Backgrounder

solarnova*

The History of Photovoltaics / The History of solarnova

From the grapefruit to energy self-sufficiency

In 1839, the then 19-year-old French physicist Alexandre Edmond Becquerel discovered the PV-effect in his father's laboratory: when light (photo) hits certain substances, voltage (voltaic) is produced. 115 years later, the first silicon cell was developed with a 5 percent degree of efficiency, and another four years later (1958) the United States introduced VANGUARD I – the first solar energy powered satellite. It gets its nickname "grapefruit" thanks to its shape and size: it had a diameter of 16.5 centimeters and weighed 1.47 kg. Thanks to solar energy, it could send signals from its trajectory in outer space for seven years, thus providing insights into the shape of the Earth.

In 1962, Germany developed its first plans for a national aerospace program under the auspices of the German Federal Ministry of Scientific Research. Number 5, Version A was also among the various proposals for an initial satellite project. It later came to be called Project 625A and was renamed to AZUR (blue) during the course of the project. Germany cooperated with NASA and the *Gesellschaft für Weltraumtechnik* became the project leader responsible for negotiating partnerships with German industry. AEG-TELEFUNKEN, headquartered in Wedel, was among the pioneers and established a department for aerospace technology in the same year. This department was responsible for operations, project planning and project management of all space-related tasks. The small team's scope of responsibilities included the development, qualification and production of solar cells, solar generators, energy conversion and storage, energy distribution and systems technology. Simultaneously, a department for unconventional energy supply was founded. First, the respective employees carried out their work on Hafenstrasse in Wedel, and later on Industriestrasse. On November 8, 1969, AZUR was ready: Weighing 72 kilograms, it was considered a "journeyman's piece" of German space exploration. AZUR made it possible to investigate cosmic radiation in its interaction with the magnetosphere-atmosphere, polar light as well as solar winds caused by solar flares. AEG-TELEFUNKEN developed the 40-watt solar cell system, which was installed on its exterior and consisted of 5,000 silicon solar cells, each of which were 2 x 2 centimeters in size – a construct that was the AZUR's power source. The company was also involved in INTELSAT IV. The contract was worth about 12 million marks. It therefore played a major role in the construction of the satellite's telecommunications equipment and its energy supply, which encompassed 100,000 solar cells. Among other things, the INTELSAT IV was responsible for broadcasting the 1972 Olympic Games.

SYMPHONIE, HELIOS and MARECS (Maritime European Communication Satellite, made to improve radio contact for seafaring vessels) were also powered by solar technology from Wedel. That was also the case with TV-SAT, which was responsible for the direct reception of television and radio programs from space starting in 1985. Two years later, METEOSAT was able to make improved weather forecasts possible. AEG-TELEFUNKEN had supplied cover glass-integrated solar cells for three satellites plus one spare satellite. They were mounted on a cylinder. The energy of the solar generator (300 Watt) had to guarantee that it could last the entire service life of three years.

Discovery with HUBBLE

The space shuttle Discovery was launched on April 24, 1990, with the cargo compartment filled to the brim with the 12-ton HUBBLE Space Telescope. Since then, the world's most expensive astronomical observatory travels around the Earth at 27,000 kilometers per hour every 96 minutes. Solar cells on the two golden wings feed energy into the batteries. AEG-TELEFUNKEN was responsible for the solar generator that unrolled itself like a solar sheet from a reel upon reaching its orbit. It covered a total area of 60 square meters with more than 50,000 silicon cells. The anticipated high number of 30,000 thermal cycles between +100 °C and -100 °C, and the requirement that the solar generator had to be resistant to atomic oxygen, presented the highest technological demands throughout its long service life. The first images HUBBLE sent to the earth are still remembered today.

Oil crisis increases interest in solar technology

Wedel concentrated on terrestrial photovoltaic applications in 1973 as a result of the oil crisis. At first, solar cell rejects from aeronautics were used for experimenting. Interconnections were tested and embedding in plastic and glass were developed to protect the solar cells against environmental influences. The first practical application was a 10-watt solar generator made from 2 x 2 centimeter solar cells used in AZUR. It loaded the NiCd battery of a portable radio from TELEFUNKEN. Using polycrystalline silicon – cast at Wacker-Chemie – was the first step towards reducing the cost of producing solar modules.

In 1981, the first fully automated production line in the world was designed for producing terrestrial solar modules and put into operation in Wedel. It consisted of two welding machines, a vacuum chamber (to attach the laminated glass, sheets and interconnected solar cell array), a framing station, a measuring station and peripheral production equipment such as sheet cutting machines and a washer system. The individual stations were connected by a transport system. Modules with a capacity of approximately 2 megawatts per year could be produced here. In 1983, a 300 kWp system, the largest PV power plant of its time, went into operation on the island of Pellworm in Germany – made by AEG-TELEFUNKEN. Four years later, solar cell and solar module production were combined at the Wedel site. The solar center now covers around 9,000 square meters.

solarnova is born

When solarnova was founded in mid-1996, the module production facility in Wedel had turbulent years behind it: AEG was first taken over by Daimler-Benz, then Deutsche Aerospace (DASA) and later the ASE Angewandte Solarenergie, a joint venture between DASA and RWE, was responsible for the solar energy business. The relocation of ASE to Alzenau opened the door to an opportunity in Wedel. A handful of employees in key positions at AEG-Solartechnik, DASA and ASE seized the opportunity to combine and ensure 25 years of solar module technology expertise proven to work at an established location. The slogan they chose for the company was: solarnova – a young company with decades of experience. The core business was the construction of customized modules that satisfied all architectural aspects. Accurately designed according to the specifications of designers and building contractors, the glass elements were developed especially for use in facades and skylights. The necessary production equipment was developed in Wedel by the company's founders themselves with the support of the DBU (German Federal Environmental Foundation). As early as the 1990s, the machinery could already produce solar modules with dimensions up to 2 x 3 meters and 2 x 12 mm in glass thickness to cover entire floor levels. The unique machines produce solar modules with laminated glass technology, which can also be used in planning highly sensitive overhead areas. Diversity and individuality are solarnova's major strengths.

After the first major project following the founding of the company, a 720-square-meter solar installation for the ADAC headquarters in Hannover in 1997, many others followed: The EWE ARENA in Oldenburg (Germany), where the solar facade "tracks" the sun a quarter kilometer every day, the PUMA Plaza in Herzogenaurach (Germany), the National Academy of Sciences in Washington DC, the Europe Promenade on Usedom (Germany) and the Public Safety Building in Salt Lake City (USA).

Efficiency increases, costs decrease

After the "1000-Dächerprogramm" (1,000 Roofs Program) in Germany – a total of 6 megawatts were actually installed on around 2,500 roofs in 1990 – came the Renewable Energies Act (EEG). The PV enthusiasts started rethinking things: self-sufficiency was no longer determining investment decisions, but rather ideas of return on investment were. In 2004, solarnova created machines for a second production line and expanded the production capacity to 16 megawatts per year. The reason was the development of our own PV module standard line that rolled out in May 2004. It enabled customers, among others stakeholders, to be able to benefit from the EEG remuneration: the feed-in tariff for photovoltaic energy was 0.57 euro/kWh; a kWp cost approximately 5,300 euros at that time. Germany became the largest photovoltaics market – sales increased, as did the competition. In 2009, kWp

costs for rooftop installations had already fallen to 3,400 euros; in 2010, prices had decreased by almost 80 percent compared to 1989. Conversely, solar cell efficiency was increasing: from about 5 percent in 1954 to 16 percent and more in 2009.

Sylvia Schmenk has been the Managing Director of solarnova Germany GmbH since early 2015. Under her leadership, the multilingual sales team wants to push the international business even further, with partners in Mexico, Chile and elsewhere. The company's proven strengths are the unique combination of experience, expertise, “Made in Germany” quality production, a highly qualified and committed team and a refreshing dose of enthusiasm for a future worth living in. Environmentalism and sustainability are just as much a company philosophy as hanseatic values are, and not to mention an almost proverbial dependability in consulting, design and manufacturing processes.

Black is beautiful – Living inside the power plant

The most recent flagship project is currently under construction in Frankfurt am Main: solarnova has supplied 348 customized BIPV modules to the ABG municipal housing company for facade integration. The Energy Plus concept, popular with homeowners, will be transferred over to the Aktiv-Stadthaus – an ultra-modern and sophisticated building comprising 74 residential units located downtown. The Aktiv-Stadthaus is a self-sufficient energy supplier and generates its own energy through a combination of PV roof and facade modules. An energy surplus is even produced and stored in a battery that can be used, among other things, for recharging electric vehicles. The building sets an example for Europe and encapsulates the advantages of BIPV in one place: solar modules replace other costly exterior facade modules and simultaneously contribute to energy efficiency and distinct building aesthetics. In Frankfurt they decided on dark black glass / glass modules with the same kind of cells. “Black is beautiful” is a motto that many architects adhere to, particularly in Europe.

Building the future

According to the calculations from BSW Solar, around 24 million tons of CO_2 were avoided in 2014 because of photovoltaics. Last year alone the installed PV systems in Germany produced 34.9 TWh of power, and their share of Germany's gross energy consumption was about six percent. This figure is expected to rise to between eight and ten percent by 2020, which also underpins the trend in the construction industry: buildings that do not rely on external power or produce CO_2 emissions are in demand. solarnova is helping to build the future.

Date: June 2015

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