

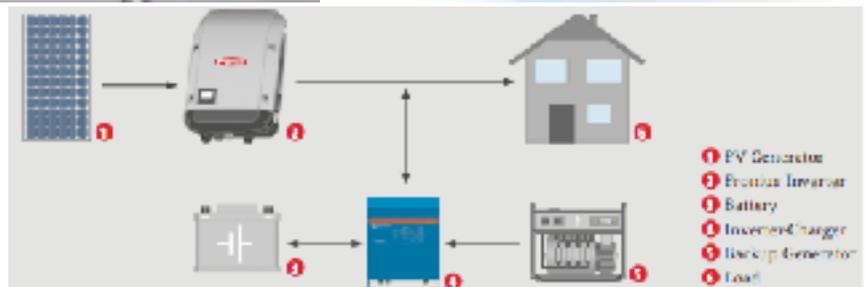


# Sunnytek Solar Sweden

## ISP Industrial power unit for 24/7 operation with no grid



This power solution is optimised to be used in remote areas with no grid for smaller and medium sized industrial establishments or cities. Here the normal power solution is a costly diesel generator that make electricity to a very high cost. This solution can replace most of diesel costs by pure solar energy. It have a smart new combination of charger/inverters in what we call phase angle control operation.



This solution is optimised for tropical installations and as close to zero maintenance as possible. Life time design is 10-20 years and we have a reliable long time battery systems for dark hours. This can be designed to operate 24/7 and diesel is not used at all. This new technology is clearly better and simpler and then less costly that todays solution. Maintenance is very small and we can make tests and checks by a mobile phone.

### Features ISP systems

- \* 27 / 7 operation to replace diesel generators or an unreliable grid by pure and clean solar power
- \* Long life deep cycle battery solution based on new Ni-MH bipolar technology and up to 20 years life time
- \* Works with reliability in high tropical temperatures and climate without significant degeneration over years
- \* Phase sensing angle control gives better efficiency up to 10% for power savings in daytime
- \* Less costly that other systems and not so many components and cables
- \* Simpler design makes better reliability and lower costs and maintenance by less skilled staff.
- \* Green long life battery with no acids and dangerous materials. Up to 20 years LCC. No Lithium is used
- \* Galvanically insulated inverters + extra units makes less risks and better resistance when lightning struck.
- \* Thin film panels for best power in twilight and at rainy days. Surfe protectors for lightning protection.
- \* Double laminated glasses for longer life up to 40 years life cycle
- \* Web interface by mobile phone to make remote service and supervising the whole system

This system will fit in many sites where simplicity and reliability are key words. This is the perfect diesel replacement unit. Production costs are often 20-40 % of costs for diesel generated power.

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Page 2/4 6 April 2017

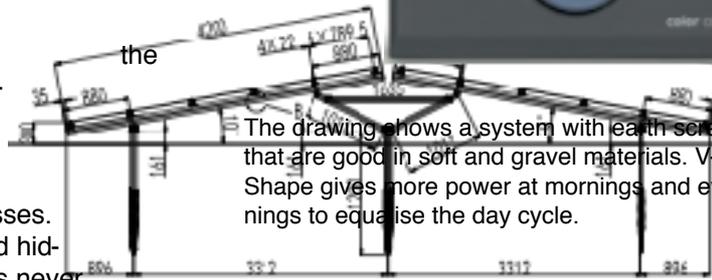
**Solar panels and the solar farm.** We use 145 W thin film panels to have best performance in general and in particular days with little sun. Twilight and cloudy operations sets limits and sunny days is never a problem. Thin film gives 20-30 % more KWH a cloudy day compared to crystalline panels. The glossy surface is also easier to keep clean and rain wash dust away easier than matt panels will do. Spectra is better on the film panels and this adds efficiency.

All sites are calculated by us to get best balance between solar panels and day cycle consumption and to match chargers for dark hour demands.

**Solar panels installation.**

We have an aluminum profile system in a V-shape as drawing show. They face east west and this give more power in mornings and evenings to equalise day. This is the simple low maintenance system. We have a ballast mount for simplest and fastest installation

We put electronic cabinet close to panels to get shortest possible cables and lower losses. Cables and junction boxes are protected and hidden under panels. Rain and UV light + sun is never good for any cables and boxes and the perfect roof design is good for smallest footprint in area and this reduce cable and installation size.



The drawing shows a system with earth screws that are good in soft and gravel materials. V-Shape gives more power at mornings and evenings to equalise the day cycle.

Photos shows small sites in Africa with single side angles.



**Inverters and electronics.**

The new feature



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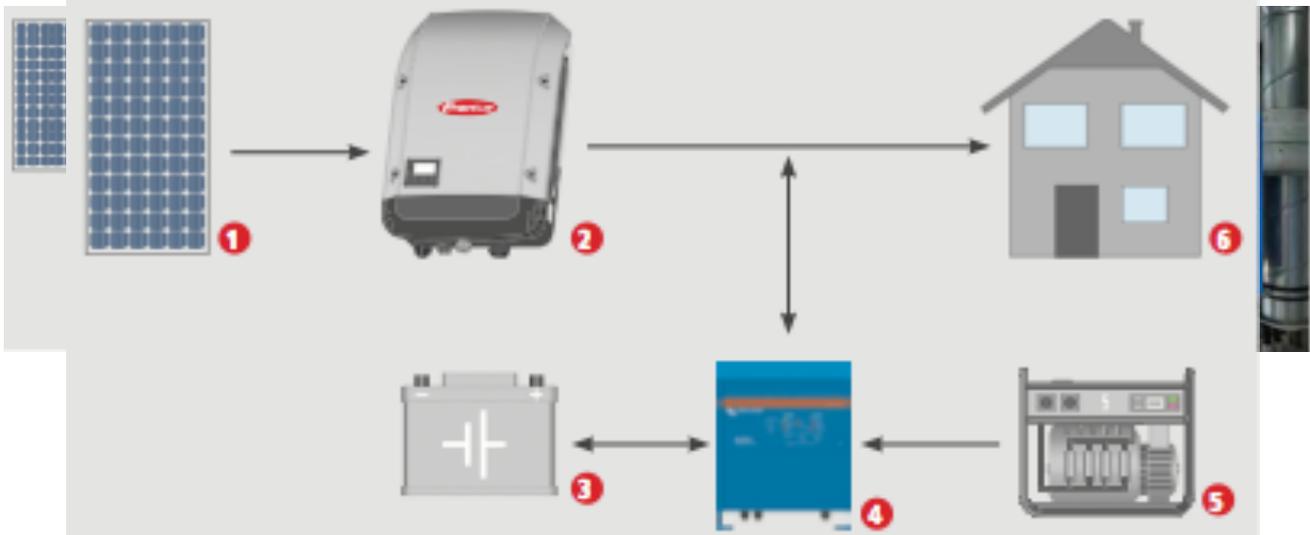
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Page 3/4 6 April 2017



in our solution is the combination of inverters and chargers to match the 24 hour energy cycle. Earlier designed needed all power to pass over a large battery system before used by the grid. Now we have special electronics and software that separate energy flow so a large part at day time can go direct from panels to AC 1 or 3 phase beside battery unit. This saves losses of 10-25 % that otherwise is lost in all chargers. electronics and a battery charge/ discharge cycle.

By measuring phase angle at DC we can exactly control a grid inverter to work off grid combined with our other units.

At daytime power that is produced by panels and used in the local grid is sent direct from Inverter to the user without passing battery and MPPT chargers. This gives far less in losses. What is stored by battery is here using the MPPT chargers and stored in a normal way.

Result is a better efficiency fewer components and a lower system cost.

We always calculate balances in day and night time to find what solar panel power is needed, Inverter size is needed and battery storage dimensions.

**Battery system**

There are several solutions available and we always see what is best in the specific site. Variables and costs set rules we must optimise.

- \* Lead battery system when cost is a key and it is max 25C in temperature and 7-10 years life cycle is OK.
- \* Bipolar Ni-MH battery when 10-20 years life time is needed and when it is 20-40 C in temperature.
- \* Flow battery when you need 20 years life cycle and kit is hot and capacity may be very large
- \* Lithium Iron Phosphate when you need min 10 years and it is hot and weight and volume is a key.

This is general comments and this needs a deeper when selected for the unique site.

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### ISP Industrial power unit for 24/7 operation with no grid Page 4/4 6 April 2017 Typical idea of a site in Tropical climate in a small mine with no grid and no diesel fuel

Power day time 110 KW mostly for pumps and motors 10 hours = 1.1 MWH in power  
Power night time 70 KW for lamps and houses 14 hours = 1 MWH in power  
Energy demand to create by system is 2.1 MWH / day  
Sunny hours with full power is 5 hours ( Typical value ) Power of solar farm is then about 400 KW

#### **The almost 100% solution that cut diesel and generator costs at least 95%**

Inverters for making 3 Phase power needs to be 110 KW at days and 70 KW at nights  
We use a Grid tie inverter of 120 - 130KW here to make direct 3 Phase.  
We need a master unit with phase sensor and this is preferable a 3x15 KW inverter ( 45 KW )  
We use grid tie inverters to make difference between 45KW and 130 KW = 85 KW = 3x30KW  
We have a charging + direct grid supply of 400 KW from all solar panels.  
Grid tie systems handle 100 KW of this direct to users  
300 KW must be possible to charge direct to battery pack and here we need an array of MPPT chargers or alternative we add on grid inverters with separate battery chargers to use all produced power.  
Battery solution is here a system for 2 MWH capacity based on Ni-MH technology with a life cycle of 15 years or more.

**Pay off time** . If you compare to use a diesel generator for all power production this system is fully paid in 2-3 years. Life time LCC is 15 years and at this point you still have 10-20 years life time of panels but battery may be OK but getting tired.

#### **The simpler solution with lower start up cost. No solar power at nights but at day.**

Solar panels 150 KW for day time operation  
Inverters 130 KW string inverters with phase sensing  
Master inverter 15 KW giving the correct phase sync and operating at a not very large battery to get stability  
MPPT direct solar charger for battery of about 10 KW max output in charging mode  
Battery back up 50 KWH capacity to equalise and stabilise local grid and a short time back up and some power that can be used for lamps at nights.

**Pay off time.** Possible less 2 years.