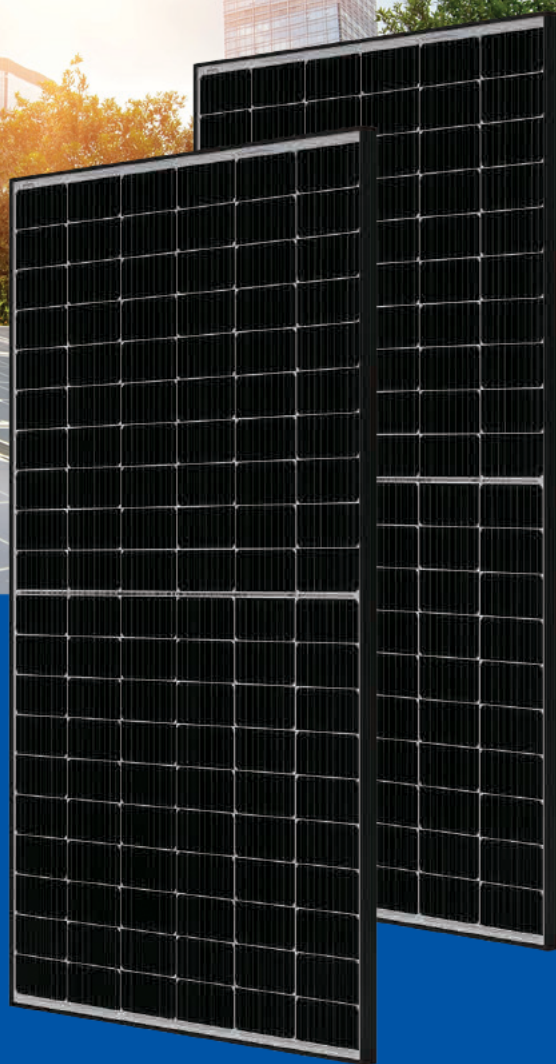
- > Less mounting kit and cabling
- > less modules to be lifted onto roof, installed and tested
- > Less modules to be shipped
- > System size on same roof space (often critical to the economics on a limited size commercial roof)

# Value Added Quality from the UK's Leading Module Supplier



## PERC Half-Cell Module

Assembled with multi-busbar PERC cells, the half-cell configuration of the modules offers the advantages of higher power output, better temperature-dependant performance, reduced shading effect on the energy generation, lower risk of hot spot, as well as enhanced tolerance for mechanical shading.



Higher output power



Lower LCOE



Less shading effect



Better mechanical loading tolerance

# Module Manufacturers



Founded in 2005, JA Solar is a global manufacturer of high-performance photovoltaic cells and modules.

Thanks to its 12 production sites and more than 20 worldwide offices, JA Solar products are available in over 100 countries and regions. They are used extensively in utility scale power plants, commercial and residential installations. Supported by technological innovation, sound financial performance and an advanced global sales and service network, JA Solar is the leading module supplier in most countries globally. For several consecutive years, the company has been listed on the Fortune China 500 list and the World Top 500 Energy Companies.



Leading the pack when it comes to global module sales JinkoSolar is a world-renowned solar module manufacturer. JinkoSolar distributes its solutions and services internationally to a diversified utility, commercial and residential customer base.

JinkoSolar have topped the Silicon Module Super League for two years in a row and are front runners in Module Level Power Electronics with the Jinko MX cell string optimised modules.

Their new Jinko Tiger modules (shown right) come with special round ribbon with Tiling Ribbon Technology and are offered with n-type cells, both of these have proven to increase reliability and performance.





LG Solar offers some of the most technologically advanced and aesthetically pleasing solar panels available. For years the company has led the way in the development of high efficiency modules. A solid, global company with a 25-year product and performance guarantee, the LG brand makes for a worthwhile choice on a commercial project.

In the commercial sector, the NeON<sup>®</sup> 2 bifacial panels offer double sided generation being designed to absorb irradiation from both the front and the back of the panel. The dual faces of the cell allow for higher energy yields of up to 30% (Compared to a monofacial module of equal nominal power)

In addition to that Segen offers LGs most recent commercial range of modules called LG's Mono X<sup>®</sup> Plus (shown right). This is a premium solar panel; it's reliable and powerful technology will give you eco-friendly power with half-cut cell technology for high efficiency and performance. The ideal panel for your commercial installations.



Canadian Solar was founded in 2001 in Canada and is one of the world's largest and foremost solar power companies. It is a leading manufacturer of solar photovoltaic modules and provider of solar energy solutions and has a geographically diversified pipeline of utility-scale power projects in various stages of development.

Over the past 18 years, Canadian Solar has successfully delivered over 34 GW of premium quality modules to customers in over 150 countries around the world. Canadian Solar is one of the most bankable companies in the solar industry, having been publicly listed on NASDAQ since 2006.





## TIGER • Mono-facial All Black

With tiling-ribbon technology



### TR technology + Half Cell

TR technology with Half cell aims to eliminate the cell gap to increase module efficiency (mono-facial up to 20.96%).



### Low Light Induced Degradation

The N-type cell shows extremely low light induced degradation (LID) performance when comparing with the P-type cell.



### 9BB instead of 5BB

9BB technology decreases the distance between bus bars and finger grid line which is benefit to power increase.



### Best Warranty

25 year product warranty,  
30 year linear power warranty



### Better low-light performance

Excellent performance in low-light environments  
(e.g. early morning, dusk, and cloud, etc.)



### Severe Weather Resilience

Certified to withstand: wind load (2400 Pascal) and snow load (5400 Pascal).

# Inverters

## Inverter Types

Historically the inverter choice within the UK has been dominated by a small but solid group of European brands, sought after for their perceived higher quality. As technology has advanced however, cheaper, Chinese brands have been able to improve the quality of their devices with relatively little increase in price, changing the landscape of the UK PV market as focus has shifted over to them. Because of the range of options now available, it is equally as important when selecting an inverter supplier to consider the stability of the company and what sort of ongoing support they may offer should you need it.

There are two main types of inverters suitable for mid-sized commercial scale PV systems:

- **String Inverters** – A typical mid-sized commercial PV system will consist of one or more three phase inverters between 5kW and 110kW with two or more strings into each and linked together on the AC side. String inverter systems are simpler than ever before to design and install, but careful consideration must be given to linking the inverters to allow effective fault reporting as well as for setting up communication.  
Apart from traditional 3-phase low voltage (400V AC) inverters stocked by Segen, we also offer Commercial project inverters suitable for high or medium voltage grids. We currently stock products such as the Huawei 105kW or 185kW and Solis 125kW or 255kW. Where required we can also offer any other sizes of MV/HV range of inverters supplied by Huawei, Solis as well as Solar Edge.  
\*As these are unusual products, we supply them on a Buy to Order basis, meaning there is a lead-time and minimum order size.
- **Power Optimised** – Developed to maximise energy harvest, arrays using power optimisers can have an individual optimiser per module or more commonly on commercial sites, one dual optimiser per two modules. These are linked to one or more three phase inverters, each in turn wired together on the AC side.  
A power optimised system could appear more costly initially but thanks to longer strings can also save money on cabling and accessories as well as provide higher yield thanks to higher roof utilisation, especially if there are any issues with shading.  
Module Level Electronics can also help with safety due to the ability to detect arc and disable individual modules in event of fault.

## Inverter Warranties

Many commercial scale funded systems will require a minimum 10 year – maximum 20-year warranty. It is important to remember to include the costs of any extended warranties at initial quote stage. If a long term extended warranty is required, then the cost can be substantial and, in some cases, buying an inverter with a longer “out of the box” warranty can be cheaper.

## Quick Configurator

Our ‘Quick Configurator’ can be used to quickly establish the best inverter solution for your new or existing array (if a replacement/upgrade of inverter is required). By entering details of the module, quantity, or target size you require, along with preferred brand selection, the compatible inverter options will be listed, along with string, price and stock information.

<https://portal.segen.co.uk/reseller/QuickConfig/QuickConfig>

# String Inverters

A commercial scale system designed using string inverters will usually consist of one or more three phase inverters between 5kW - 60kW (potentially different sizes in the same array), with two, three, four or six MPP trackers per inverter and linked together on the AC side.

Segen offers three phase string inverters from few different manufacturers, each offering a variety of rating, MPP trackers, monitoring, protection, warranties, and performance options.

Each string inverter operates independently of the others, controlling between two and twelve strings of modules and exporting power into the AC grid.

Whilst it is possible to design a large system with numerous smaller single-phase inverters this is unlikely to be a cost-effective solution and therefore not generally recommended by Segen.

# String Inverter Manufacturers



Well established as the No1 inverter brand in the UK, Solis make a solid investment choice for any commercial project. Ranked in the Top 10 Global PV Inverter Market Shares, the company was recently publicly listed helping secure its position in the global market. With a dedicated UK tech team – Solis tick many project must have boxes.



Solis inverters are compact and light weight with IP65 rating suitable for outdoor installations at almost any site. The Solis three phase range is available in units from 5kW up to 255kW and features multiple trackers where needed to enable any size of commercial system to be cost effectively designed.

Larger Solis three-phase commercial inverters can be ordered with built in AC disconnectors as well as with SPD (surge protection device) or AFCI (arc-fault circuit interrupter) devices.

Industry leading low failure rate of 0.5% measured over the more than one million units sold and installed worldwide.



Huawei bring their excellence as the world's largest telecoms company to the solar PV sector with the FusionSolar Smart PV division specialising in production of their string inverter range. In 2015 Huawei held the World's number 1 commercial inverter manufacturer position by shipments and maintained that position from 2016 to 2018.

Huawei offers a range of three phase inverters, from 12kW to 185kW with multiple MPPT depending on inverter size. Larger commercial inverters can be ordered with built in AFCI (arc-fault circuit interrupter) devices.

An especially desirable brand if a project is being financed, as Huawei have global revenues of over \$90bn and are trusted across the industry.



SolarEdge are the longest established and market leading DC optimiser manufacturer offering a range of three phase inverters from 4kW up to 82.8kW with single and dual DC optimisers. The SolarEdge solution includes both inverter and DC optimisers.

Three phase systems from 15kW upwards utilise dual optimisers which optimise each pair of modules and are highly efficient, lightweight, and easy to install. The Firefighter Gateway provides centralised safety management of SolarEdge systems. The power production can be stopped either manually, through an emergency stop button, or automatically through a Fire Alarm Control Panel system – both methods stop the AC production and reduce string DC voltage to a safe voltage using the unique SafeDC™ feature.

A key benefit of SolarEdge is that free of charge lifetime module level monitoring is included with every system enabling the system owner, or maintainer, to monitor the performance of every element of the system and reduce time



spent on site fault finding. Offer your customer a maintenance contract to ensure maximum performance ratio for their system.

All SolarEdge commercial inverters with CPU version 3.19xx / 4.xx and higher support Arc Fault Circuit Interruption (AFCI) functionality as standard. Please note the feature is disabled as default. “

AI BOOST



# Digital PV Solution for Optimal LCOE

**Higher Yields**

>2% More Energy

**Smart O&M**

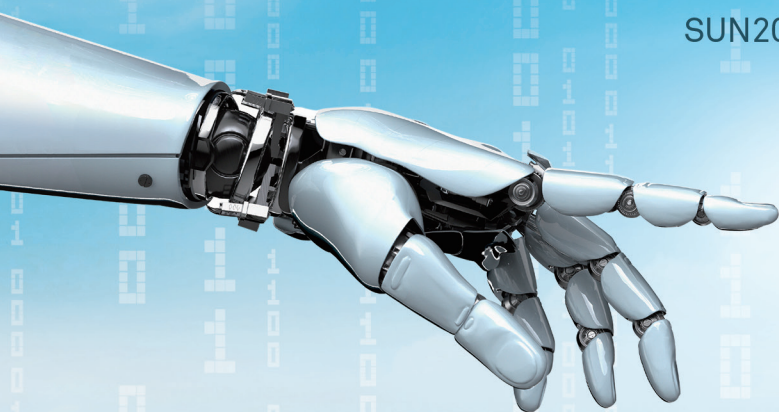
Lower OPEX

**Safe & Reliable**

25-year's Reliability



SUN2000-185KTL



# Performance Monitoring

Commercial systems will incur significant investment, so it's especially important to ensure that they are performing as they should be and to identify any issues swiftly.

Most PV systems installed nowadays are connected to some form of monitoring system, either locally in the building on a display screen; or, more commonly, remotely via the internet. By far the biggest benefit to any monitoring system is that in a lot of cases remote diagnostics can be done and often firmware updates sent remotely to resolve issues, mitigating the need for costly site visits.

This should always be considered if you are intending on offering an O&M service to your clients.

Wherever possible it is recommended to connect via a cable to the internet as even the most reliable Wi-Fi connections can occasionally drop out. Consideration should also be given to whether module level monitoring is required in which case SolarEdge is the only solution to offer this.

All the inverter brands available from Segen offer system monitoring via an online platform.



## The Maximum Power Point Tracker (MPPT) Debate, Multiple or Single?

### Multiple MPPT V's Single MPPT Inverters

Monitoring and maximising the energy yield of any PV system is critical to the stakeholder that will be benefitting from the production. It might be the system owner, or the PPA owner that will be concerned about the O & M cost as well as the yield of the system. It might be the bank that is financing the system. Achieving the best possible return on investment is what will matter.

A key consideration is to decide what level of flexibility and control is needed over an array for the given project. This can be achieved by determining how many MPPTs are required.

### More MPPT's: Better Yield

- PV inverters were originally designed to have a single MPPT, which means the inverter can maximise the output for one value of DC current.
- This limits the inverter to getting the best out of one roof face only, or one type of PV module.
- For small and simple PV arrays, that might be adequate. For larger and more complex designs, having the PV array managed by more MPPTs will help to improve the energy yield.

## MPPT: Maximise your Modules

The function of an MPPT is to maximise the energy available from the connected solar module arrays at any time during its operation. Many factors can cause an array performance to reduce, such as:

1.

### MODULE MISMATCH -

PV modules of the same rating from the same production line rarely possess identical current/voltage characteristics, this is called module mismatch. And module mismatch will only increase as the system ages – so although a few watts here or there may not have much of an effect in the early days – as time goes on and modules degrade naturally at different rates this begins to have a greater effect on single MPPT string level output.

A series circuit can only have one value of current – which will be based on the worst performing module. The function of the MPPT is to extract the most amount of power from the circuit. It does this by varying the resistance in the circuit to adjust the voltage and current.

A series circuit works at the lowest current in the string, so the more MPPTs the inverter has, the smaller the number of affected modules by the lowest current.

2.

### SHADING -

A shaded module produces drastically lower current, and the current of the whole string will drop down to the value of the affected module. On a multi-MPPT inverter, where there are only two strings per MPPT, that shaded module will cause the current from two strings to drop. On a single MPPT inverter, the entire array current will drop even if only a single module is shaded

3.

### SOILING -

Soiling can drastically affect the performance of individual modules. On average there is a daily efficiency reduction of 0.2% in days without rainfall in dry weather. Annual losses caused by this trend due to soiling ranges from 1.5% to 6.2% depending on the location of the PV plant. For larger ground mounted systems, the bottom row of the modules can be separated from the rest of the sub-array when using an inverter with multiple MPPTs to ensure the overall performance is not affected.

4.

### MODULE TEMPERATURES -

Modules produce less energy the hotter they are, typically they reduce in output by about 4% for every 10 degrees increase in temperature. Modules on different sections of roof will reach different temperatures due to the amount of ventilation and exposure to even light winds. With a multi-MPPT inverter each area of roof will perform to its maximum based on the actual module temperature and not be affected by higher temperature modules elsewhere on the roof. Using more advanced module technology (like PERC) can help to minimize the negative effect of operating at high temperatures or under low light conditions.

5.

### START-UP VOLTAGE -

Every MPPT will have a minimum voltage needed before it starts up and so in the early morning whilst there may be some sunlight on the modules it may not be enough to enable the MPPT to operate. To maximise the energy yield it is therefore essential to have a lower a MPPT start-up voltage as possible. E.g., an MPPT with a start-up voltage of 200V will generate energy earlier in the morning and later in the evening than one with a start-up voltage of 600V. With a multi-MPPT inverter each MPPT will individually start up as soon as it can, independent of the others, whereas a single MPPT inverter will only start up when the entire module array produces enough voltage.

# Design a system in 90 seconds with the Renusol PV Configurator 3.0

The 3rd generation Renusol PV Configurator saves cost by precisely determining the components required for the operational safety of a system which, in turn, saves unnecessary parts and speeds up the installation.

[www.pv-configurator.com](http://www.pv-configurator.com)

- ▶ Google Maps drawing function
- ▶ Simple editing of module fields
- ▶ Easily understood detailed assembly plans
- ▶ Supports different mounting systems, roof types & coverings
- ▶ User specific module manager
- ▶ UK technical support team
- ▶ Produce full reports, layout CAD drawings, or a simple material list



*Many UK specific functions have been implemented in the tool - specific pressure coefficients for wind loads, UK only fixings, etc.*

*The design process itself is also incredibly fast – an experienced user can design a project in only 90 seconds.*

## Renusol PV Configurator 3.0

SAVES COST & INCREASES SAFETY

# Mounting Systems

With the different types of roof and surface on which a commercial scale Solar PV systems can be installed including tiled, metal, standing seam, fibre cement, flat and ground mounting.

Segen supplies solutions suitable for almost all situations. Due to complexity and unique nature of ground mount PV systems, Segen recommends using 3rd party specialist manufacturers for large commercial ground mount systems.

With technological advancements in modules, design and planning must now also consider the type of modules being used – for example bifacial. A system which is designed to utilise bifacial modules will require specific mounting equipment for the system to benefit from the additional yield a bifacial array can deliver.

## Flat Roof

On suitable flat roofs, solar PV panels can be mounted on metal racking systems which are angled at between 10 and 30 degrees to improve the energy capture. These systems are quick and simple to install and following a detailed site survey a suitable system can be selected depending on the type and strength of the roof. Segen supply ballasted rail systems (Renusol FS10 and 18) as well as standalone “tubs” (Console) which can be filled with ballast.

## Bifacial Module Flat Roof Mounting

The mounting of bifacial modules of flat roof is simple with the Renusol Trisole range. One simple part added to your usual mounting equipment for a flat roof installation ensures you install bifacial modules correctly and to perform to their optimum.

## Metal Roof

The Renusol “MetaSole” mounting system provides the most cost-effective method of mounting solar modules onto a trapezoidal or corrugated metal roof. The system does not need mounting rails (which are traditionally the most expensive part of a mounting system) just screw directly into the roof and utilise standard module clips to match your chosen module. The flexibility of the ‘MetaSole’ system allows both landscape and portrait installation of modules.

## Standing Seam Roof

Standing seam roofs are one of the most popular types of commercial roofs currently on the market. Renusol offer a range of clamps suitable for a broad range of standing seam roof types. These clamps made by specialist company S5! perform the same function as roof hooks and allow using standard on roof railing system on seamed roofs.



Renusol is one of the largest companies offering solar mounting solutions. Based in Germany, Renusol offers unique solar panel mounting solutions to suit every application.

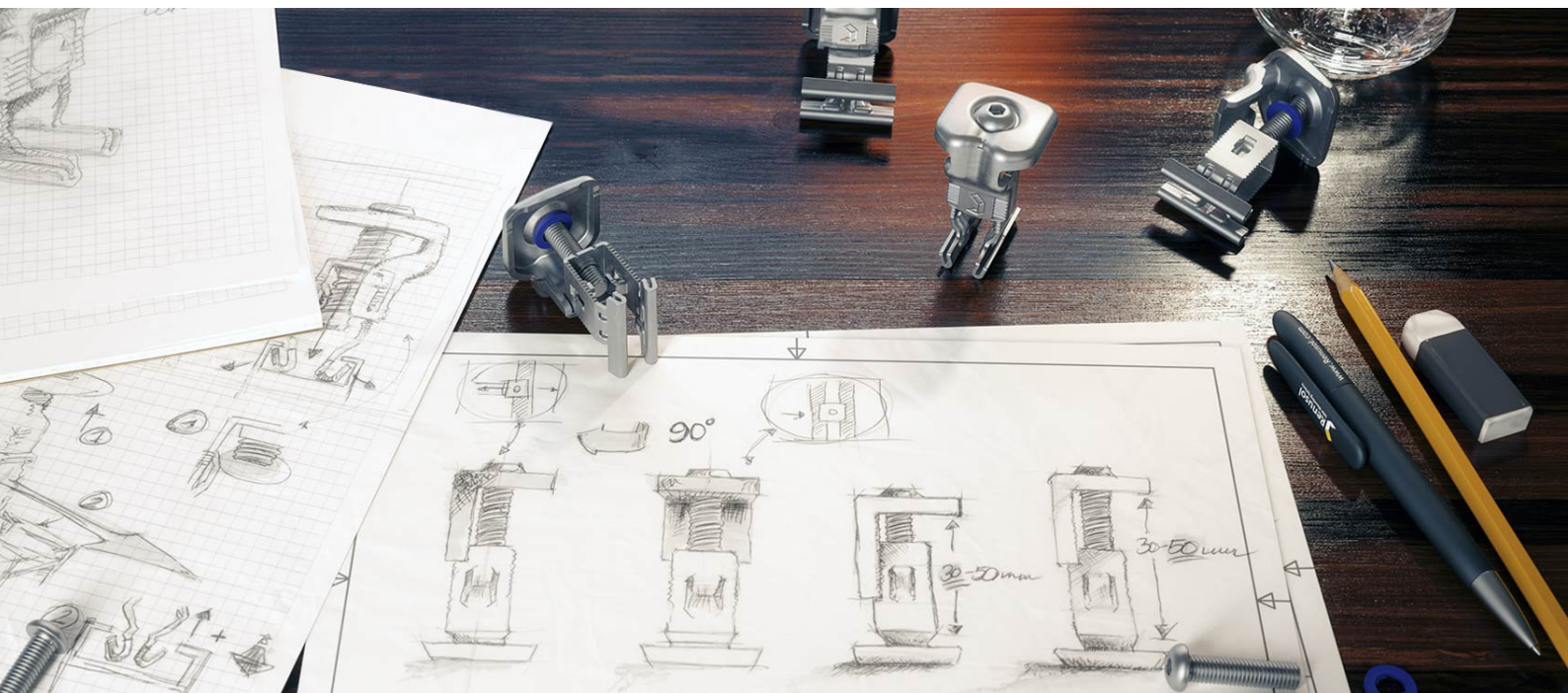
Since 1997 Renusol has been developing and producing innovative and cost-efficient solar racking solutions for the photovoltaic industry. Their products are flexible across the range and consists of a solution to fit every requirement and roof type.

The MetaSole+ range is the carefree solution for solar mounting on IBR and corrugated metal sheet of aluminium and steel. Made up of only a few components that makes for fast installation on even the largest commercial roof.

The FS10/FS18 system is perfect for any flat roof install. In either a South facing configuration or East/West, with both 10 degree and 18-degree options on offer, making this system extremely versatile for every requirement.

The ConSole+ system is a Ballasted racking system for flat roofs without roof penetration suitable for south-oriented solar installations on regular flat roofs, small flat roofs, such as garages or bungalows, and on redeveloped surfaces on the ground.

The TriSole+ system is a Triangular racking frame for pitched, flat roofs & ground mounting. It is available in various inclinations. Thanks to the large number of compatible roof connection elements and the option of ballasting TriSole, is suitable for a variety of different types of roofs and roof coverings.



# ESDEC

Esdec has been supplying mounting systems for solar panels since 2004 for both flat roofs (with FlatFix) and pitched roofs (with ClickFit). With over 15 years of experience and more than 7 GWP installed capacity with their systems, they are a leading player, operating worldwide.

Esdec was founded by installers. As a result, convenience for the installer is always the priority in the design of their products. By integrating the input from professional installers immediately into their designs, Esdec managed to develop a number of the most popular mounting systems on the market.

## WHY CHOOSE ESDEC?

Here's five reasons why our customers love Esdec.

- Quick & Easy installation, designed by installers.
- Streamlined components, using the minimum required.
- Works on all roof types.
- Safe, reliable & durable.
- Online calculation tool to check required materials.



# Export Limitation

With the UK Grid under more and more strain, export limitation – or Power Management as it's often referred to – is becoming more widely utilised. Export limitation is the system of controlling the amount of power from a PV installation that is exported to the grid.

In certain regions of the UK the electricity supply network can't physically accept any more exported power back to the grid - this is where export limitation becomes invaluable to a PV installation. For example, a project may require a 100kW system to be installed but the DNO will only approve 50kW. In this situation export limitation becomes a valuable solution to meet the needs of your client and the DNO as export can be limited to 50kW whilst still installing 100kW of PV.

Export limitation is more advanced than simply clamping the output of inverters. It is a reactive solution that constantly monitors the energy consumption on site, and only limits the power production if the amount being exported to the grid exceeds the limit. That means if the demand on site is high, the inverters can be allowed to work to their full potential, maximising the benefit to the site.

Export limitation now comes with its own grid certification (G100) so this is something else to consider when choosing the products for your project. Some inverters have export limitation capability built in; others need additional hardware.

It is however worth noting that when installing a system with a G100 approved export limiting solution, it doesn't exclude the system from having to apply under the relevant grid certification scheme for the net capacity of the system. E.g. You can limit a 50kW system to 3.68kW – but despite output only being 3.68kW you would need to register this under G99, not G98.

Being clear on the needs of your client and liaising with your Segen account manager on the products that will meet all those needs and deliver a suitable solution will ensure the project runs smoothly.



# A Quick Guide to G99

**The Engineering Recommendation G59/3 was replaced by G99 in April 2019.**

G99 has been introduced to give DNO's greater control over connected generators in the UK. Due to the amount of installed generating systems far exceeding Ofgem & the National Grid's expectations, changes have been implemented so that DNO's can ensure the energy network remains compliant with statutory voltage, frequency, and power quality requirements.

When applying for permission to connect to the DNO the process is essentially the same except you will be required to complete a G99 application instead of G59/3.

G99 covers both single and three-phase installations. For smaller commercial projects, G99 applications can usually be turned around in 2 – 6 weeks. Larger projects will require more time, and which can vary by DNO. You are advised to involve your DNO as early as possible in your plans. The DNO may allow up to 20-25kW to be connected to a strong single-phase grid connection, depending on the state and impact it has on the local transformer, otherwise they will ask for it to be balanced across a 3-phase connection.

For anything over a 50kW installation, an external G99 relay may be required to be fitted for additional protection. This will add time and cost to the installation and should not be overlooked.

G99 requires an additional test by all inverter manufacturers. This test involves measuring the G99 relay within the inverter to a higher standard. Once passed, it may allow any certified inverter to be used by installers for larger projects without having to fit the expensive G99 relay and having to pay for DNO tests, thus lowering project costs. This implementation varies between DNO's so it's important to ensure this is confirmed with the DNO during the planning stage.

For more details on G99 please refer to the Energy Networks Association

Website [www.energynetworks.org](http://www.energynetworks.org)

## **Surge Protection (Overvoltage)**

Although the UK doesn't suffer thunderstorms like other countries might, protection from power surges caused by a lightning strike is advisable as the impact on a PV installation can be catastrophic. Some sort of surge protection is a likely requirement on commercial systems that are mounted on a building with high occupancy (a hospital or school), with a fire risk (an industrial facility) or in an exposed location at higher risk of lightning strikes.

Some manufacturers have built surge protection into the inverter itself, so it is always worth checking if this is the case with products you are quoting. Alternatively, there are separate devices available which can be fitted to the PV system to provide protection.

<https://portal.segen.co.uk/nav/pv/Protection>

# Commercial Funding

For commercial property owners, the opportunities for solar PV are significant, not only in the short-term to reduce energy costs, but over the longer term to drive creative ways in which they can maximise returns from generating their own electricity. Of course, there is a capital cost to deploying these solar installations and for many businesses, this can prevent them from taking advantage of the opportunities represented by their property. A number of Investment banks can offer project funding for solar projects, however, there is a way to take advantage of the benefits of a solar installation without deploying capital. This is possible due to the interest of institutional investors in solar as an alternative asset class and the use of a Power Purchase Agreement (PPA).

## Power Purchase Agreement

A solar PPA is an agreement in which an investor funds the installation of a solar system at no capital cost to the property owner. This includes working with an experienced developer and asset manager who facilitates the technical design, gains necessary permissions, and manages the

installation of the solar PV system. All of this is backed by professional institutional investors that provide the capital based on the returns they receive from the electricity generated over the life of the system, which is consumed by the property owner.

### Three main reasons why PPAs benefit clients.

- **Immediate reduction in energy costs:** Clients receive significant energy savings and solar PPAs also provide a predictable cost of electricity for the term of the agreement, with the price the client pays increasing at an agreed rate.
- **No capital investment:** Without any upfront investment, the client can begin saving money as soon as the system becomes operational.
- **No ongoing maintenance burden:** The asset manager takes responsibility for system performance and operating risk.

Contact your Segen Commercial Account manager for more information about funding.

# Need Reliability?

## The solution is...

**solis**  
inverters



Solis inverters are widely used from small commercial projects through to ground mount utility scale. The wide model range typically is able to provide a solution to all configuration requirements.

**Dual MPPT:** 3P4G / 5-20kW

**Tri/Quad MPPT:** 3P4G / 25-40kW

**Quad MPPT:** 3P / 50-60K

**Single MPPT, 1500V:** 3P5G / 125kW



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