

## Power from the sun 🛛 👌 🔌 🔍 💻





# Free solar energy for generating power using photovoltaics

As renewable energy systems have become more widespread, consumers and end users have become increasingly keen to generate their own electricity. Today, an efficient photovoltaic system offers the opportunity to make profitable use of free solar energy. By installing photovoltaic modules, users demonstrate their responsible attitude towards the environment, and make an active contribution towards protecting the climate by reducing  $CO_2$  emissions.

With energy costs constantly rising, a photovoltaic system helps users save money and reduces their dependence on energy suppliers. The power they generate can be used for their own needs or exported to the public grid. Thanks to statutory remuneration and savings resulting from on-site consumption, the investment pays for itself in just a few years. A photovoltaic system also increases the value of the property.

On the following pages you will find comprehensive information on the Viessmann photovoltaic system and the perfectly matching components available. These include photovoltaic modules, inverters, assembly systems, power storage systems and heat pumps to help you consume more of your own power on site.

The high quality provided by the photovoltaic modules ensures economic efficiency and a long service life. Comprehensive services from planning and sizing through to delivery and servicing complete the photovoltaic offer provided by Viessmann's professional trade partners.



## Saving energy and protecting the climate

Viessmann is aware of its responsibilities towards the sustained protection of the environment. Our company philosophy and products have been designed with this duty in mind.



"Nothing is so good that it cannot be improved". This motto is also reflected in our company principles. Viessmann can rightfully claim to be the leader in quality and technology, and as such, aims to continually set new standards.

Of course, this applies in particular to the company's product range, which is consistently geared towards significantly lowering the consumption of fossil fuels and gradually replacing them with renewable sources of energy.

At around 40 percent, the heating market actually accounts for the largest proportion of energy consumption in Germany. The rest is shared by freight, personal transport and power generation, each accounting for 20 percent. These values can also be applied approximately to other industrial countries. Ever-rising energy costs mean that the emphasis is on reducing the consumption of fossil fuels as quickly as possible.



#### Efficient photovoltaic systems

By installing a Viessmann photovoltaic system, anyone can generate their own power. Converting free solar energy into power makes financial sense and the use of power storage facilities allows you to be less dependent on the public grid for your electricity. Furthermore, users are helping to reduce the consumption of fossil fuels, thereby actively contributing to climate protection. With its perfectly matching components, Viessmann provides highly efficient solutions, whether for an existing building or new build.

Viessmann has the right solution for you.





Viessmann offers energy efficient heating systems for oil, gas, solar, biomass, air and geothermal heat. The pictographs will help you choose the right system.





## Did you know?

#### Good reasons to choose a photovoltaic system from Viessmann

A module surface area of 450 x 450 km would be sufficient to cover the power demand of the entire world. Our sun not only provides energy in abundance – it is also an environmentally responsible source of energy. Better still – the power it delivers is free.

Although both the Vitovolt (photovoltaic) and the Vitosol (solar thermal) systems use sunlight to generate power, they differ in planning and operation. Electrical power is generated directly in the photovoltaic module. However, in solar thermal systems, the heat gained in the collectors is transferred hydraulically via a heat transfer medium, so it can be used for DHW or central heating.

#### Power from the sun

In conventional power stations, only one third of the primary energy spent 'translates' into useful power. Around two thirds of the primary energy is lost during power generation and distribution through the national grid. The provision of electrical power has a considerable impact on the environment. It is therefore particularly worthwhile to generate electricity using renewables such as the sun, wind, hydroelectric power and biomass, by means of a decentralised source close to the point of consumption. Generating electrical power directly from solar energy, known as photovoltaics, is an elegant and reliable option. Generating roughly the amount of power an average person consumes in a year requires a photovoltaic surface area of approx. 8.5 m<sup>2</sup>.

#### General solar data

Annually, the amount of energy that reaches the surface area of the Federal Republic of Germany is equivalent to approx. 80 times the country's total energy consumption. Around half of this reaches the Earth's surface as direct insolation, the other half as diffused light.

Consequently, a total of around 950 to 1200 kWh/m<sup>2</sup> reach a horizontal surface every year. Solar cells convert more than 15 percent of this into electrical power, with around two thirds of the energy being yielded in summer and one third in winter.

#### Solar power has a safe future

Installing a photovoltaic system on the roof turns every homeowner into a power generator. In fact, it's really quite simple, just assemble the modules, plug in the connecting cables, connect the inverter, and you're done. You can add a power storage system as well if required. The number of house builders interested in this form of power generation is continuing to rise.



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## VITOVOLT

Power from the sun. 8.5 m<sup>2</sup> of photovoltaic surface is enough to meet the power demand of the average person.

## Feed-in remuneration and using generated power on site

If you generate your own power, you can receive a guaranteed remuneration from your power supply utility over 20 years. This is governed by the German Renewable Energy Sources Act (EEG), which states that energy utilities are obliged to accept the power not consumed on site and absorb it into their grid.

There are currently two ways in which the solar power generated by a rooftop photovoltaic system can be used: It can either be exported to the grid in its entirety, or it can be partially or completely consumed on site.

In the past it was usually more financially attractive to export all solar power generated into the grid. Falling feed-in tariffs on the one hand and increasing electricity costs on the other, make the option of using your own power on site more appealing. Electricity costs per kilowatt hour are generally far higher than the remuneration tariff for the same kilowatt hour of solar power that is exported into the grid.

For this reason, the number of house builders interested in this form of power generation is continuing to grow.

- Make a noticeable contribution towards protecting the environment. The use of photovoltaic systems reduces the damage caused by emissions and protects natural resources.
- Generating solar power is already significantly cheaper than drawing domestic power from the grid.
- A PV system will enhance your property and increase its value.

Viessmann photovoltaic systems are designed to last for decades. Thanks to their simple operating principle they are completely reliable.

#### Vitovolt 300



Monocrystalline photovoltaic module with black anodised frame and dark Tedlar film with an output up to 275 W<sub>n</sub>



Polycrystalline photovoltaic module with 48 cells and

an output of 200 W<sub>n</sub>



Polycrystalline photovoltaic module with 60 cells and an output up to 265  $W_{\rm p}$ 

#### Vitovolt 200



Single glazed version with mono- and polycrystalline silicon cells for vertical and horizontal installation



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## VITOVOLT

Installing a photovoltaic system isn't rocket science. With the fully assembled modules, you, too, could soon be getting power straight from your roof.

#### Vitovolt function explained

Basically, a mains-connected solar power system operates in three stages:

#### 1. Harvesting energy

When light falls on the photovoltaic modules, electrons are released inside the solar cells. Positive and negative charge carriers collect at the respective electrical contacts, resulting in a DC current between the front and back of the cell. This photoelectric effect is created without mechanical or chemical reactions, and so is maintenance-free and not subject to wear.

#### 2. Power conversion

DC power generated by the solar generator is then converted by the inverter (commonly known as a mains feed-in device) into AC power suitable for the grid (230 or 400 volt AC current at 50 Hz). Proven safety standards and fully developed processors, as well as cutting edge power electronics, ensure effective conversion of the solar power.

#### 3. On-site consumption

The falling remuneration rates for privately generated solar power and the rising cost of electricity are motivation enough for developing an optimised energy concept for detached and two-family houses. In the meantime, using solar power in your own home – the more the better – has become much more attractive financially. Using a power storage system for solar power generated at home increases the rate of power consumption on site and reduces purchases from the grid still further.



#### Vitovolt Silicon solar cell

- Negative electrode
- N-doped silicon
- Boundary layer
- 4 P-doped silicon
- 5 Positive electrode

## Photovoltaic modules



Photovoltaic system with Vitovolt 300

Photovoltaic modules with a high yield capacity, uncompromising quality and guaranteed safety

The Vitovolt 300 product range consists of monocrystalline modules in a black design with an output up to 275  $W_p$  and polycrystalline modules of 48 or 60 cells with an output up to 265  $W_p$ .

Vitovolt 300 photovoltaic modules feature high outputs and uncompromising quality, plus the comprehensive Viessmann product and performance guarantee. In addition, all modules are only ever supplied with positive output tolerances. You benefit from an increase in output of up to 5 W<sub>p</sub> as a result.

Our PV modules are suitable for installation on the roofs of detached houses and apartment buildings, as well as on commercial and industrial premises.

#### Attractive design

Vitovolt 300 modules are distinguished by their design and dimensions. Modules in the MSBC series feature a black anodised frame, monocrystalline cells in a particularly dark hue and a black Tedlar film. Extraordinary design has been combined with the highest performance values. The effect is even more architecturally stunning when these modules are incorporated into a flush mounted roof integration system.

#### Matching installation systems

Our installation systems form the basis for a perfectly matching appearance, whether they are installed on the roofs of private homes or business and industrial premises. All installation options feature quick and safe installation and static certification.



Monocrystalline PV module Vitovolt 300 with black anodised frame and dark Tedlar film



Polycrystalline photovoltaic module Vitovolt 300 with 48 cells





#### Take advantage of these benefits

- Positive output tolerance for additional output of up to 5 W<sub>p</sub> per module
- Secured investment with Viessmann's extended product warranty of 10 years and 25 year performance guarantee of at least 80 % rated output
- High module efficiency of up to 16.8 %
- Anti-reflection glass for high yields
- Anti-twisting anodised aluminium frame
- Strict cell selection process for balanced and high value appearance
- High operational reliability as a result of three bypass diode jumpers
- Tested Viessmann quality: Every PV module is subjected to an optical and electrical quality test
- Standardised process for the ability to recycle all Vitovolt 300 modules in a sustainable and efficient manner

Polycrystalline photovoltaic module Vitovolt 300 with 60 cells

#### Vitovolt 200

## Photovoltaic modules



Poly- and monocrystalline PV module Vitovolt 200

#### High performance module at an affordable price

Vitovolt 200 photovoltaic modules are available with monocrystalline and polycrystalline silicon cells.

The PV modules consist of a glass laminate where individual solar cells are embedded in two plastic films. A weather-resistant foil covers the back of the module. Panes and foils are laminated together to protect the cells reliably against external weather influences.

Thanks to its low weight the fully wired module is particularly easy to install on the roof.

#### **Easy installation**

The connection of the PV modules is prepared at the factory. The inverters and installation systems are matched to the individual PV system; cables simply need to be plugged together on site.

Robust aluminium frames enable the modules to comply with even the most demanding pressure and suction limits.







Monocrystalline photovoltaic module Vitovolt 200

#### Take advantage of these benefits

- High quality single pane modules with an attractive price/performance ratio
- High efficiency
- High quality standard in the selection of silicon cells
- All necessary components for the photovoltaic system are perfectly matched
- Quick installation with simple plug-in connection of cables
- Highly efficient inverter with display optional data entry is performed easily either by remote display or via internet portal and mobile terminal devices



## Power storage systems

#### Consumption of generated power on site for higher efficiency

Viessmann power storage systems increase consumption on site of the energy you generate and improve the efficiency of the photovoltaic system. The system will charge the power storage unit when the home is not calling for power. When needed, this power can be used to operate electrical appliances, for example. If the power storage unit is fully charged and no consumers are connected, excess power will be exported into the grid and remunerated accordingly.

#### Power storage system, type LAA

- An ideal solution for detached houses: Compact size for wall mounting and modern design for installation in living areas
- Environmentally responsible lithium ion technology
- Secure investment with high cycle stability (up to 20 years service life)
- The Plug & Work system ensures quick and easy installation
- Integrated battery management and backup to guarantee high operational reliability
- Efficient and quiet operation with a passive cooling system
- Low maintenance system as there is no need for mechanical ventilation, winter mode or maintenance charging

#### Power storage system, type BHA/BHB

- A compact, easy to install solution with perfectly matching components
- Maintenance free, sealed power storage system with lead-gel technology
- Established returns system for spent batteries
- Lower electricity costs
- Free, standard internet access to monitor the system

#### Power storage system (type LAA)

**Power storage system** (type BHA/BHB)

#### Power storage system, type LVA

- Modular storage system gives you the flexibility to match storage capacity and retrofitting according to your own requirements
- Environmentally responsible lithium ion technology
- Easy to position using the 'cabinet for insertable units' concept
- Optimal matching cells and power electronics provide a long service life and high safety levels
- Easy service: Fault analysis via the cylinder control unit and replacement of individual modules
- Three phase emergency power function for an assured power supply
- Compatible with all commercially available single and three phase inverters



Power storage system (type LVA)



### Photovoltaic modules

Since generating solar power onsite is cheaper than drawing power from the grid, on-site consumption offers financial advantages. An optimised system concept with perfectly matched components ensures this high level of on-site consumption.

- Photovoltaic system
- 2 Photovoltaic inverter
- Photovoltaic meter
- 4 Consumer
- 5 Heat pump meter
- Heat pump with
  Vitotronic 200
  (type WO1C)
- Consumption and generation meters
- Public grid



#### Optimum system concept

Those intending to combine a photovoltaic system with a heat pump should select a heat pump that specifically optimises on-site consumption and can be adapted to match the generating characteristics of the PV system. For this purpose Viessmann has developed a correspondingly matched system comprising photovoltaics and heat pump. A power meter on the heat pump control unit captures photovoltaic yield at regular intervals. It then adjusts its characteristics based on this information, to increase your on-site consumption. The heat pump can then heat up the heating and domestic hot water. The heat gained during the day by means of photovoltaic power is held in a well-insulated buffer cylinder for central heating or in the DHW cylinder to be used as domestic hot water as required. Heat pumps with a cooling function can also be used in summer to keep the building cool.

With the Vitotronic 200 heat pump control unit (type WO1C), on-site consumption of solar power is increased automatically. Combining the Viessmann heat pump with a PV system also offers the possibility of integrating additional components that increase on-site consumption of the solar power generated on your roof, such as ventilation equipment, for example. Using actual data and adaptive logic, the control unit determines if and when demand for DHW, central heating or cooling can be expected in the building. Depending on the established demand, the heat pump supplies heat to the DHW cylinder, the heating water buffer cylinder or the heating system. Alternatively, the heat pump can also be switched to cool the building.

Before the heat pump is activated, priority is given to meeting the power demand for electrical household appliances with solar power generated on site. After the household appliances have been satisfied, an energy meter captures the amount of remaining solar power and communicates this to the heat pump. Via the heat pump, this solar power surplus is then stored in the form of thermal energy and made available when required. This raises the level of on-site consumption and makes use of the solar energy while it is available.

Thanks to the targeted increase in the proportion of on-site consumption, the economic viability of the PV system is substantially improved. The lower cost of solar power also makes the heat pump more economically attractive.

#### Vitotronic 200 control unit (type WO1C)

Ensuring optimum interaction between a heat pump and a photovoltaic system requires a well-honed control system. This is offered by Viessmann in the shape of the Vitotronic 200 control unit (type WO1C). This control unit increases consumption on site of solar power generated on your roof by controlling how the heat pump operates to optimum effect. All parameters that are relevant to on-site consumption are taken into consideration:

- Solar power currently available
- Current household power demand
- Heat-up condition of the available cylinder(s)
- Use of ventilation
- Use of cooling system

In addition to optimising on-site consumption, the unit's many control functions offer further benefits:

- Easy heating system diagnostics
- Extended options for evaluating key energy indicators
- Improved heat source management, e.g. in combination with the ice store system
- Optimised integration of other renewable energy sources

#### Dual mode system comprising an oil boiler and DHW heat pump optimises energy consumption

If an existing oil boiler provides central heating during the winter months, then DHW heating can be provided by a Vitocal 161-A heat pump. This will be driven by the home-generated solar power from a PV system. For this, the heat pump uses indoor air to provide cost-effective DHW heating. The dual mode system therefore covers most of the energy demand on its own.

By meeting the energy demand for central heating and/or domestic hot water with the help of a heat pump, the user can increase consumption of their homegenerated power considerably. Viessmann has specially developed a matching system for this application using a heat pump and a photovoltaic system. The heat pump optimises consumption by matching its operation to the power generated by the PV system. Since generating solar power on-site is cheaper than drawing power from the grid, on-site consumption offers financial advantages. The perfectly matched system ensures a high degree of on-site consumption.

> Extract from the function overview of heat pumps with the Vitotronic 200

	Brine/water							Air/water (split)			Air/water monobloc		
Switching the control function	200-G	222-G	242-G	300-G	333-G	343-G	350-G	200-S	222-S	242-S	200-A	300-A AWC/ AWO	350-A AWC/ AWO
Optimising on-site consumption of PV power			-					-			-		
Solar DHW heating (incl. optimisation by suppressing reheating)	-		•	•		•	•	-		•	-		
Active cooling				2			2	<b>1</b>					
Ventilation unit Vitovent 300-F		•	•		•	•			•	•	•		
Ice store													
External heat generator											-		
Vitotrol app													



## Individual solutions with efficient systems

The comprehensive range of products and services from Viessmann offers individual solutions with efficient systems for all fuel types and application areas. As one of the world's leading manufacturers, Viessmann offers intelligent, convenient and efficient systems for heating, cooling and decentralised power generation. Viessmann products and systems are synonymous with the very highest levels of efficiency and reliability.

Our comprehensive product range offers top technology and sets new benchmarks. By focusing on using energy efficiently, we can help cut costs, protect natural resources and the environment.

#### Everything from a single source

You will find the right product and system for all your needs in the Viessmann range. Whether it's a wall mounted or floorstanding solution, for use in homes, businesses, industry or local authorities. Whether for modernisation or new build, Viessmann is always the right partner for providing heating, steam, power and cooling.

The wide ranging expertise we have at our disposal in the Group enables us to always offer the perfect system. Our product portfolio is rounded off with a full range of services.





### The complete product range for all energy sources and output ranges

- Boilers for oil or gas up to 116 MW heat or 120 t/h steam
- Combined heat and power generation up to 50 MW<sub>el</sub>
- Heat pumps up to 2 MW
- Wood combustion technology up to 50 MW
- Biogas production plants from 50 kW<sub>el</sub> to 20 MW<sub>gas</sub>
- Biogas upgrading plants up to 3000 m<sup>3</sup>/h
- Solar thermal systems
- Photovoltaics
- Accessories
- Refrigeration technology

#### Maintenance and service

Whether for commissioning, maintenance or service – our trade partners can always count on the Viessmann Group for professional support. Our online tools also offer valuable tips, and spare parts can be delivered the next morning if necessary.

#### Training

The Viessmann Academy offers extensive knowledge in commercial seminars and technical training sessions. The continuing training that our trade partners receive ensures our mutual success.





## Viessmann – climate of innovation

Viessmann is one of the world's leading manufacturers of intelligent, convenient and efficient systems for heating, cooling and decentralised power generation.

As a third generation family run business, Viessmann has been supplying highly efficient and clean heating systems for many decades.

#### A strong brand creates trust

Together with our brand label, our key brand message is an identifying feature throughout the world. "Climate of innovation" is a promise on three levels: It is a commitment to a culture of innovation. It is also a promise of enhanced product benefits and, at the same time, an obligation to protect the environment.

#### Acting in a sustainable manner

For Viessmann, taking responsibility signifies a commitment to acting sustainably.

This means to harmonise ecology, economy and social responsibility so that the needs of today are met without compromising the quality of life of future generations.

We consider climate protection, environmental responsibility and resource efficiency to be key priorities throughout our company, which has more than 11,400 employees worldwide.

#### **Example of Best Practice**

With its strategic sustainability project, Viessmann demonstrates at its own head office in Allendorf (Eder) that the energy and climate policy goals set for 2050 can in fact be achieved today with commercially available technology. The results speak for themselves:

- Expansion of renewables to 60 percent
- CO<sub>2</sub> emissions reduced by 80 per cent

The long-term goal is for the company to sustainably meet all of its own heating energy requirements.



2009/2011/2013: German Sustainability Award for Production/Brand/Resource Efficiency



Energy Efficiency Award 2010

#### Viessmann Group

#### **Company details**

- Established in: 1917
- Employees: 11,400
- Group turnover: 2.1 billion euros
- Export share: 55 percent
- 27 production companies in 11 countries
- 74 countries with sales companies and representation
- 120 sales offices worldwide

# The comprehensive product range from the Viessmann Group for all energy sources and output ranges

- Boilers for oil or gas
- Combined heat and power units
- Heat pumps
- Wood combustion technology
- Biogas production plants
- Biogas upgrading plants
- Solar thermal systems
- Photovoltaics
- Accessories
- Refrigeration technology



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