Hering Architectural Concrete

SUNOVATION

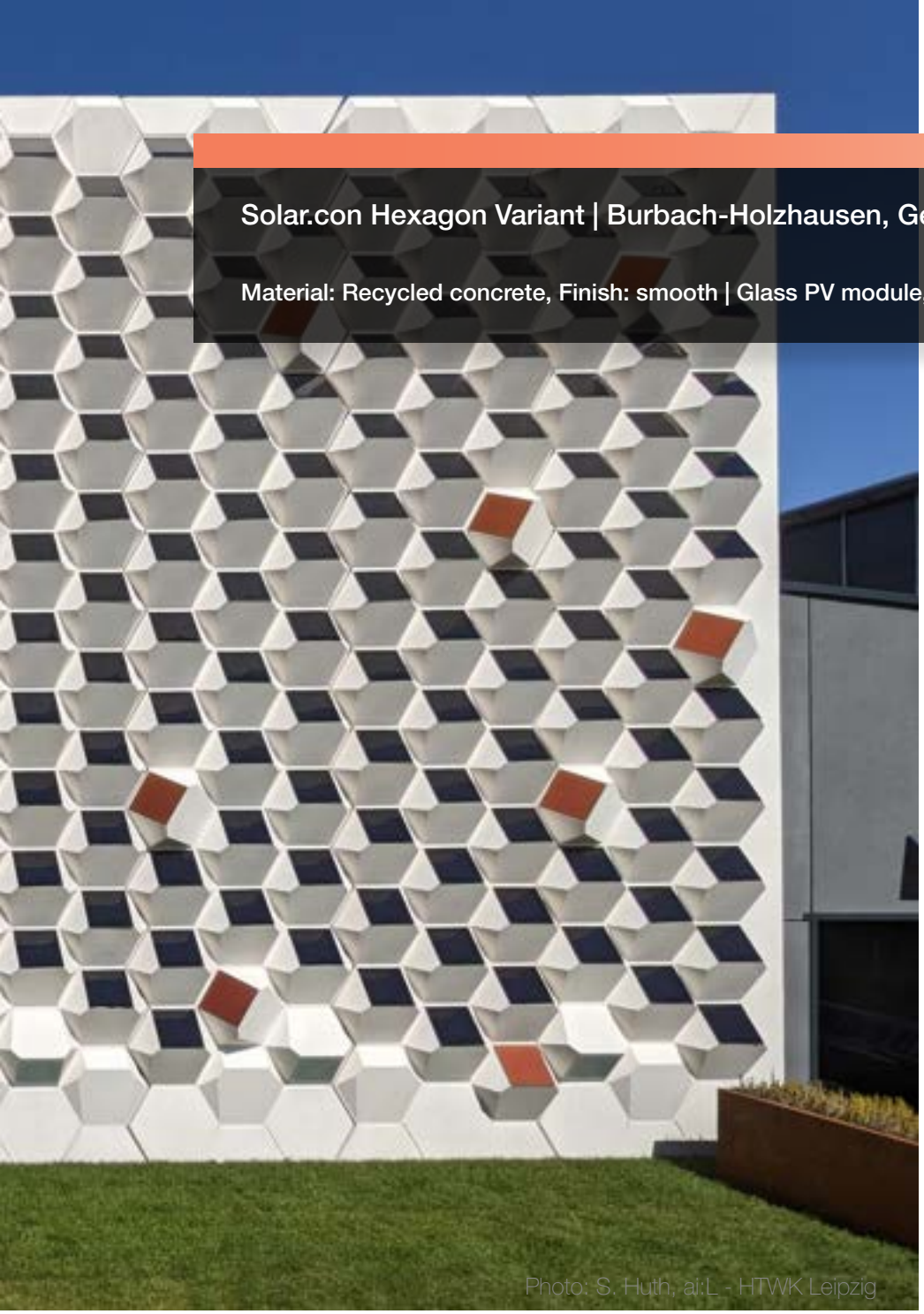
ai:L

Solar.con

Exposed Concrete Facades with Photovoltaic Modules in Yield-Optimized Orientation

The Future is Solar

We are committed to the societal challenge of shaping the transformation towards a climate-neutral energy supply and sustainable construction. Significant potential lies in building-integrated photovoltaics (BIPV), combined with durable exposed concrete facades. BIPV can generate emission-free electricity from freely available solar energy right where it is consumed. Photovoltaics are an indispensable component of contemporary energy concepts and resilient supply. Consequently, some German federal states have already introduced a solar obligation for new and existing buildings.



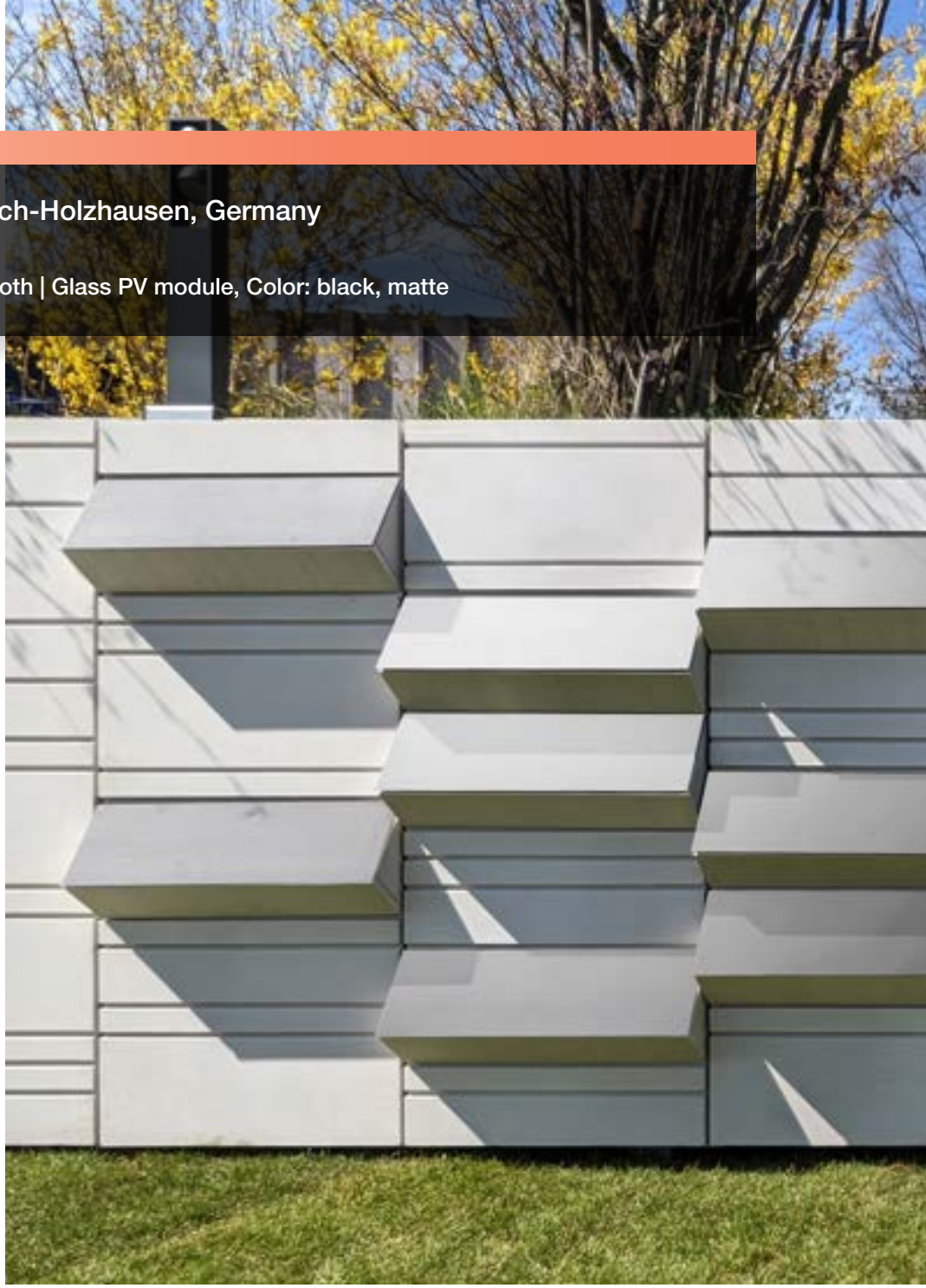
Solar.con Hexagon Variant | Burbach-Holzhausen, Germany

Material: Recycled concrete, Finish: smooth | Glass PV module, Colors: black and red, glossy

Photo: S. Huth, ai:L - HTWK Leipzig

Surface Potentials in Facades

Photovoltaic systems placed on rooftops alone are not sufficient in terms of yield and also compete with terraces, air conditioning units, and green roofs. Therefore, facade surfaces represent an important future potential, accounting for over 70% of the total building surfaces available for PV integration. In combination with concrete as a mineral building material, synergies emerge for new projects as well as for the building stock. Due to innovation and customization, we can offer exposed concrete solar facades that meet aesthetic, technical, and ecological requirements.



Solar.con Linear Variant | Burbach-Holzhausen, Germany

Material: Textile concrete, Finish: smooth | Glass PV module, Color: black, matte

Design Integration

Due to their size, standard PV modules hardly allow planners to address the built environment and its unique location factors with suitable facade design. In contrast, the Solar.con facade utilizes small-format PV modules that can be flexibly integrated into facades to scale. Depending on the orientation and shading, these are optimally aligned to the sun during the design process with the help of computer calculations. This increases the yield and gives the building a varied appearance with its three-dimensionally arranged concrete and solar surfaces.

Photo: S. Huth, ai:L - HTWK Leipzig

Construction and Materiality

Solar.con is a suspended rear-ventilated facade that can be made of either textile-reinforced or steel-reinforced concrete and is available in various exposed concrete qualities. The glass PV mini-modules, with their monocrystalline silicon cells, integrate seamlessly into the prefabricated exposed concrete elements and can be mounted independently and quickly replaced later through a special fastening system. At the rear junction box of the modules, there are two cables with connectors in the ventilation space, which are accessible from the outside of the facade. This enables a separation of trades on the construction site.

Digital Planning and Production

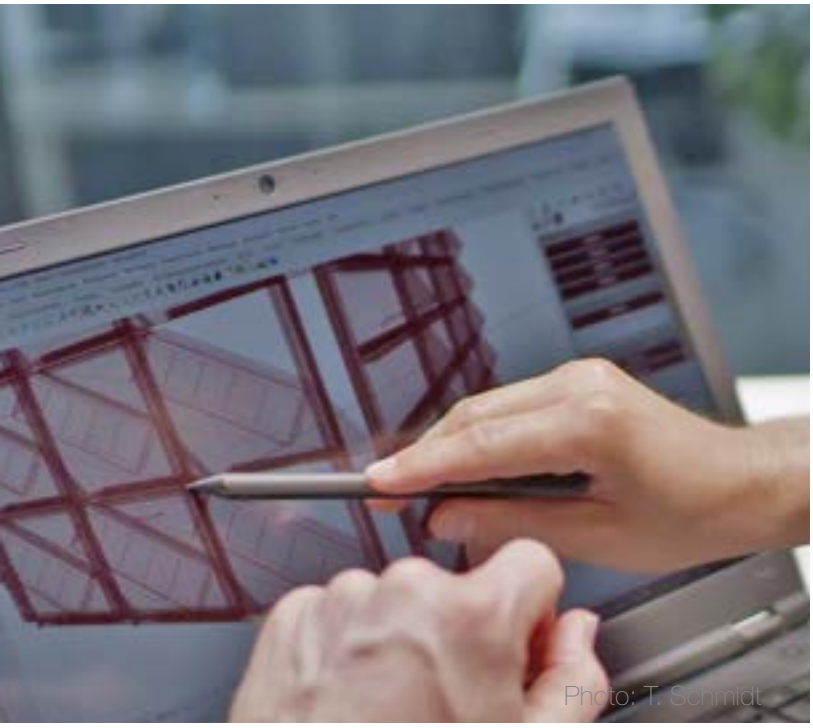


Photo: T. Schmidt

The innovative planning approach was preceded by a research project funded by the federal government of Germany. The parametric-generative algorithms developed with the software Rhinoceros and the plugin Grasshopper increase the solar yield per square meter of PV surface by up to 55% compared to modules that lie flat in the facade plane. In the digital workflow, the generated geometry data of the three-dimensional facade elements are automatically passed on to machine processing. We will support you in all service phases with competent consulting and planning as well as in the high-quality construction implementation.

Ecology and Sustainability

Photo: N. Otto, Hering Architectural Concrete

We optimize the ecological footprint of our steel-reinforced exposed concrete elements by using R-concrete with 30% recycled aggregate and CO2-reduced cements. The advantage of the lightweight textile-reinforced concrete panels lies in their thin-walled construction, which reduces material usage by approximately 70%. The long lifespan of concrete as a mineral building material and the low maintenance effort significantly contribute to improving the environmental balance. The PV modules generate renewable electricity and have energetically paid for themselves after just 2 years. Exchange, material separation, and recycling are carried out without affecting the exposed concrete elements.

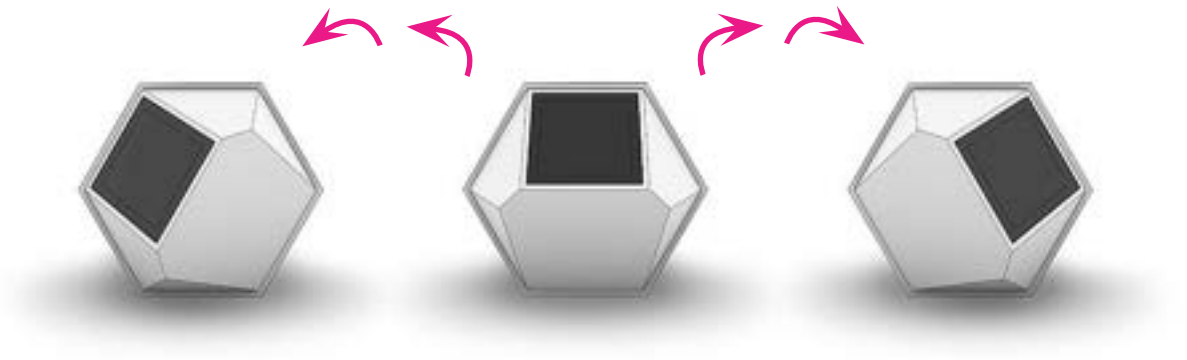
Flexible Modularity

Hexagon Variant

The element is rotated 60° to the left for east facades

Optimal solar orientation of the PV module for south facades

The element is rotated 60° to the right for west facades



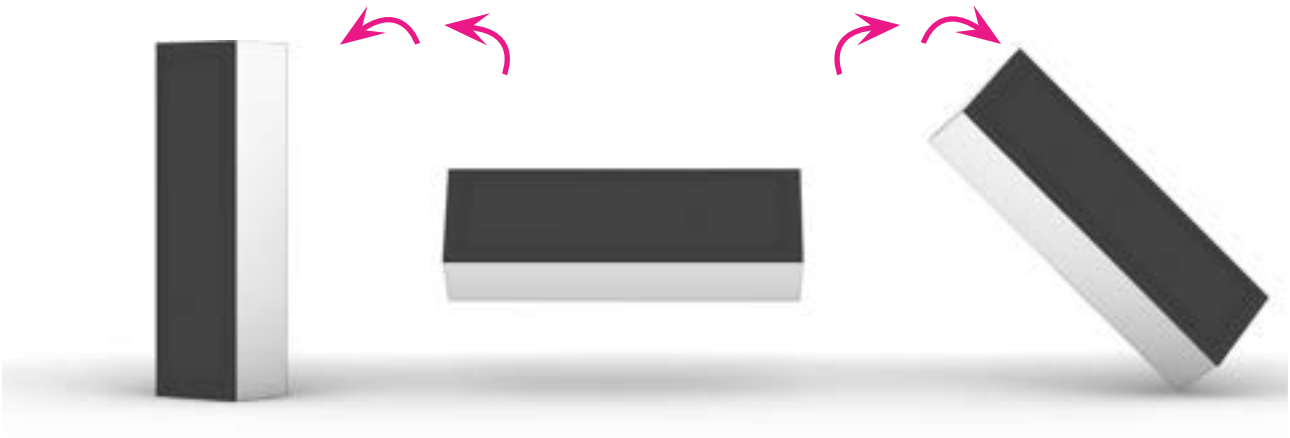
Alignment options | Graphic: S. Huth, ai:L - HTWK Leipzig

Linear Variant

The element is variably rotated up to 90° to the left for east facades

Optimal solar orientation of the PV module for south facades

The element is variably rotated up to 90° to the right for west facades.



Alignment options | Graphic: A. Heller, ai:L - HTWK Leipzig

Technical Specifications

Exposed Concrete Elements

Facade type:	Suspended rearventilated facade on metal substructure
Element structure:	Optionally executed in solid construction from steel-reinforced recycled concrete or in lightweight construction from thin-walled textile concrete (betoShell)
Element dimensions:	Dimensions from single-man elements to full-height elements according to approval and statics.
Colors:	White, Beige, Gray, Charcoal, Red
Surface finish:	Fine washed, acid-etched, blasted, polished
Surface protection:	Factory-applied hydrophobic treatment, graffiti protection

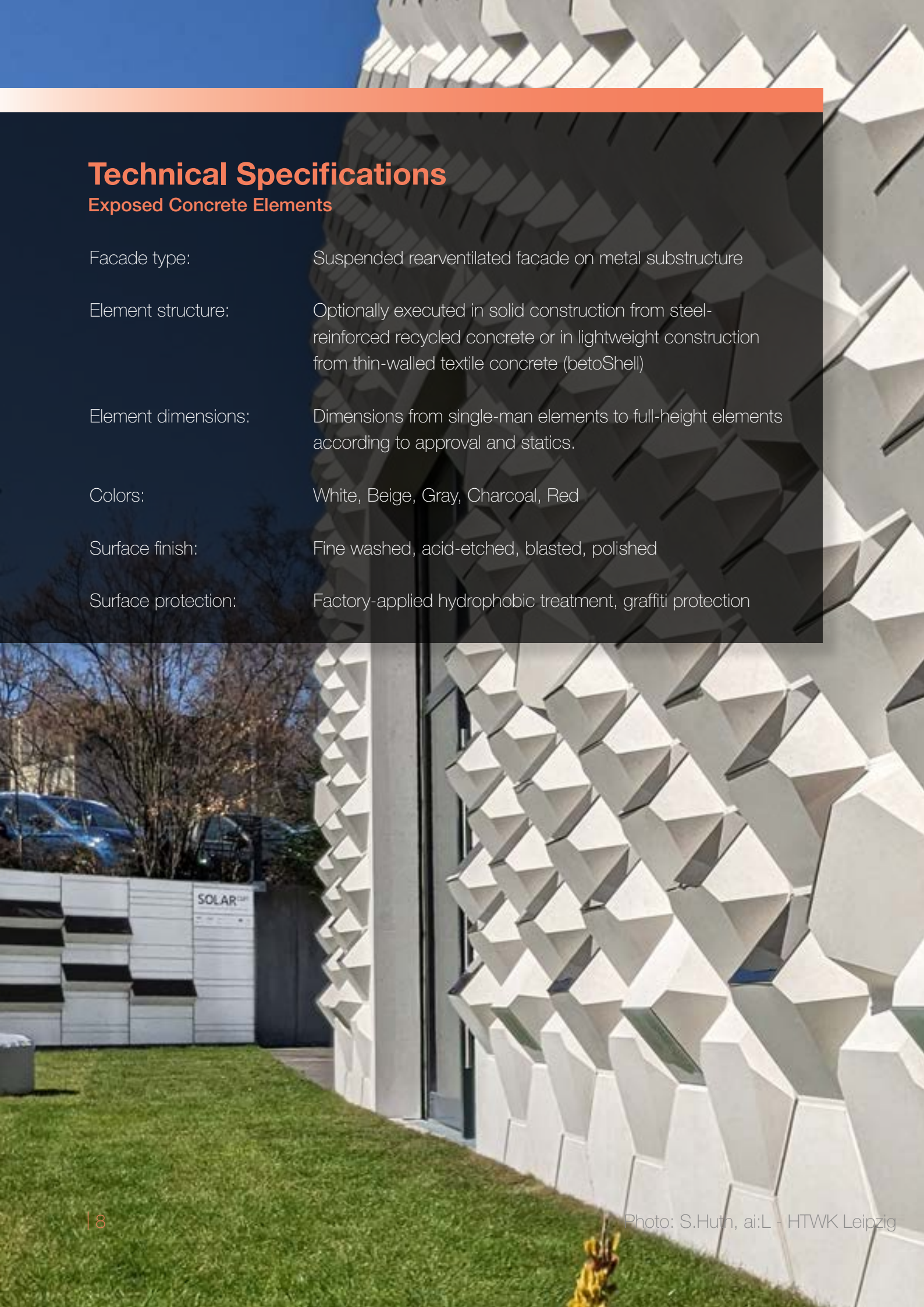


Photo: S.Huth, ai:L - HTWK Leipzig

Individual Design Options

Exposed Concrete Elements

Color

The use of white cement as a binder enables the coloring of the concrete with various pigments. This allows us to ensure clear colors and high-quality architectural concrete.

Surface

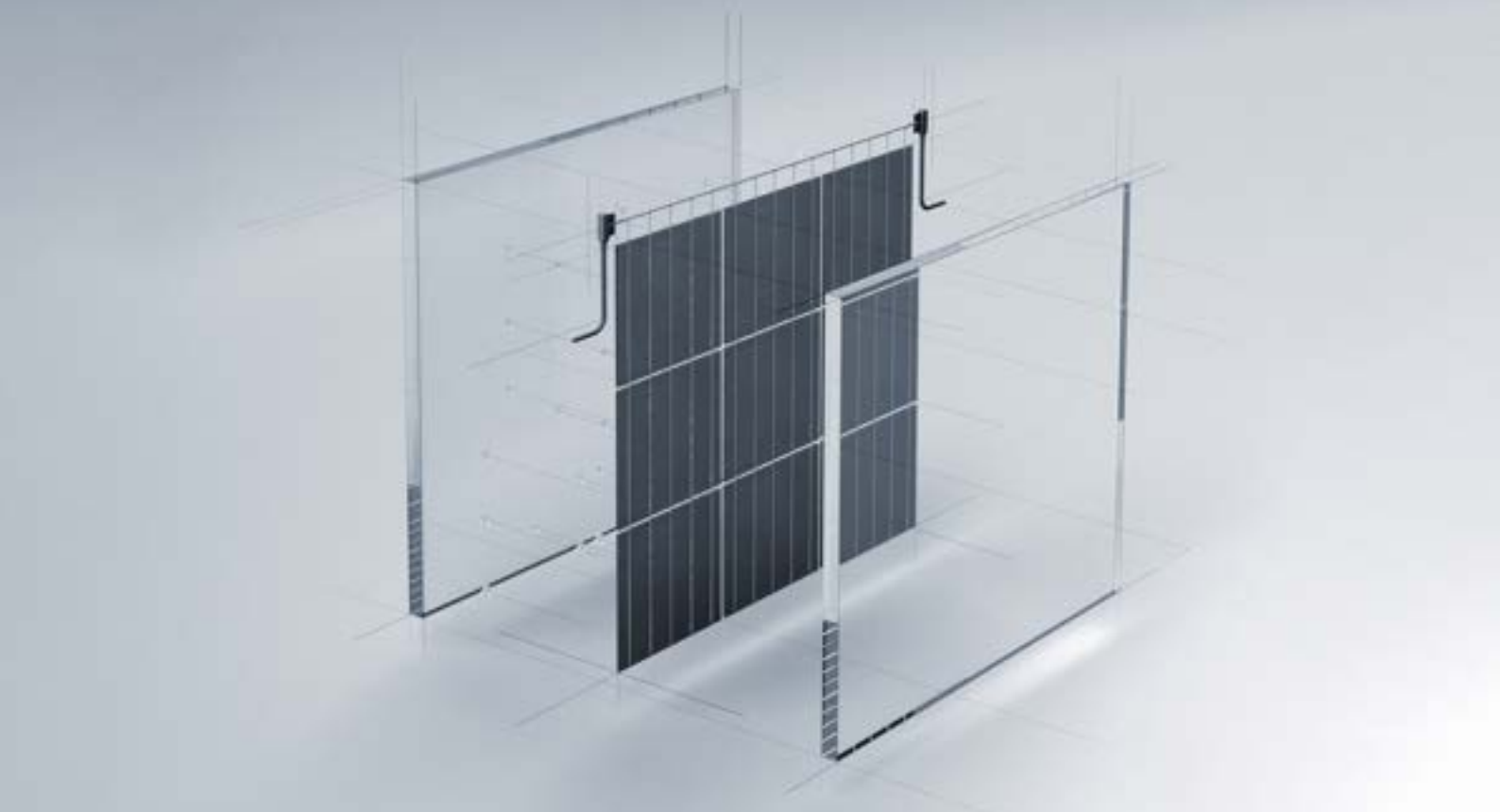
The surface finish depends on the complexity of the chosen facade geometry. We verify the quality and uniformity of the surface treatment during the planning process using facade samples.

	White 11/06	Beige 15/12	Gray 09/12	Charcoal 12/11	Red 10/12
Washed					
Etched					
Blasted					
Polished					

Technical Specifications

Photovoltaic Modules

Module structure:	Frameless glass-glass modules consisting of front glass, PV cells, and back glass (SUNOVATION eFORM)
Module dimensions:	Dimensions from 239 mm x 239 mm
Module nominal power:	Depending on color, from 145–200 W_P/m^2_{PV}
Cell types:	Monocrystalline silicon cells
Conductor tracks:	Visible / Hidden
Module Colors:	Black / Colored
Glass surfaces:	Clear / Satinized



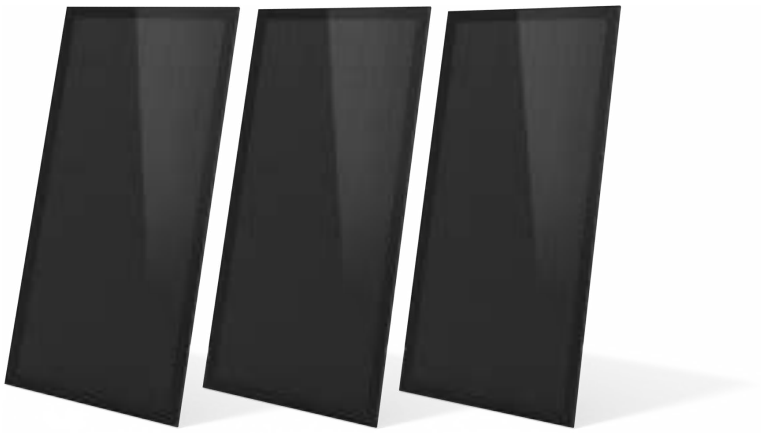
Module structure: Front glass, PV cells, back glass | Graphic: SUNOVATION

Individual Design Options

Photovoltaic Modules

Black PV Modules

Black glass-glass modules of the eFORM color series with subtly visible photovoltaic cells gain maximum solar yields. From a distance, these modules appear as a black glass surface. Upon closer inspection, one can discern the specific structure of the PV cells, which lends the product an interesting surface effect. Optionally, the conductor tracks can be executed in black for an even more subtle appearance.



Module series eFORM color | Graphic: SUNOVATION

Colored PV modules

Photovoltaic modules from the eFORM unichrome series can be selected for colorful accents in the façade. A full-surface coating with special color pigments creates a homogeneous, colored surface effect. The specific structure of the PV cells is no longer visible here. Currently, the modules are available in 15 exclusive colors. Upon request, individual color customization is possible.

Module series eFORM unichrome | Graphic: SUNOVATI-

Hexagon variant

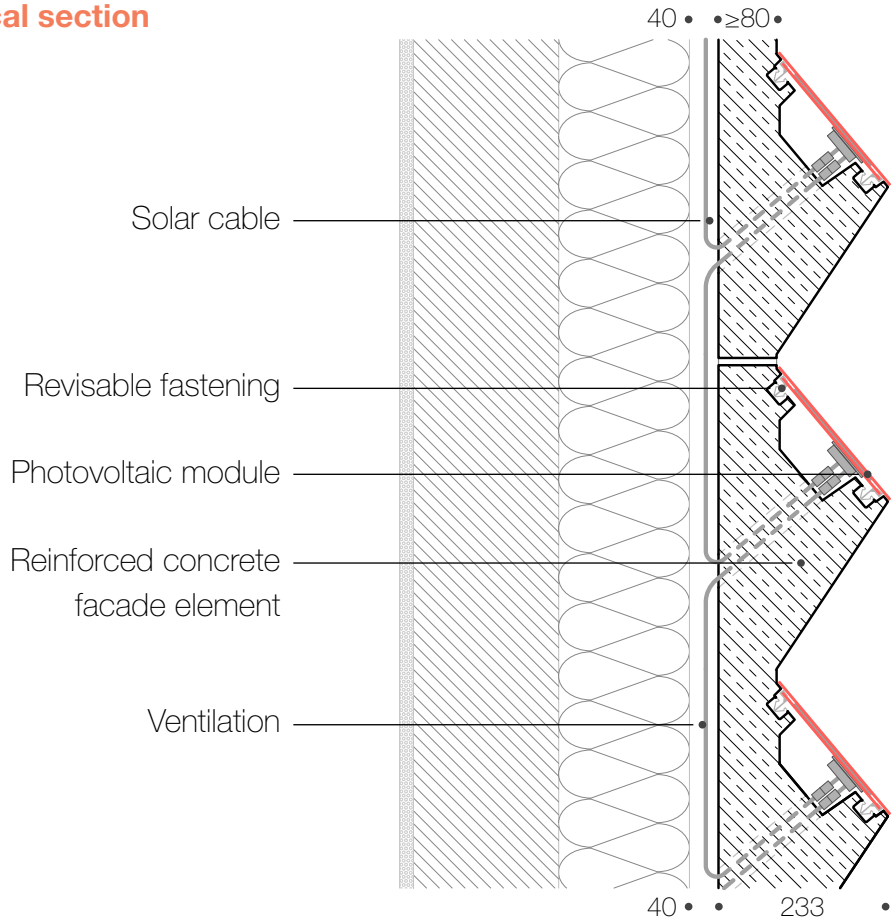
Planning Assistance

Photo: F. Hülsmeier, ai

Standard Detail

Hexagon variant

Vertical section



Technical Specifications

Thickness of facade element:	≥233 mm (plus 40 mm ventilation)
Weight of facade element:	approximately 300 kg/m²
Fire classification:	Reinforced concrete: Non-combustible, building material class A1 according to DIN 4102-1 PV module: Flame retardant, building material class B-s, d0, according to DIN EN 13501-1
Approval:	Reinforced concrete element: Dimensioning acc. to DIN PV module: Project-specific usability certificate

Linear variant

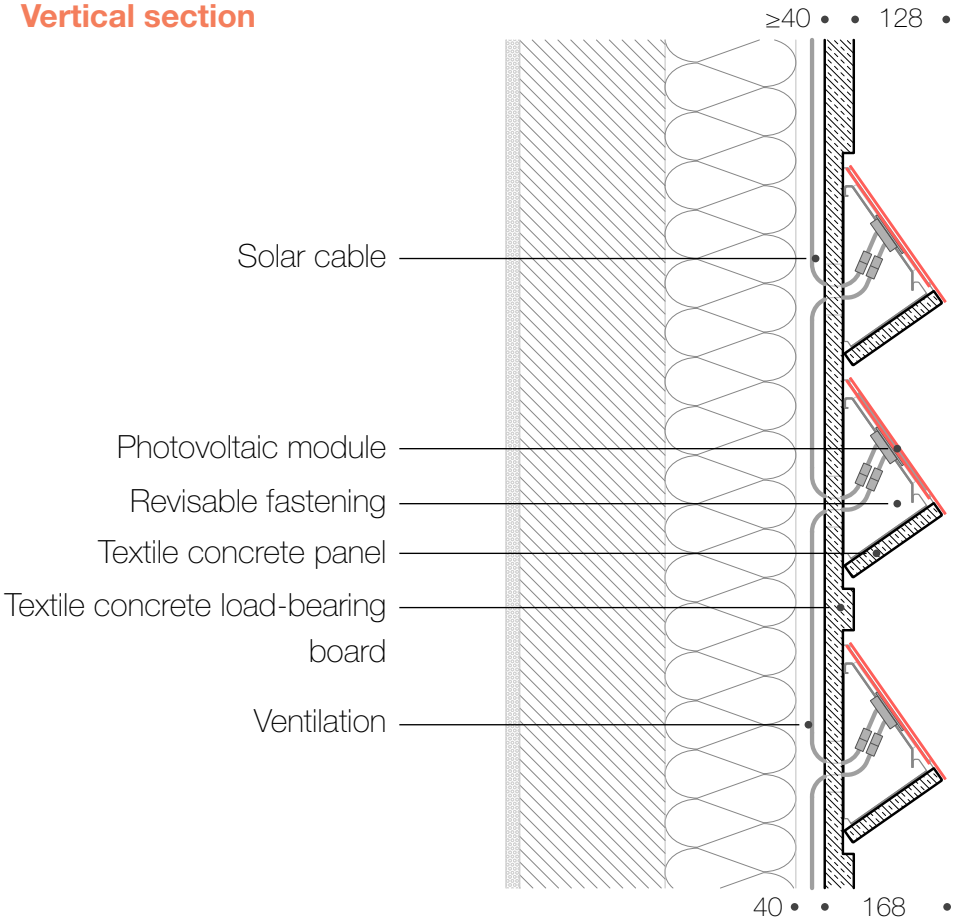
Planning Assistance

Photo: S. Huth, ai:L - HTWK Leipzig

Standard Detail

Linear variant

Vertical section



Technical Specifications

Thickness of facade element:	≥168 mm (plus 40 mm ventilation)
Weight of facade element:	approx. 100 kg/m²
Fire classification:	Reinforced concrete: Non-combustible, building material class A1 according to DIN 4102-1 PV module: Flame retardant, building material class B-s, d0, according to DIN EN 13501-1
Approval:	Textile concrete element: Dimensioning acc. to DIN PV module: Project-specific usability certificate

Detail Matrix

Hexagon and Linear Variant

01-04 | Grid dimension and geometry of the facade elements can be individually adjusted upon request. Door and window reveals are optionally available with visible or concealed profile frames. The shape of reveals and joint arrangement can be varied according to customer preferences.

09-12 | Depending on shading, mechanical stress, and general design goals, only partial areas of a facade can also be solar activated. Special geometries form the transition areas either clearly defined or as a gradual transition.

05-08 | Standard solutions are available for forming the building corners, which faciliates the transition between elements of different solar orientation. Additional corner solutions can be developed in collaboration with the project planning, taking into account self-shading and shading from adjacent structures.

Module Installation, Cable Routing and Revision

Hexagon and Linear Variant

The PV modules can be quickly and easily installed using a special hooking system. Installation can be carried out either in the factory or on-site. The system allows for the separation of the solar installation and facade construction trades for a smooth construction process.

The cable routing is done in series connection from PV module to PV module, to efficiently utilize solar yields with minimal cable length and energy losses. Cable bridges with standard solar connectors are pre-installed at element joints and more distant connection points. In case of shading, each PV module is bypassed by a built-in bypass diode.
The cable routing is located in the rear ventilation zone of the facade and can be fire-sealed according to project-specific fire protection requirements.

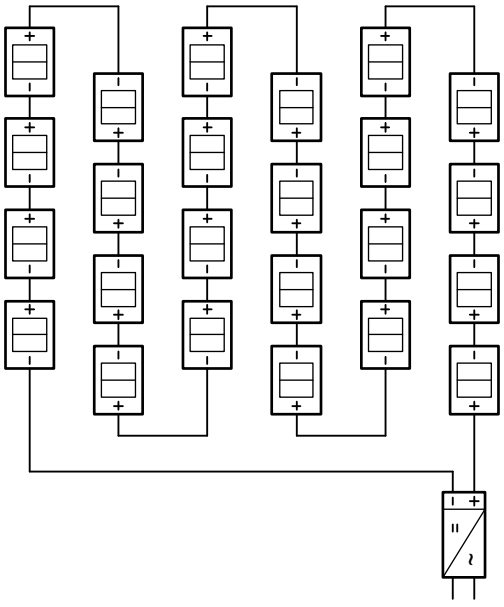
The PV modules can be easily and quickly replaced using the hooking system. This may be necessary for defective or damaged modules, or when a complete replacement is made after the end of the over 25-year lifespan. The concrete elements do not need to be removed or replaced when installing a new generation of PV modules.

Photo: N. Otto, Hering Architectural Concrete

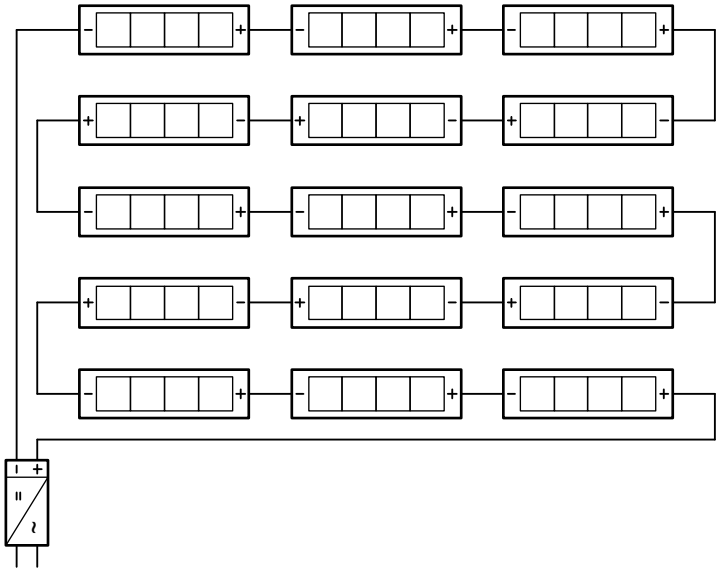
Foto: S. Kühn, ai:L - HTWK Leipzig

Wiring Diagram

Hexagon Variant



Linear Variant



PV module | 2 half-cells incl. bypass diode

PV module | 4 full cells incl. bypass diode

Inverter

Wiring diagram | Drawing: F. Hülsmeier, ai:L - HTWK Leipzig

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