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Solar Energy

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# CATALOGUE 2009

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## The electrosolar potential

There is more than enough solar radiation available around the world to satisfy the demand for solar power systems. The proportion of the sun's rays that reaches the earth's surface can satisfy global energy consumption 10,000 times over. On average, each square metre of land is exposed to enough sunlight to receive 1,700 kWh of energy every year. The average energy received in Europe is about 1,000 kWh per square metre per year, for example. It has been calculated that if 0.71% of the European land mass was covered with PV modules, this would meet Europe's entire electricity consumption. Furthermore, International Energy Agency (IEA) calculations show that if only 4% of the world's very dry desert areas were used for PV installations, this would meet the whole world's total primary energy demand.

Considering the vast areas of unused space (roofs, building surfaces, fallow land, deserts etc) the potential is almost inexhaustible.
At the heart of electrosolar - photovoltaic (PV) technology is a semi-conductor material which can be adapted to release electrons, the negatively charged particles that form the basis of electricity. The most common semi-conductor material used in photovoltaic cells is silicon, an element most commonly found in sand. There is no limitation to its availability as a raw material; silicon is the second most abundant material in the earth's mass.

## The advantages of Electrosolar PV technology:

- The fuel is free.
- There are no moving parts to wear out, break down or replace.
- Only minimal maintenance is required to keep the system running.
- The systems are modular and can be quickly installed anywhere.
- It produces no noise, harmful emissions or polluting gases.

1. PV array; 2. PV array combiner / junction box; 3. Grid-tied inverter; 4. Import / Export meter; 5. Connection to the grid; 6. Load.

## Types of Electrosolar PV system

### Grid-connected

This is the most popular type of electrosolar system for homes and businesses in the developed world. Connection to the local electricity network allows any excess power produced to be sold to the utility. Electricity is then imported from the network outside daylight hours. An inverter is used to convert the DC power produced by the system to AC power for running normal electrical equipment.
In countries with a premium feed-in tariff, payment for the electricity generated (see Part Six: Policy Drivers) is considerably higher than the usual tariff paid by the customer to the utility, so all the electricity produced is often fed into the public grid and sold to the utility. This is the situation in countries such as Germany or Spain.

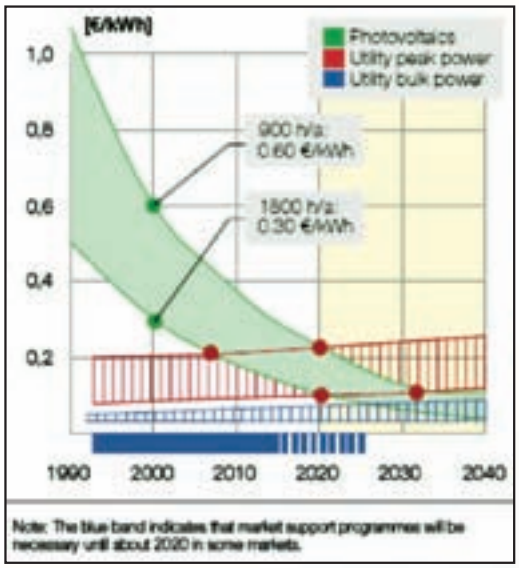
### Off-grid

Where no mains electricity is available, the system is connected to a battery via a charge controller. This stores the electricity generated for future use and acts as the main power supply. An inverter can be used to provide AC power, enabling the use of normal electrical appliances. Typical off-grid applications are repeater stations for mobile phones, electrification for remote areas (mountain huts) or rural electrification in developing countries. Rural electrification means either small solar home systems covering basic electricity needs in a single household, or larger solar mini-grids, which provide enough power for several homes.

### Hybrid system

A solar system can be combined with another source of power - a biomass generator, a wind turbine or diesel generator - to ensure a consistent supply of electricity. A hybrid system can be grid-connected, stand-alone or grid-support.

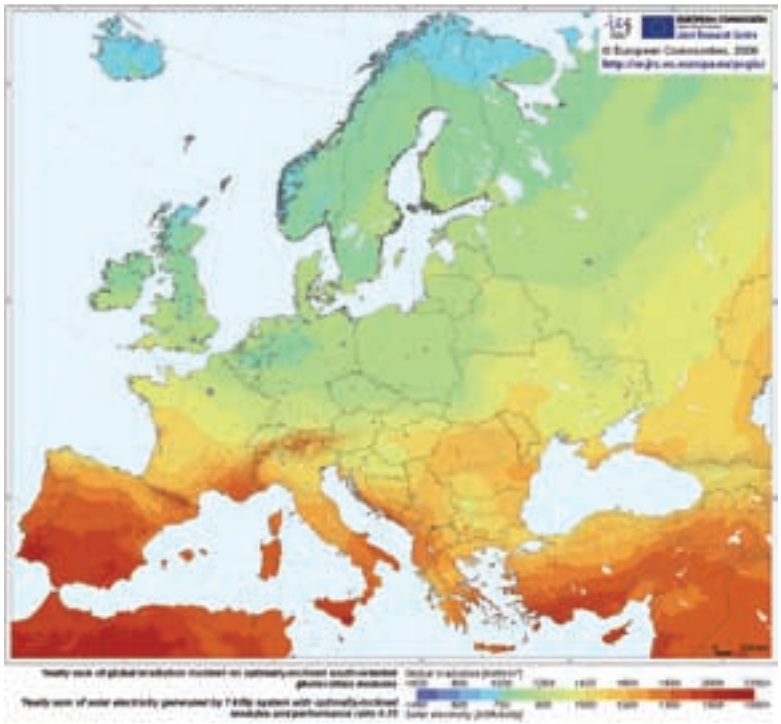
## Development of utility prices and PV generation costs




## Solar Generation scenario results for global PV market up to 2030

| | 2006 | 2010 | 2020 | 2030 |
|---|---|---|---|---|
| Annual installations in GW | 1.5 | 5.6 | 44 | 179 |
| Cumulative capacity in GW | 6.6 | 28.9 | 241 | 1,272 |
| Electricity production in TWh | 8 | 25 | 320 | 1,802 |
| PV contribution to electricity consumption - Reference Scenario (IEA) | 0.05% | 0.14% | 1.83% | 6.41% |
| PV contribution to electricity consumption - Alternative Scenario | 0.05% | 0.18% | 1.93% | 9.39% |
| Grid-connected people people in millions | 5 | 15 | 157 | 776 |
| Off-grid connected people in millions | 10 | 61 | 966 | 2,894 |
| Employment in thousands | 74 | 271 | 1,840 | 6,329 |
| Market value in billion Đ | 9 | 25 | 113 | 318 |
| Annual $CO_2$ savings in million tonnes | 5 | 15 | 192 | 1,081 |
| Cumulative $CO_2$ savings in million tonnes | 20 | 61 | 898 | 6,671 |

## Photovoltaic Solar Electricity Potential in European Countries

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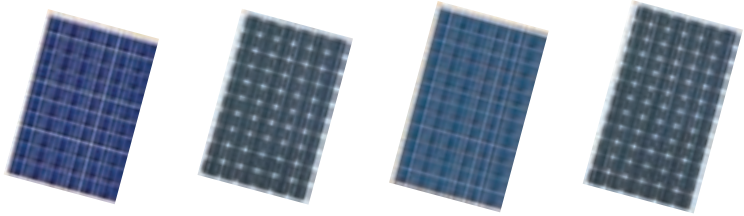
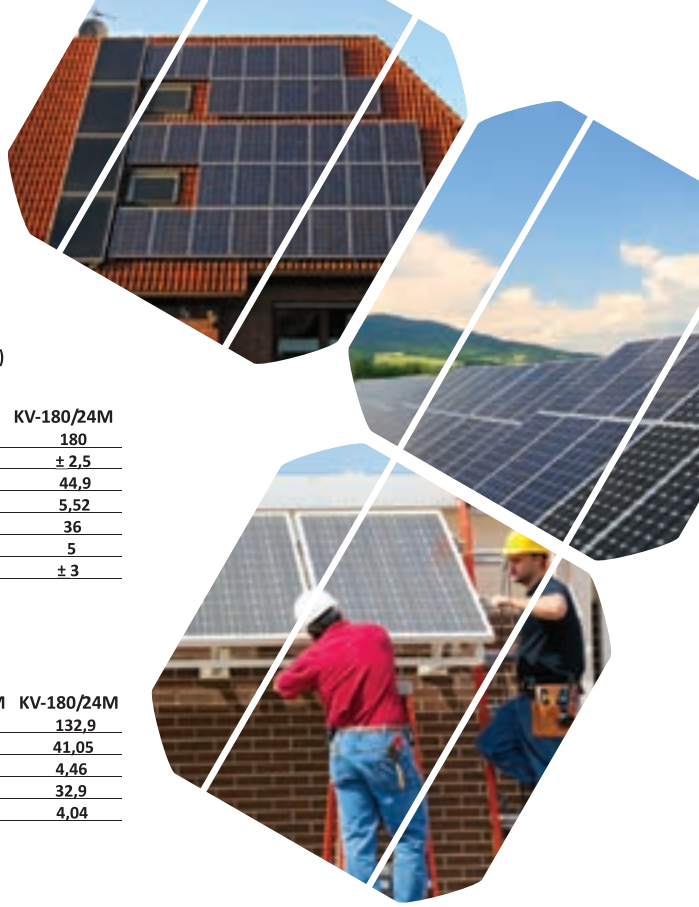
## KV 160-180/24M type photovoltaic terrestrial module





Electrical dataunder STC ( Irradiance = 1000 W/m²; air mass = AM 1,5;Nominal operating temperature T = 25°C)
(The average statistical module parameters)

| Type of module | | KV-160/24M | KV-165/24M | KV-170/24M | KV-175/24M | KV-180/24M |
|---|---|---|---|---|---|---|
| Nominal power | Pmax, Wp | 160 | 165 | 170 | 175 | 180 |
| Sorting limits | W | ± 2,5 | ± 2,5 | ± 2,5 | ± 2,5 | ± 2,5 |
| Open circuit voltage | Voc, V | 43,6 | 44,1 | 44,3 | 44,5 | 44,9 |
| Short circuit current | Isc, A | 5,17 | 5,24 | 5,36 | 5,4 | 5,52 |
| Voltage at maximum power | Vmpp, V | 34,6 | 35 | 35,25 | 35,5 | 36 |
| Current at maximum power | Impp, A | 4,63 | 4,72 | 4,82 | 4,93 | 5 |
| Tolerance of power, % | | ± 3 | ± 3 | ± 3 | ± 3 | ± 3 |

Electrical data at 800 W/m²; air mass = AM 1,5;NOCT
(The average statistical module parameters)

| Type of module | | KV-160/24M | KV-165/24M | KV-170/24M | KV-175/24M | KV-180/24M |
|---|---|---|---|---|---|---|
| Performance at MPP approx. | Pmax, Wp | 118 | 121,9 | 125,6 | 129,5 | 132,9 |
| Open circuit voltage approx. | Voc, V | 39,85 | 40,3 | 40,5 | 40,68 | 41,05 |
| Short circuit current approx. | Isc, A | 4,18 | 4,24 | 4,33 | 4,37 | 4,46 |
| Voltage approx. | Vmpp, V | 31,63 | 32 | 32,22 | 32,45 | 32,9 |
| Current approx. | Impp, A | 3,74 | 3,81 | 3,9 | 3,99 | 4,04 |

## ORVALDI Electrosolar Inverter DC/AC

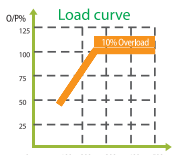
**Orvaldi Solar Power** is the most advanced solar inverter for grid connected PV-plants.

Solar Power is designed base on following principles:
- high converting efficiency,
- boosting system efficiency via MPPT,
- low cost,
- easy installation and maintenance,
- user friendly,
- long-life usage.


| Model | SLK-1500 | SLK-2000 | SLK-3000 | SLK-4000 |
|---|---|---|---|---|
| **Input Data** | | | | |
| Maximum Input power | 1875W | 2500W | 3750W | 5000W |
| Max. input voltage | 500VDC | | | |
| Maximum PV open voltage | 360~400V | | | |
| Nominal DC voltage | 150V to 500V +/-5% | | | |
| MPPT voltage range | 100 +/-5% | | | |
| System start-up voltage | 100 +/-5% ~ 500 -5% +0%V | | | |
| Initial feeding voltage | 150V +/-5% | | | |
| Max. input current | 7.5ADC | 10ADC | 15ADC | 20ADC |
| Full rating working range | 250V to 500V | | | |
| Shutdown voltage | 80V typical | | | |
| DC voltage ripple | < 10% | | | |
| DC insulation resistance | > 8M ohm | | | |
| DC switch | ON/OFF 20A | | | |
| DC connector | Tyco-contact (1 pair) | | | |
| Attached DC connector | Tyco-contact (1 pair)-cable type | | | Tyco-contact (3 pair) |
| **Output Data** | | | | |
| Nominal output power | 1500W | 2000W | 3000W [7] | 4000W |
| Maximum output power | 1650W | 2200W | 3300W [8] | 4400W |
| Operational voltage range [1] | 198V, minimum 256V, minimum | | | |
| Operational normal voltage | 230Vac | | | |
| Operational frequency range | | | | |
| Nominal output current | 6.6A | 8.7A | 13A | 17.4A |
| O/P current distortion [4] | THD<5%, each harmonics< 3% | | | |
| Power Factor | > 0.99 | | | |
| DC current injection | <0.5% of rated inverter output current | | | |
| **Output Data** | | | | |
| Internal power consumption | < 7W | | | |
| Standby power (at night) | < 0.1W | | | |
| Minimum conversion efficiency (DC/AC) | > 90% Under input voltage >210V, load>20% | | | |
| Maximum Conversion Efficiency (DC/AC) [5] | > 94% | > 96% | | |
| European Efficiency | > 93% | > 95% | | |
| GFCI threshold [6] | See ground fault current detection | | | |
| Ground current detection range | 0 ~ 500mA | | | |
| Ground current detection frequency | 0 ~ 700Hz | | | |
| Protection degree | IP 65 or IP43 | | | |
| Operation temperature | -25 to 55° C | | | |
| Humidity | 0 to 95%, non-condensing | | | |
| Heat Dissipation | Convection | | | |
| Acoustic noise level | < 40dB, A-weighted, frequency up to 20kHz | | | |
| Altitude | Up to 3000m without power derating, 5° C derated for each additional 500m | | | |
| Physical : W x D x H (mm) | 380x300x133 | 380x300x133 | 380x300x143 | 550 x 300 x 133 |
| Physical : Weight (kg) | 14 | 14 | 14 | 21 |
| Shipping : W x D x H (mm) | 495x465x285 | 495x465x285 | 495x465x285 | 665 x 465 x 285 |
| Shipping : Weight (kg) | 16 | 16 | 16 | 23 |

The relation of input DC voltage and output power is shown in figure. Once input V is less than 2 50V, the relation of I/P V and load % is : Load% = 0.4 x Vi

1.VDE0126-1-1, it is -20%/ +15%
2.Based on the limit of VDE0126-1-1
3.Based on limit of IEEE1547
4.Under utility voltage THD<3%, reference IEEE1547, EN61000-3-2
5.under input voltage>= 400V, full rated output power, 25°C ambient
6.According to VDE0126-1-1 requirement
7.Based on the output voltage is higher than 200Vac
8.Based on the output voltage is higher than 220Vac




## Remote control and management

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UPS - Power Protection Company

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