

Wednesday, 06. September 2017

Solar Spline: Lightweight architectural construction uses printed organic photovoltaic modules from OPVIUS

The showpiece, made at the University of Kassel and the Art College of Kassel, combines an uncompromisingly lightweight construction with the sustainable production of energy of OPVs in the form of a self-supporting Solar Cloud

Kitzingen / Kassel / Süßen, Germany – Following the successful integration of OPV modules in the glass façade of the exterior elevator shaft of the Sun Pharmacy in Marburg in 2016, OPVIUS and Timo Carl of AiD Architecture decided to carry out a second joint project in Kassel. This time the project took place in an interdisciplinary, university context, as a cooperation between the Department of Conceptual and Structural Design (*EEK* in its German acronym) run by Prof. Frank Stepper, Timo Carl at the University of Kassel on the architectural side, and Dr. Markus Schein, leader of the academic workshop for Digital Design and Production Techniques at the Art College of Kassel. Students from the fields of architecture, design, environmental engineering, and information technology were all involved in the project.

The experimental prototype “Solar Spline” was presented at the Art College’s yearly exhibition, which is also the site of Documenta 14, and will be displayed there until the beginning of October.

The structure is made up of 300 printed organic photovoltaic modules that are integrated into an ultra-lightweight construction that appears to be suspended in the air. A mesh of cable carriers made of thin aluminium tubes are stretched between main cables, and serve both as a cable route and to hold the modules in place. The modules themselves are integrated into a sandwich solution made of a transparent, highly-taught carrier-surface with a reflective film coating that was developed especially for this project.

The resulting Solar Cloud is supported by a three dimensional cable structure, and more than 10 anchor points. The anchor cables and suspended cables were provided by *Carl Stahl Architektur* from Süßen, who also reviewed the structure of the digital model. A motor pulls on two cables which moves the solar cells, allowing them to follow the sunlight during the day, and bringing them to a resting position when the light is low which opens up the space beneath the cells to the sky.

As part of the installation, and in order to draw attention to the energy output generated by the organic photovoltaics, every eighth module drives a ventilator, which gets faster and louder with increased energy input, so that those standing close-by can perceive a “swarm of ventilators”.

The low weight and easy integration of OPV modules plays an important role here. With a surface area of 30 m² and a total installation area of 100 m², the “Solar Spline” weighs less than 120kg in total, which not only made the installation easier, but also kept the static load low. The lean construction principle particularly benefits the topics of energy generation and providing shade in urban spaces, and creates a structure that is soft, and apparently light and mobile.

The “Solar Spline” thereby combines active solar energy generation with passive shading in an aesthetic way. An application for such a combination could, for example, be the covering of courtyards and urban squares, as its current location in the Art Academy demonstrates. In this regard, the “Solar Spline” can be used in different ways: from remedying the so-called “Urban Heat Islands”, to further development as a vertical element, and for the retrofitting of exposed south-facing facades of existing buildings.

The design possibilities are virtually limitless. Freedom in terms of form, colour, and degree of transparency allows architects to match the modules to any particular installation. The project is based exclusively on commercially available components, and therefore is more of a pilot installation than a concept.

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“The Solar Spline, which we developed using products from OPVIUS and *Carl Stahl Architektur*, not only influences the function of energy extraction, but also the quality of its environment through the creation of shade and through a lively show of light reflection, triggered by the movement of the Solar Cloud in the wind” says Timo Carl, research associate at EEK. “Rather than understanding architecture as a conventional mass-produced product, we want to develop it as three-dimensional experience space.”

Vito Gualazzini of *Carl Stahl Architektur* observes that “the integration of additional characteristics to the lightweight construction leads to a momentary mind-set that is in a way ad absurdum: normally one would try to leave as many functions as possible out, in order to create the idea of a lightweight construct. Through the combination of cable architecture and printed organic photovoltaics, we are in a position – with regard to the integrated energy creation – to enrich shade-creation solutions with new functions whilst maintaining lightweight modes of construction.”

Hermann Issa, Senior Director, Business Development & Sales at OPVIUS added: “Providing shade for plants and buildings in urban spaces is an important topic that will continue to have an increasing relevance in the future. The example of the “Solar Spline” shows that through the combination of forward-looking technologies, such as lightweight construction and printed organic photovoltaics, wholly new approaches can be generated. The collaboration with Timo Carl, Markus Schein, and Frank Stepper has shown that solutions in the field of creating shaded spaces had to be entirely re-thought when combined with energy generation.”

View project documentation on [You Tube >](#)

About the Department of Conceptual and Structural Design, Prof. Frank Stepper, M.Arch (UCLA) Timo Carl:

When one cannot think of the “im-possible”, and instead only thinks of the “possible”, one uses rules or undertakes projects. One surrenders to predictable causality, is pragmatic, and consequently will neither determine something nor create anything.

An integrated approach to design combines experimental, artistic design with functional needs. Shapes and spaces are not fixed, rather are developed as an answer arising from the processing of a particular task.

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About Digital Design and Production Techniques – 3D Techniques, Art College of Kassel, Dr. Markus Schein:

The Department is an academic workshop that, through teaching and research, researches and develops advanced digital modelling techniques, and combines this with contemporary computerized production methods, from various 3D printing methods, to robotically-supported construction, relating is to traditional material-based modelling.

Projects and seminars are often conducted in inter-disciplinary cooperation with various fields of architecture. International colleges and private companies are also increasingly among our collaboration partners.

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About Carl Stahl Architektur: Ballustrade in-fills, fall protections systems, architectural lighting installations, rope systems or complex zoolutions: CARL STAHL ARCHITEKTUR carries out the most versatile applications with stainless steel cables and meshes. Since 1880, everything at Carl Stahl revolves around the topic of cables – in the beginning in the form of natural fibre cables for agriculture, today with steel cables and lifting equipment to haul the heaviest loads. In the 1990s, architecture emerged within this long-established business as an area of expertise. From consulting and planning with regard to static calculation, to production and installation, CARL STAHL ARCHITEKTUR offers its clients everything they need – worldwide- for the development of creative ideas with cables, meshes, and stainless steel-system components.

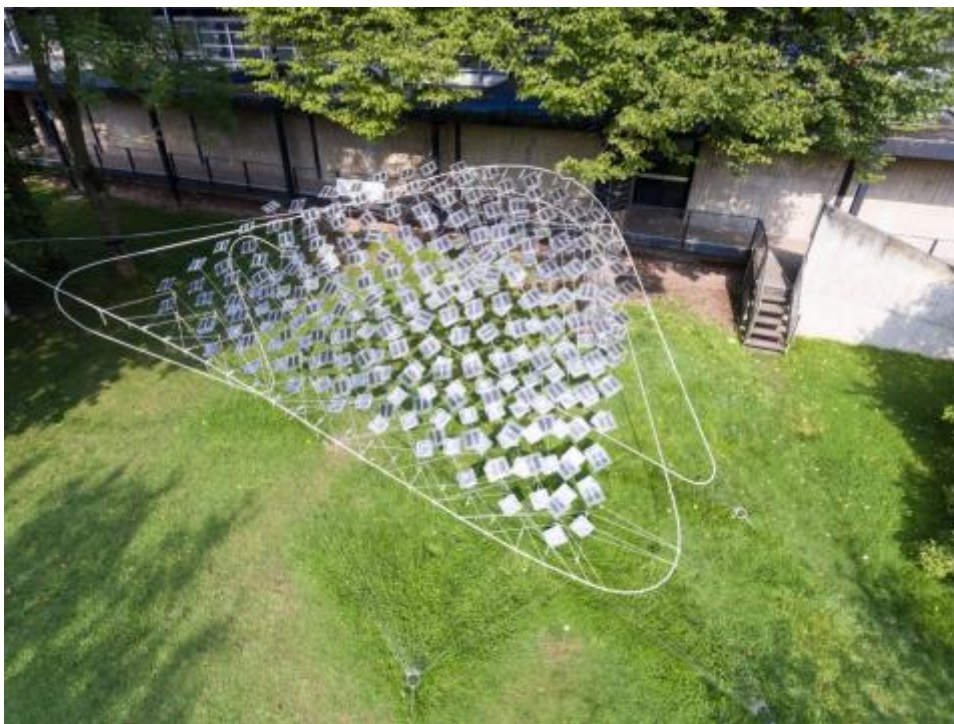
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About OPVIUS: OPVIUS GmbH, founded in 2012 and located in Nuremberg and Kitzingen (INNOPARK Kitzingen), is among the world-leaders in the field of organic photovoltaics. OPVIUS produces organic solar cells with a focus on client-specific solutions. In addition, the company is also active in the field of research and development, in order to continue to provide its clients with creative and innovative solutions. In this regard, OPVIUS uses a unique production process, combining printing, lamination, and laser structuring techniques. This advanced technology is easily scalable and allows the production of the utmost individual, customer-specific designs. OPVIUS also helps clients with system solutions in order to integrate OPVs into already existing or new products.

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Picture 1: The "Solar Spline" at the Art College in Kassel.

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Picture 2: Detail of the OPVIUS OPV modules.

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