

# Wind power

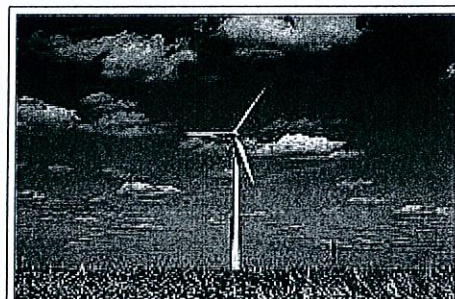
From Wikipedia, the free encyclopedia

**Wind power** is the conversion of wind energy into a useful form of energy, such as using wind turbines to make electricity, wind mills for mechanical power, wind pumps for pumping water or drainage, or sails to propel ships.

At the end of 2008, worldwide nameplate capacity of wind-powered generators was 121.2 gigawatts (GW).<sup>[1]</sup>, which is about 1.5% of worldwide electricity usage;<sup>[1][2]</sup> and is growing rapidly, having doubled in the three years between 2005 and 2008. Several countries have achieved relatively high levels of wind power penetration, such as 19% of stationary electricity production in Denmark, 11% in Spain and Portugal, and 7% in Germany and the Republic of Ireland in 2008. As of May 2009, eighty countries around the world are using wind power on a commercial basis.<sup>[2]</sup>

Large-scale wind farms are connected to the electric power transmission network; smaller facilities are used to provide electricity to isolated locations. Utility companies increasingly buy back surplus electricity produced by small domestic turbines. Wind energy as a power source is attractive as an alternative to fossil fuels, because it is plentiful, renewable, widely distributed, clean, and produces no greenhouse gas emissions. However, the construction of wind farms is not universally welcomed because of their visual impact and other effects on the environment.

Wind power is non-dispatchable, meaning that for economic operation, all of the available output must be taken when it is available. Other resources, such as hydropower, and standard load management techniques must be used to match supply with demand. The intermittency of wind seldom creates problems when using wind power to supply a low proportion of total demand.<sup>[3][4]</sup>



A Wind turbine.

## Renewable energy



Biofuel  
Biomass  
Geothermal  
Hydroelectricity  
Solar energy  
Tidal power  
Wave power  
**Wind power**



## Sustainable energy

**Renewable energy**  
Anaerobic digestion  
Hydroelectricity · Geothermal  
Microgeneration · Solar  
Tidal · Wave · **Wind**

**Energy conservation**  
Cogeneration · Energy efficiency  
Geothermal heat pump  
Green building · Passive Solar

**Sustainable transport**  
Plug-in hybrids · Electric vehicles

 **Environment Portal**

## Contents

- 1 History
- 2 Wind energy
  - 2.1 Distribution of wind speed
- 3 Electricity generation
  - 3.1 Grid management
  - 3.2 Capacity factor
  - 3.3 Penetration
  - 3.4 Intermittency and penetration limits
  - 3.5 Capacity credit and fuel saving
- 4 Turbine placement
- 5 Wind power usage
  - 5.1 Power Analysis



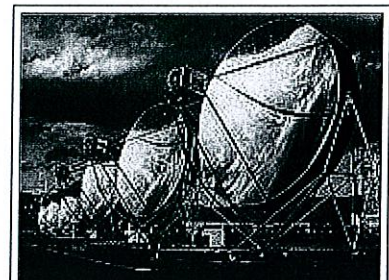
# Solar energy

From Wikipedia, the free encyclopedia

**Solar energy**, radiant light and heat from the Sun, has been harnessed by humans since ancient times using a range of ever-evolving technologies. Solar radiation, along with secondary solar-powered resources such as wind and wave power, hydroelectricity and biomass, account for most of the available renewable energy on Earth. Only a minuscule fraction of the available solar energy is used.

Solar powered electrical generation relies on heat engines and photovoltaics. Solar energy's uses are limited only by human ingenuity. A partial list of solar applications includes space heating and cooling through solar architecture, potable water via distillation and disinfection, daylighting, solar hot water, solar cooking, and high temperature process heat for industrial purposes. To harvest the solar energy, the most common way is to use solar panels

Solar technologies are broadly characterized as either passive solar or active solar depending on the way they capture, convert and distribute solar energy. Active solar techniques include the use of photovoltaic panels and solar thermal collectors to harness the energy. Passive solar techniques include orienting a building to the Sun, selecting materials with favorable thermal mass or light dispersing properties, and designing spaces that naturally circulate air.



A parabolic dish and Stirling engine system, which concentrates sunlight to produce useful solar power.

## Solar energy



Solar power  
Solar thermal  
Photovoltaics  
Solar vehicle

## Renewable energy



Biofuel  
Biomass  
Geothermal  
Hydroelectricity  
**Solar energy**  
Tidal power  
Wave power  
Wind power

## Contents

- 1 Energy from the Sun
- 2 Applications of solar technology
  - 2.1 Architecture and urban planning
  - 2.2 Agriculture and horticulture
  - 2.3 Solar lighting
  - 2.4 Solar thermal
    - 2.4.1 Water heating
    - 2.4.2 Heating, cooling and ventilation
    - 2.4.3 Water treatment
    - 2.4.4 Cooking
    - 2.4.5 Process heat
  - 2.5 Electrical generation
    - 2.5.1 Experimental solar power
  - 2.6 Solar chemical
  - 2.7 Solar vehicles
- 3 Energy storage methods
- 4 Development, deployment and economics
- 5 ISO Standards
- 6 See also
- 7 Notes



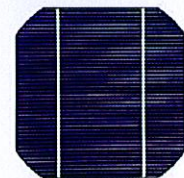
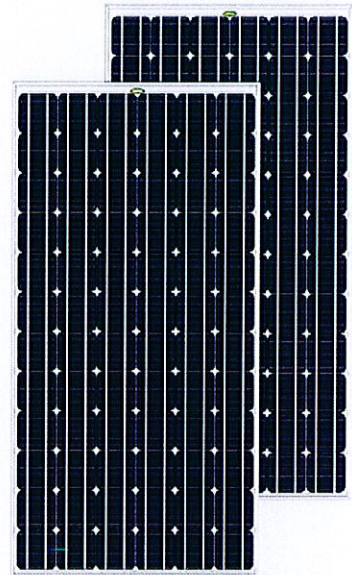
# EPL MODULE

## EPL-100W Performance Data Sheet

EPL panels offer you the most cost effective power performance. These PV modules are designed to work under extreme operating environment and reduced using carefully selected mono- and polycrystalline cells to deliver maximum power output even under reduced light conditions.

### BENEFITS OF EPL MODULES

- ✱ Robust, clear anodized aluminium frame with pre-drilled holes for quick installation
- ✱ Low voltage temperature coefficient enhances high-temperature operation
- ✱ Output power tolerance of +/- 5%
- ✱ Superior aesthetics with clear anodized frame
- ✱ Highest quality, high-transmission tempered glass provides enhanced stiffness and impact resistance
- ✱ Advanced EVA encapsulation system with multi-layer back sheet to meet the most stringent safety requirements for high-voltage operation
- ✱ Sturdy, anodized aluminium frame for easy mounting on roof with various standard mounting systems



*Delivering GREEN energy to our world*





## Physical Specifications

### Warranty

2 years limited warranty on materials and workmanship  
20 years limited warranty on power output

### Rated Power and Maximum Tolerance

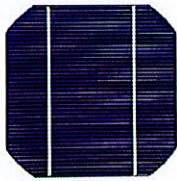
Rated power 100W  
Connecting socket IP 65

### System Design Characteristics

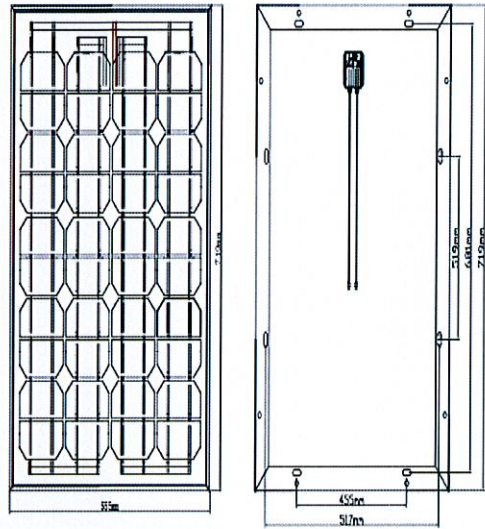
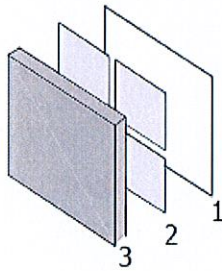
Maximum System Voltage 1000V  
Module Array 36 cells 125\*125  
Conversion Efficiency 14-16%

### Normal Operating Conditions

Operating Temperature -40 to +194°F / -40 to +90°C  
Storage Temperature -40 to +194°F / -40 to +90°C



1. Front: Tempered Glass
2. Monocrystalline PV cell embedded in EVA
3. Rear: Tedlar Film



## Electrical Specifications

### Performance Under Standard Test Condition (STC)

Peak Power (Pmax) 100W  
Maximum Power Point Voltage (Vmpp) 17.3V  
Maximum Power Point Current (Impp) 5.78A  
Open Circuit Voltage(Voc) 22.6V  
Short Circuit Current(Isc) 6.2A  
NOCT 47°C

### Packing and Shipping

Dimension 1476\*658\*35  
Weight 12.3kg  
Packing 2 pcs/ carton

## Temperature Coefficients

$\alpha$  Isc 0.08%/°C  
 $\alpha$  Vmpp -0.37%/°C  
 $\alpha$  Pmpp -0.44%/°C

The I/V graph below shows the typical performance of EPL solar module at various levels of irradiance.

The I/V graph below shows the typical performance of EPL solar module at various cell temperatures.

