PHOTOVOLTAIC GLOSSARY

Accumulator
An accumulator stores electrical energy. In photovoltaics, accumulators are used for stand-alone systems.

Alternating current
Alternating current is electrical current in which the direction and the voltage changes in accordance with certain laws of physics. Alternating current is found in most electrical grids (230 volts, 50 hertz).

Amorphous modules
Modules made of amorphous silicon (a-Si) are a type of thin-film modules. Their cells are made up of glass or metal panes coated with a thin layer of silicon. The name comes from the fact that, when the glass or metal is coated, the silicon atoms are not distributed in the crystalline structure but are spread amorphously, i.e. at random. a-Si modules can be recognised by their brown colour.

Amortisation
Energetic amortisation (also known as energy return time) is the time which a solar electricity system needs to generate the energy used for its production and installation. When the period of its energetic amortisation has expired, its balance of energy is then positive. There is no energetic amortisation in the case of power plants operated with fossil fuels.

Balance of System costs
In a photovoltaic system the balance of system (BoS) costs are made up of the costs of all components except those of the modules. BoS costs comprise planning costs, construction preparation costs, the mounting system, DC cabling, inverters, buildings, grid connection and installation.

CdTe modules
CdTe modules are thin-film modules which use the semiconductor material cadmium telluride to generate electricity. The cadmium content is low. Heavy metal cannot be dissolved through a non-technically procedure so there is no danger for the user or the environment.

CIS or CIGS modules
CIS or CIGS modules are a type of thin-film module whose solar cells are made up of several layers of copper indium (gallium) diselenide which are doped with different impurities. Efficiency is currently around 12 percent.

CO_2 savings
Photovoltaic plants make a contribution to climate protection: An example is the 15.8 megawatt solar power plant in Moos near Würzburg (Germany) which saves around 9.700 tonnes of carbon dioxide (CO_2) a year.

Crystalline modules
Crystalline modules are made of solar cells with crystalline silicon which is around 0.2 to 0.4 millimetres thick. A differentiation is made between modules with monocrystalline and polycrystalline (also known as multicrystalline) cells. The basic material is ultra-pure polysilicon. Efficiency is between 14 and 18 percent.

Degradation
Solar cells age as, over the course of their lifetime, their efficiency diminishes. This natural process of ageing induced by light irradiation is called degradation. In calculating yield assumptions this effect is generally already included.

Degression
The German Renewable Energies Act (Erneuerbare-Energien-Gesetz (EEG)) provides for an annual lowering of the feed-in tariff. The compensation rates for new installed systems, for instance, fell by 13 percent on 1 January 2011 and will fall again on 1 July 2011 between 3 and 15 percent. This rate depends on the growth of the whole market in Germany. A sliding scale regulates the reduction: If the newly installed output in a specific year exceeds or falls below a defined growth corridor, degression is either raised or lowered accordingly by one percentage point in the following year. Degression is intended to promote competition in the solar industry and to lead to lowering the cost of generating solar electricity.

Direct current
Direct current is an electric current which maintains the same direction and a constant electrical voltage. Solar modules generate direct current.

Efficiency
The efficiency generally denotes the relationship between useful and used energy. The efficiency of solar cells indicates the percentage of the sun's energy which is converted into electric charge.

Feed-in tariffs
Feed-in tariffs constitute the fixed price, as defined under the German Renewable Energies Act (EEG), for feeding solar electricity into the grid and which must be paid by the grid operator to the producer of solar electricity. The amount of the remuneration rate per kilowatt hour depends on the type and size of the system and the year when it was taken into operation, and will remain steady over a period of 20 years.

Flagship project
A flagship project is a completed project which, along with its original purpose, is considered to be exemplary and set a benchmark for the whole sector. The reasons may be the successful deployment of new technologies, new areas of application or new yardsticks set in respect of yield and return.

German Renewable Energies Act (EEG)
The German Renewable Energies Act (EEG) came into force on 1 April 2000. Its objective is to promote the generation of energy from sources of renewable energies. Among other things, it regulates the feeding in and remuneration of renewable energies into the grid. The last amendment to the Act has been in force since 1 January 2009 and, in particular, provides for a swifter degression of the feed-in tariffs for photovoltaic systems. Another amendment to the Act is expected at the beginning of 2012. In the meantime, the EEG is regarded as a model and has already been used as a blueprint by a number of European countries (France, Italy and Greece, for example) for similar legislation.

Grid-connected systems
Grid-connected systems are solar power plants which have been connected up to the power supply system and continuously feed in solar electricity.

Grid parity
The grid parity of solar electricity means that the price of generating one kilowatt hour of solar electricity is no higher than the end consumer price for electricity from the mains socket. Grid parity is therefore tied to the location of consumption, as solar electricity is often generated where it is consumed. The definition of grid parity is not therefore a comparison between the production costs of solar electricity and those of energy generated from fossil-based sources.

Inverters
Inverters convert the direct current generated by the solar cells into alternating current which is compatible with the grid. They are an integral component of solar power plants.

Kilowatt (kW)
The kilowatt (kW) is the general unit of measurement for output. The electrical output of a solar power plant is also given in kW.

Kilowatt hour (kWh)
The kilowatt hour (kWh) is a unit of measurement for energy used or generated. One kWh equals a kilowatt over the period of an hour. The kWh is the unit of energy commonly used for the measurement of household electricity consumption. One kilowatt hour is sufficient to light one bulb of a hundred watts for ten hours.

Megawatt (MW)
A megawatt is a unit of measurement for output, and is equivalent to one million watts (10^6 W). For example, the new solar power plant in Senftenberg in Brandenburg (Germany), which was built in summer 2010, has a peak output of 18.3 megawatt.

Micromorphous modules
Micromorphous modules (also known as tandem modules) combine both amorphous and microcrystalline technologies. The light spectrum absorbed is raised to the near-infrared region through an additional microcrystalline layer of silicon applied to an amorphous silicon layer. Micromorphous modules are therefore more efficient than amorphous modules.

Monocrystalline cells
The input material for monocrystalline cells is ultra-pure silicon which is extracted from silicon smelt and fabricated into wafers of up to twelve centimetres in diameter. All crystal lattices are evenly distributed in monocrystalline. Monocrystalline cells are more efficient than polycrystalline cells but are also more expensive to manufacture. They can be recognised by their characteristic graphite colour.

Nominal output
Nominal output (also known as peak output) is an indication of the output of a solar module or a solar power plant, for instance.

Operation
Along with configuration and system integration, the commercial and technical operation of solar power plants are key factors influencing the yield and therefore the return. Core tasks are to secure steady-state optimal operation, the monitoring and reporting of yield data, as well as compliance with the statutory provisions and periodic inspections.

Peak power output (peak output)
The maximum power output possible from a solar module or power system under standard test conditions (STC) is defined as the peak power output (also known as peak power). It is measured in watt (W) and stated as watt peak (Wp).

Phoenix TectoBridge
The Phoenix TectoBridge is an innovative on-roof system developed by Phoenix Solar. It can be used for roofs which were formerly not suitable for the construction of a photovoltaic system. The construction derives from bridge building and allows span distances of up to six metres.

Phoenix TectoSun
Phoenix TectoSun is a roof installation system developed by Phoenix Solar which enables photovoltaic systems to be swiftly and simply installed.

Photovoltaics
Photovoltaic is defined as the environmentally compatible generating of electricity through tapping the sun's energy. In this process, solar cells linked up to one another in solar modules convert the sun's light into electricity.

Polycrystalline cells
The basic material for polycrystalline (also known as multicrystalline) cells is ultra-pure silicon. Liquid silicon for polycrystalline cells is first cast as ingots and then cut into wafers which are 0.2 to 0.4 millimetres thick. The cells that result from this process are made up of many small single crystals, so-called crystallites, which are separated by grain boundaries. The pattern which results from the composition of different crystals is unmistakable, as is the bluish colour.

Private consumption
Electricity produced by a solar power system can also be used for one's own consumption, alongside feeding into the public grid. Under the German Renewable Energies Act (EEG), each kilowatt hour produced and used for private consumption will be remunerated in an amount of 16.74 cent as from 1 January 2011.

Renewable energies
Renewable energies (also known as regenerative energies) are defined as energies from a source which either renews itself in the short term or where use does not contribute to exhausting the respective source. This includes solar irradiation and hydropower, geothermics and the potential in the energy recoverable from tidal power or biomass. The share of renewable energy sources in Germany's energy consumption is now higher than 17 percent. The use of solar power through photovoltaics has recorded the highest growth rates in renewable energies for a number of years.

Solar cells
A solar module is made up of several solar cells which are connected to one another. Solar cells when exposed to light release positive and negative charge carriers (photovoltaic effect) which generates direct current. In the production of a solar cell, wafers from the semiconducting material silicon are doped (impurity doping). When two semiconductor layers with different impurities are put together, a so-called p-n junction is generated between the layers. An electric field is generated at this junction which separates the charge carriers released by photons. Voltage is tapped through the con-

tacts on the front and back. An anti-reflex layer protects the cell and reduces reflection losses at the surface of the cell. A differentiation is made between the different types of cells and modules.

Solar modules
A solar module is made up of a number of solar cells which are electrically connected in a series and which, after application of current connectors, are processed to form a module. The generally square solar cells are applied to a substrate, covered by a glass plate and laminated to protect them against weather exposure. A frame is often attached for the purpose of simplifying assembly. Solar modules customary in the markets are generally made from mono- or polycrystalline solar cells or thin-film modules.

Solar silicon
Solar silicon (also known as polysilicon) is the basic material used in the production of crystalline solar modules. The production of solar cells necessitates silicon in an ultra-pure form (solar grade).

Stand-alone system
Stand-alone systems (also known as off-grid systems) are photovoltaic systems which are operated independently of the grid and which thus generate a self-sufficient supply of electricity. With these systems, the electricity produced is not fed into the grid but stored in accumulators from where it is sourced for consumption. Stand-alone systems are particularly suitable for remote locations in regions with small or unstable grids or for areas where linking up to the grid would not be commercially viable.

Standard Test Conditions (STC)
The specific data of a solar module are measured under standard test conditions. Standard test conditions are defined as the solar irradiation of one kilowatt (kW) per square metre, a module temperature of 25 degrees Celsius and a solar irradiation angle of 45 degrees.

String
A string is the parallel wiring of a number of solar modules connected up electrically in a series.

System costs
The system costs of a photovoltaic plant are a key factor for determining the investment costs and therefore the length of the period of amortisation. They are made up of the costs of all technical components (solar modules, installation system, direct current master switch, inverters, cabling and electricity meters) and of the work performed (development, planning, building, handover etc.). Financing costs, costs of official approval, expert opinions, legal advice and similar services are not part of the system costs.

System integration
The efficiency of a photovoltaic system depends to a great degree on the ideal interaction of all the individual components. The more technologies and products offered for selection in the market, the greater the optimisation potential through consistent system integration. The tasks of system integration include the selection and checking of the individual components, as well as the reconciliation of all details in accordance with requirements, for example the installation system, taking account of local conditions on the respective site.

Temperature coefficient
The temperature coefficient is an indication of the degree to which module output changes if the temperature of the solar cell rises.

Thin-film modules
In the manufacturing of thin-film modules, active photovoltaic layers are applied directly to a glass or metal pane in an integrated process. The thickness of the layer applied in this process is a mere 0.002 millimetres. The thin coating of the active substance, amorphous silicon (a-Si), copper indium (gallium) diselenide (CIS/CIGS) or cadmium telluride (CdTe) for instance, reduces the amount of material used and the manufacturing costs. Although, in comparison to crystalline modules, thin-film modules have lower conversion efficiencies, they have better temperature coefficients, are able to convert diffused light better and are less sensitive to shadowing.

Turnkey power plant
In photovoltaics, a turnkey power plant is a fully configured solar power plant consisting of solar modules, assembly system, inverters and cabling.

Value chain
The value chain is the whole mix of products and services which go to make up one product (solar power plant) or a service (system integration, operation), comprising all links in the chain, also including suppliers of raw materials and manufacturers, across system integrators and wholesalers and retailers through to the end customer.

Wafer
Wafers are round or rectangular silicon slices which are approximately 0.2 to 0.4 millimetres thick. In photovoltaics they are the primary product used in crystalline solar cells.