L-HPK 290/300 is **Sunnytek-Large home power kit** is a package for getting power to relatively houses that are off grid. Here we operate with no grid and power by sun only enough for a family to get lamps + power for a fridge and TV set. Components are of highest quality and all key parts are European brands only. System is designed for tropical areas where demands are very high if a long maintenance free like time is a dream. Design criteria is to offer a system where nothing needs service and rapid in 5 years and most parts handle at least 10-15 years or more.

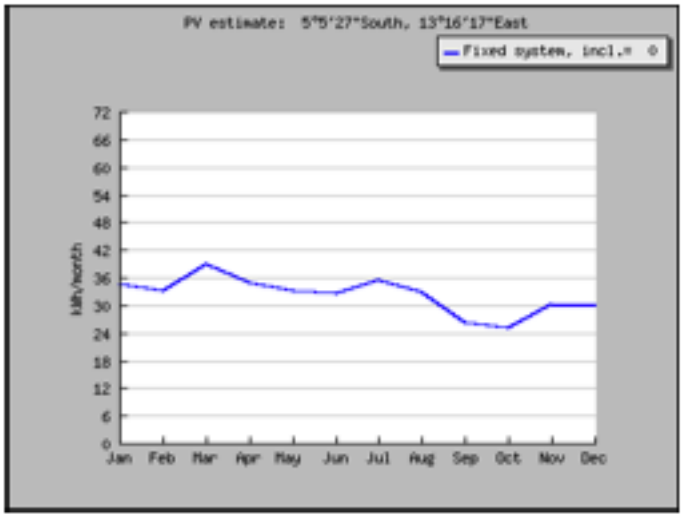
Solar panels with totally 290W output is the key component and we have selected a special model based on thin film double laminated glass design. Reasons are that these panels are far better than crystalline panels when weather is a bad and here the main problem of lost energy. Bad weather sets limits of any solar system and the best sunny days is never a problem.
Thin film often gives 20-30 % more power when weather is bad compared to crystalline panels. Thin film is also far less sensitive to dirt and debris / objects on surface as tree leaves which is a common problem in tropical areas. These panels have by far the best high temperature characteristics. Double laminated glass are by far the most rugged design.
We use a model with 2x145 W in output. This corresponds to a larger sized Crystalline panel in output as thin film normally is 10% better over one year if we look at produced power in KWH.
Panels have 100 Volt DC output making cable losses smaller than on low voltage panels.
Warranty of solar panels is full 20 years specified to 80% of original specifications. Panels are made in hardened glass and frameless.
Edges are insulated to avoid galvanic corrosion and we have no aluminum frame by same reasons. Surfaces are glossy polished glass and is not a mat surface. This make cleaning far simpler and water by rain is normally OK.
These panels have been our standard in African installations in very hand climate areas in Congo and Burundi.

Nominal power of the PV system: 0.3 kW (CdTe)
Estimated losses due to temperature and low irradiance: 9.3% (using local ambient temperature)
Estimated loss due to angular reflectance effects: 2.5%
Other losses (cables, inverter etc.): 14.0%
Combined PV system losses: 19.2%

Month	Fixed system: inclination=0 deg., orientation=0 deg.			
	Ed	Em	Hd	Hm
Jan	1.12	34.6	4.34	144
Feb	1.19	33.2	4.36	139
Mar	1.25	38.8	5.22	162
Apr	1.16	34.8	4.50	144
May	1.07	33.2	4.39	136
Jun	1.00	30.7	4.41	132
Jul	1.15	35.6	4.57	146
Aug	1.06	32.8	4.35	135
Sep	1.07	32.2	4.51	135
Oct	1.01	31.4	4.17	129
Nov	1.01	30.3	4.19	126
Dec	1.07	33.2	4.38	136
Year	1.09	33.3	4.38	133
Total for year		397		1600

Ed: Average daily electricity production from the given system (kWh)
Em: Average monthly electricity production from the given system (kWh)
Hd: Average daily sum of global irradiation per square meter received by the modules of the given system (kWh/m2)
Hm: Average sum of global irradiation per square meter received by the modules of the given system (kWh/m2)

Installation is very simple. We always supply hard ware for roof mount based on a wood profile system with rubber coated clamps. This is very easy to use on corrugated roofs and other roofs as well.
Solar panels in a tropical area will generate electrical power measured in KiloWatt Hours (KWH) . These shall be charged into the battery in a good way. We use a 145 W solar panel and here we get a typical value depending on where we are located. Our panels are thin film panels that produce more power when weather is not to sunny. In rainy areas the difference to other panels is vary large in output.
Here at left we show typical graphs of a tropical area. ED column 1 show the daily average power production. Here we see it is typical 0.53-0.67 KWH / day depending on season. This makes the battery to be able to collect and store something like 0.7 KWH per day cycle to be correct.



Monthly energy output from fixed-angle PV system

The Battery solution is the key of reliability and the most costly component in the system. Here care is needed to get a happy end user and no problems in a reasonable time. We use GEL Deep cycle technology by Victron in Holland. These have been used by us in tropical Africa with very good reliability. If charged at max 25C in ambient temperature they can often survive 5-10 years life cycle similar to Central Africa and Caribbean area.
Lead battery shall not be deep cycled more that 30-40% of its capacity to get a good life life time. Here we have a deep cycle to 30% as a safe value. Battery must store about 2-2.5 KWH to be used with little stress. We have a 24 volt battery this will be about 110AH in capacity and we can use 2 pcs of 12 volt batteries in series.

When hotter or demands higher Lithium Iron Phosphate technology is preferred. They can survive 10-15 years life cycle even when very hot and deep cycled of 80% dept daily.

Battery model	Ambient temperature	Deep cycle	Lifetime
Lead Car SMA type	20 C Max	40%	6 months
Lead Car SMA type	30 C	40%	2-3 months
Lead GEL solar	25 C	40%	4-6 years
Li-Fe-Po	60C	80-90%	10-15 years
LTO Lithium Titanate	50C	80-90%	20-30 years
Ni-MH Nilar	60 C	60-75%	15-20 years

Solar MPPT charger system 30 A and 150 Volt
All parts are important and charger is a component that can change a lot of performance. There are 2 models. One is called PWM that is Pulse width modulation that is cheapest and simplest. We have Victron design that is cost efficient and best quality based one MPPT operation as the best solution.
MPPT solar charger is more advances and stands for Maximum Peak Power tracking. Here a processor sense and see what can be collected from panels and just all parameters by a DC/DC converter inside unit. MPPT offers 20-30% more KWH / day added into battery as controller is more efficient. The unit can handle 60A /150 volt in power. (max 4 KW) If needed it is possible to add more panels later if demands in power increase.

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Inverter system 24 volt 375 W 110/230 volt 50/60 Hz

Inverter is a 24 Volt DC input inverter with 375W inverter output and clean sine wave wave form. Made in Holland by high quality and best reliability. System is fully protected for tropical applications. 5 years warranty is offered.

Cable set between solar panels and inverter

All kits have a 10 meter solar panel cable to be used from the panel connector to the solar charger. This is a weather resistant cable as it is used out door in rain and with lots of sun and corrosion.

Cable and fuse set for battery and electronics

Cable set 3 meter long between charger and battery with an automatic fuse to prevent problems. One box with cable clips is included for use on all cables.

These are European made components.

Cable set with switches and all needed parts for installation

Electric connection set 230 Volt of high quality European equipment. Here we have 3 wall switches of high quality with 20 meter cable. There is 2 wall connectors 230 Volt with earth pole.
We have 3 pcs of junction box . All parts are IP 54 encapsulated and rugged for a long life with no problems. All parts are CE marked and fulfil international standards of electrical security.

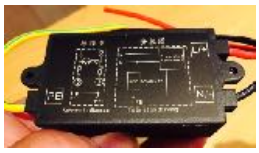
Re mark. For Colombia we have USA wall plugs and 110 Volt operation.

Lamp unit with socket and lamp unit / led bar for 24 volt DC direct operation

Lamp kit contains 6 LED lamp housings wit E27 sockets of a universal design that works in and outdoor. IP 65 protection is OK in a bathroom so it is water sealed. Lamp is a 5W LED lamp with E27 socket giving 400 Lumen in light output. This design gives typical 30-50 thousand hours of lifetime.

Thunderbolt / Lightning protection

Many tropical areas have thunderstorms and lightning problems that destroy equipment. We include a spark arrestor and transient protection to absorb the electrical shocks that can destroy all that is connected by a cable to the solar panel. This device follows the standards of 20KA Ampere transient protection (1000 Volt).
Experience shows this is a key part for long trouble free life of the installation. Lightning is a problem an where an d this is a quality insurance that stops 95% of all problems in this area



Content of the large solar home kit.

2 pcs	145 W	Solar panel with 1 meter cables and MP4 standard connectors. Totally 290W in output by sun. God cloudy weather performance
1 set	10 meter	Junction cable with MP4 connectors between panel and charger
1 pcs	30A/150	MPPT high efficiency solar charger for 24 volt battery operation. EU product
1 set	3 meter	Cable set between charger and battery pack with fuse
1 pcs	Battery	Alternative 1 Lead Gel battery 2X 165 AH 24 volt for 0–30 C ambient Temp. Battery alternative 2 Lithium Iron Phosphate battery 90 AH 24 volt for higher
1 pcs	Inverter	375 W sine wave high quality inverter. Made By Victron 110/230 V on demand
1 set	Cables	Set of all cables between battery + inverters + fuse etc. Length 1 meter.
1 pcs	Junction	For position close to inverter and battery.
3 pcs	Wall switches	110 / 230 Volt
3 pcs	Plastic Junction box	IP 65 Encapsulated
20 m	230 Volt	Cable 3x1.5 mm2 type EKK
6 pcs	Lamp	Lamp with integrated housing 6 W power
1 box	8 mm	Cable clips 8 mm
1 pcs	20 KA	Thunder bolt protection transient absorber.

Calculation criteria for large home system

6 pcs 5 W led lamps	5 hours per day = 150WH per 24 hours
1 pcs TV LED 100W	6 hours per day = 600WH per 24 hours
1 pcs Fridge 110 Liter 3 energy star system 100W	Intermittent 24 = 200WH per 24 hours
1 pcs Radio 10W	6 hours per day = 60 WH per 24 hours
3 pcs Mobile phone chargers	Intermittent 24 = 20 WH per 24 hours

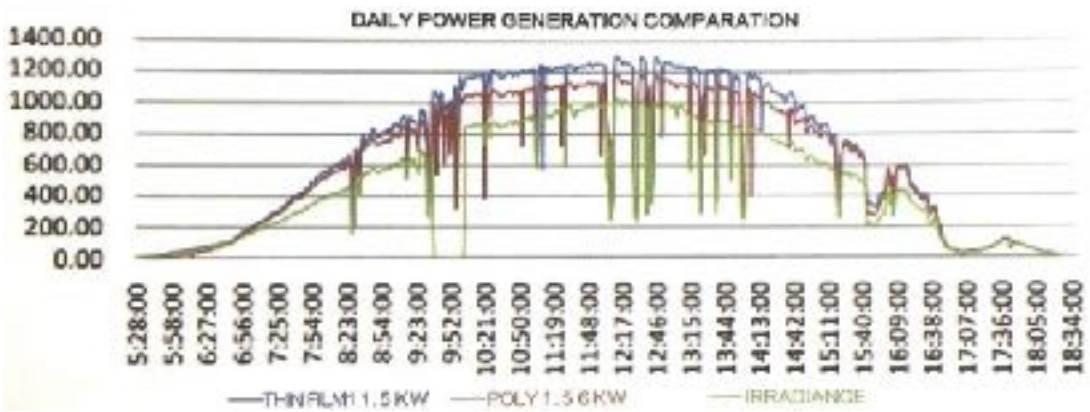
Summary in KWH per 24 hours **Total 1030 KWH / Day**

2 panels of 145W / each gives typical 1.1 KWH / day in a cloudy area as Putomayo and Congo but in sunny areas like Caribbean they make over 2 KWH / day. We are happy to assist to select what is best for your installation site. This is based on a children family with TV and children if front of TV a lot. If family is smaller and do not look to much at TV and area is very sunny a solution with 1 pcs panel may be OK.

Warranty Solar panels 25 years with 80% remaining power
MPPT charger and Inverter 5 years. Led lamps 2 years.
Battery 5 years for Lithium solution if we have a certified installer. If not 1 years warranty.

Extended warranty If we have a complete service contract we ca give up to 10 years complete warranty of all components. This included service visits and check every year and service at site. This is offered on demand.

Graph shows variations a typical day with sun and clouds. Battery absorb these variations. Sun + clouds can differ 95% of output from panels. The bad sun sets limits and here the thin film is by far the best solution



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Top a photo of this design in Bukavu Congo with typically lots of rain and clouds. This is larger with 24 panels and is installed at Panzi hospital area. Mount is the wooden profile design with clamps that is very easy to use on corrugated less flat roofs. Right is the battery system with charger and a larger inverter. Here we have same type of components but only scaled up. Area is famous for highest thunder problems in world and we have special protection of all electronics.

Some ideas about installations with Victront that is our standard source for electronics. In tropical areas and in marine applications Victron is nr 1 and we like no problems so why use something else. Corrosion in electronics in an issue and here marine electronics are far better than other solutions.