

New Generation of Solar Facades



We design and engineer solar facades

- ↓ ↑ ← with **small photovoltaic (PV) modules** that react flexibly to building size and window layout
- ↻ ↻ with **rotated PV-modules** depending on solar orientation and shading demands

You receive

- ✓ **renewable power** close to where it is consumed
- ✓ **optimised solar yields** by parametric software tools
- ✓ **innovative building designs** responding to urban needs
- ✓ **more flexibility** on roofs for greenery and terraces

ai:L is an award-winning *research institute* and *architecture studio*

Executive Summary

Increasing **urbanisation** and the strain this places on the public **power grid** mean more energy will need to be produced in urban areas, close to where it is consumed.

As a result, **solar power** generation by photovoltaics (PV) on **facades** is moving further into focus. With standard PV modules, however, a nuanced response to the design intent and subtleties of the location is almost impossible in an urban context.

In contrast to the products currently available on the market, the parametrically optimised solar facade is based on **small PV modules**, which are considerably easier to **integrate flexibly** into facades.

Parametric-generative **computer calculations** allow the designer to orientate the modules optimally towards the sun, taking into account compass direction and shading.

The resulting **yield** per square meter of PV surface is **up to 55 % higher** than that of in-plane modules.

The PV modules can be combined with **other materials** such as concrete, timber or aluminium composite panels into 3D facade elements. The facades take on **different appearances** depending on the viewing angle, including perspectives from which the solar modules are hardly visible.

Solar Facade in Urban Context

ai:L



Our team combines research and design

ai:L

Architektur-Institut Leipzig
Leipzig University of Applied Sciences

is our **research institute** at Leipzig University of Applied Sciences in Germany. We develop innovative construction and design concepts with a focus on third-party funded research in the field of lightweight and energy-efficient construction as well as multifunctional facades.

ai:L

architektur innovation labor
Heller, Huth, Hülsmeier Architekten PartGmbH

is our **architecture studio** bringing innovative developments into practice. We draw on many years of planning and construction experience and realised innovation projects in interdisciplinary teams.

ai:L



Our services from idea to realisation

Consulting

Finding customised solutions together

Design

Optimising solar facades through advanced algorithms

Engineering

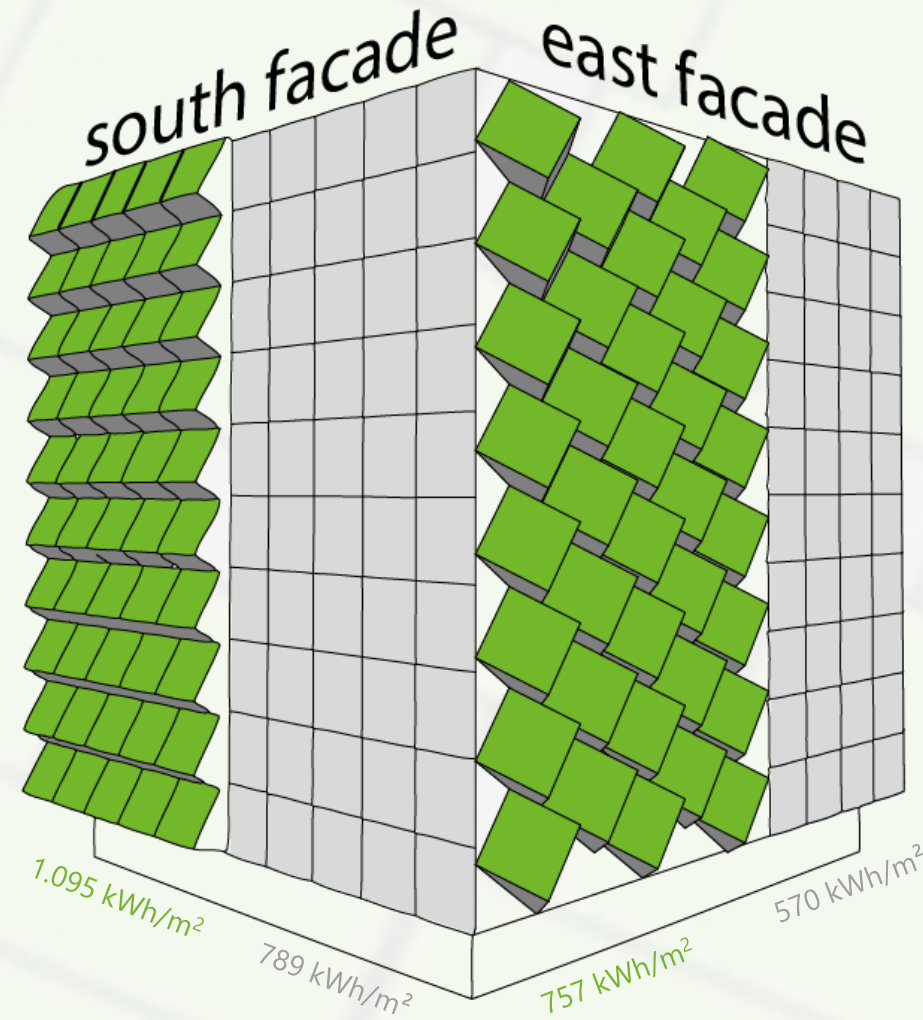
Integrating multi-purpose functions

Realisation

Organising experienced building teams

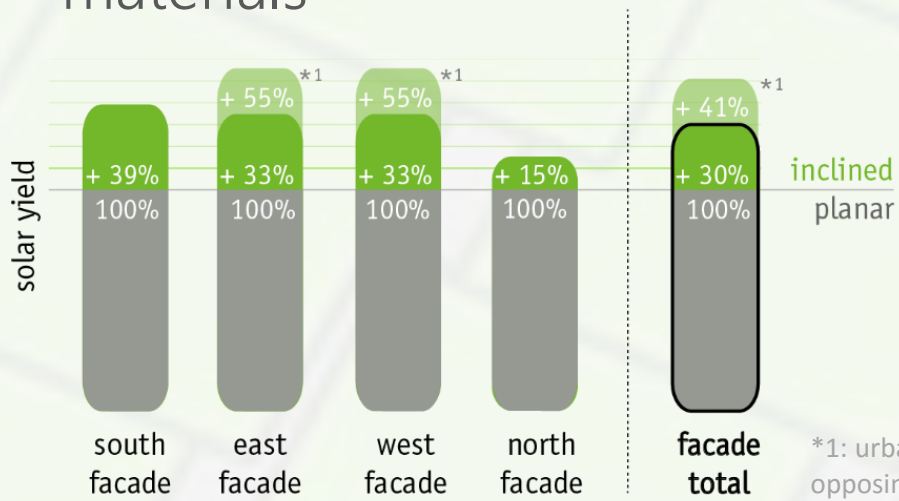
Design elements adapt to solar orientation

- individual solar patterns are optimised for each facade
- solar yields rise up to 55 % per m² PV, compared to planar solar facades
- multiple design options are applicable with further facade materials

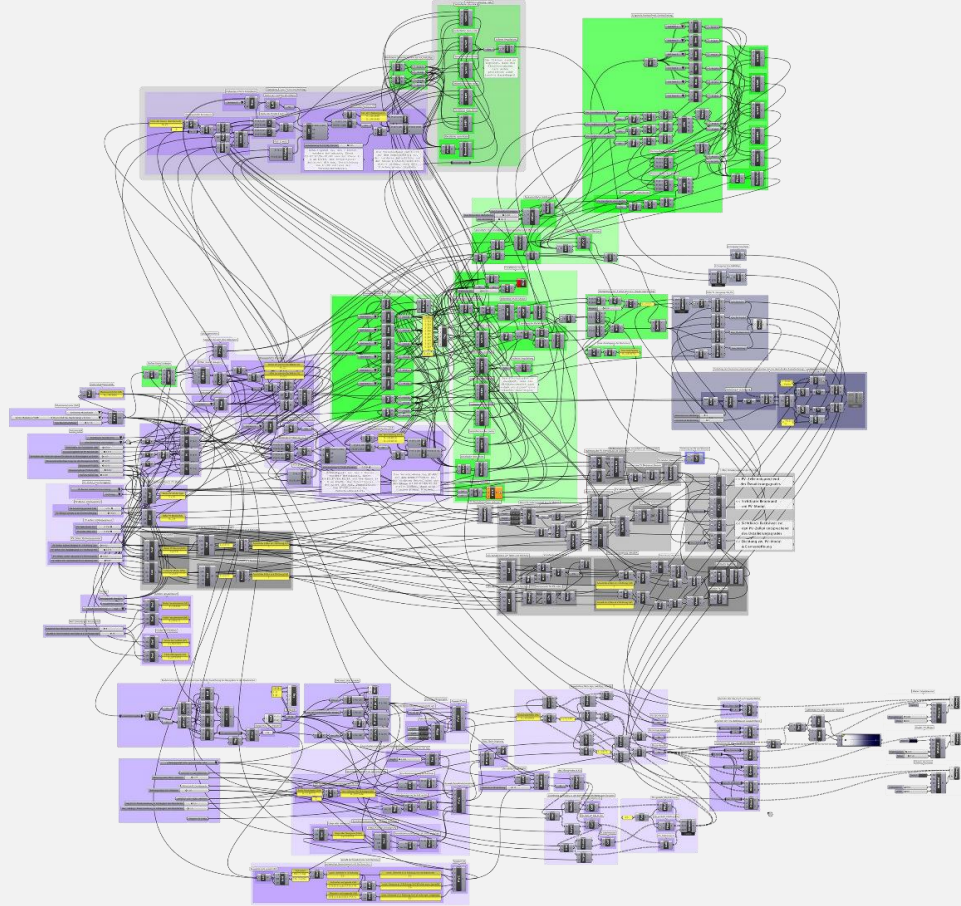
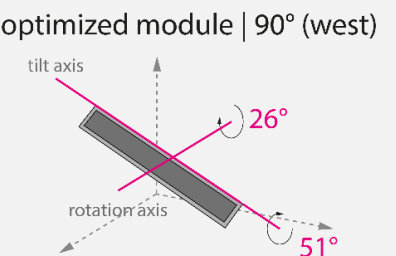
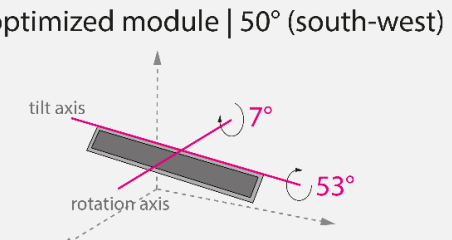
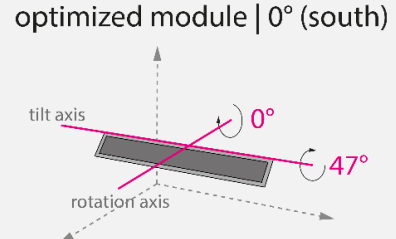
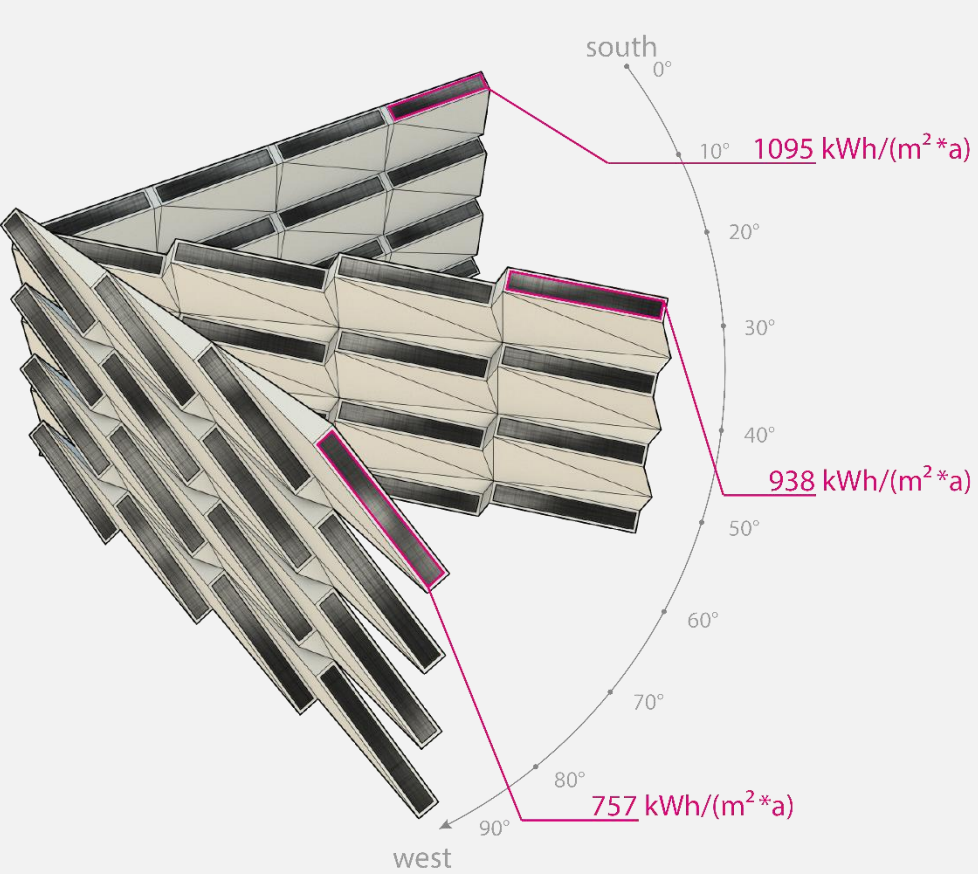


Solar irradiation per year on:

- inclined PV-modules
- planar PV-modules

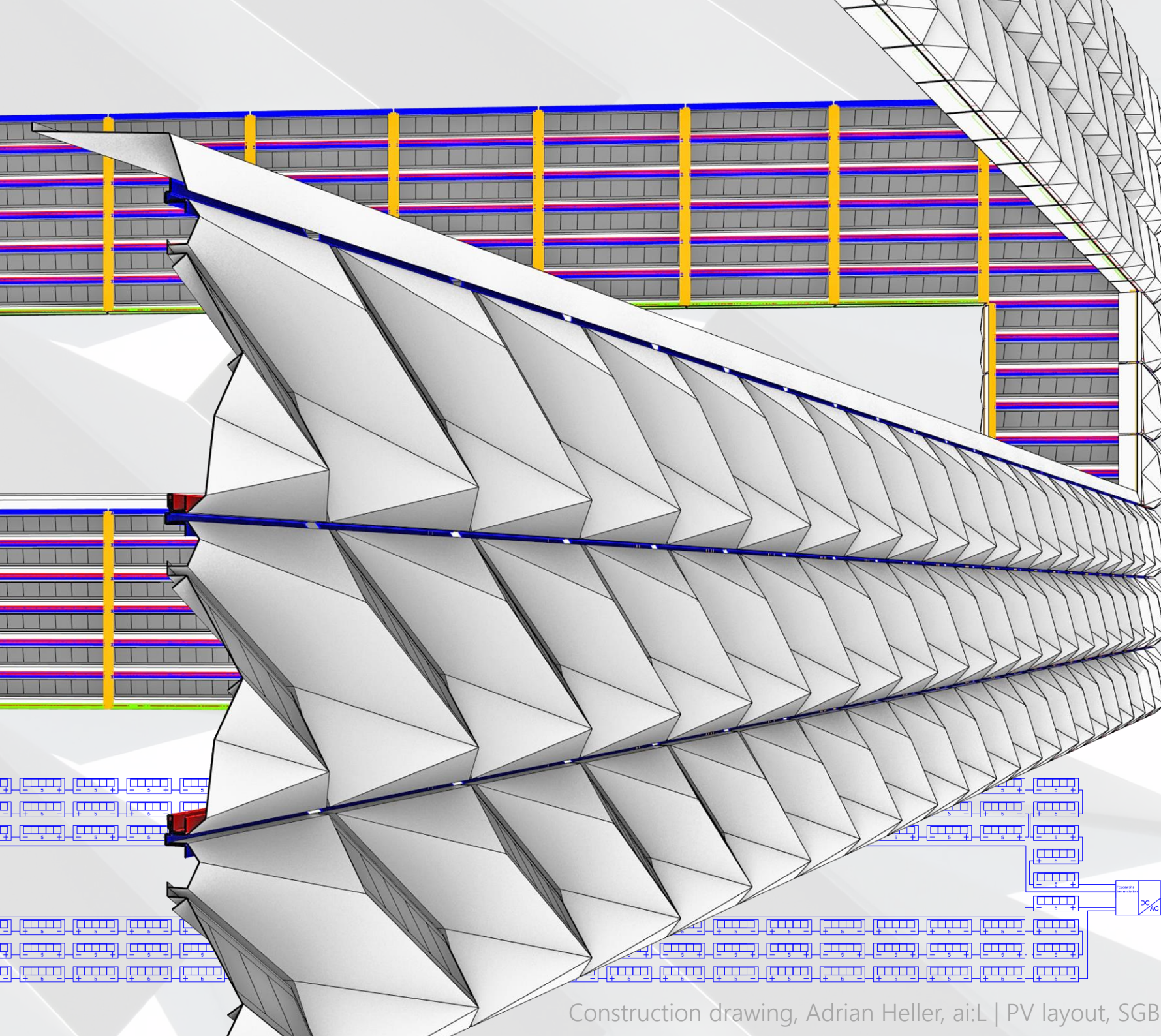


Design optimisation through advanced algorithms

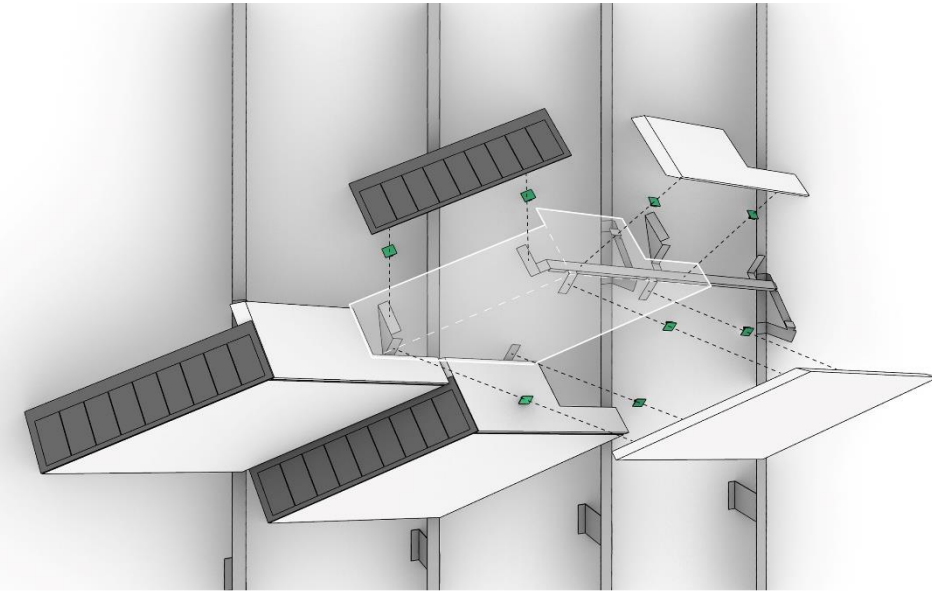


Engineering Aspects

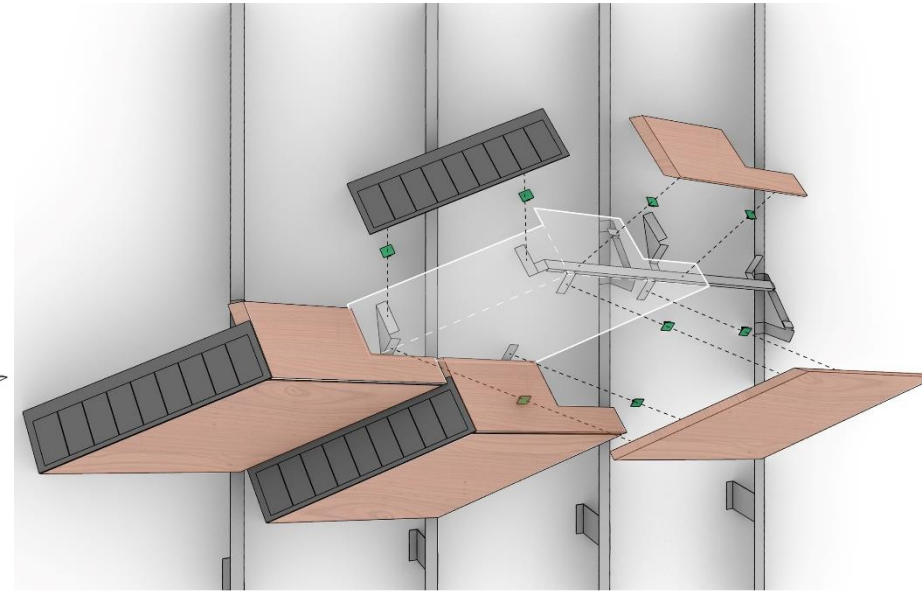
- **suspended rear-ventilated** facades
- **prefabricated** modular structure
- **replaceable** PV modules
- **new buildings** and **building stock** options
- **scaleable** from tiny house to skyscraper
- **digital process chain** with digital twin and BIM



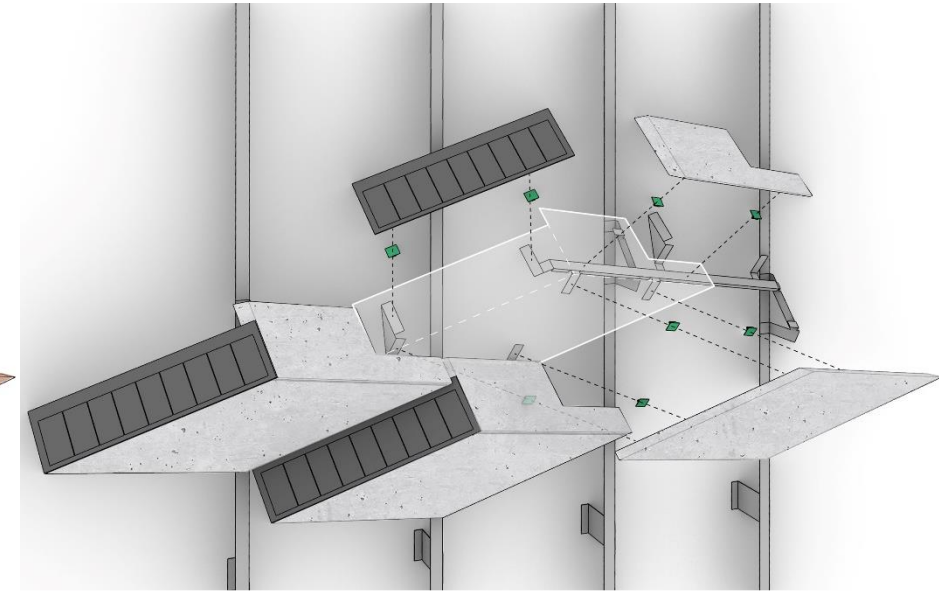
Material and Colour Options



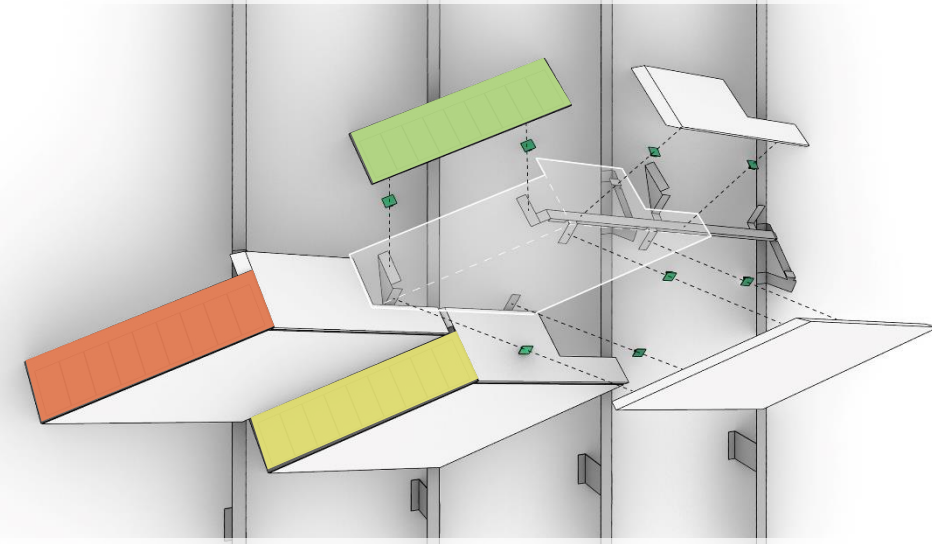
Steel / Aluminium / PV non coloured



Wood / PV non coloured

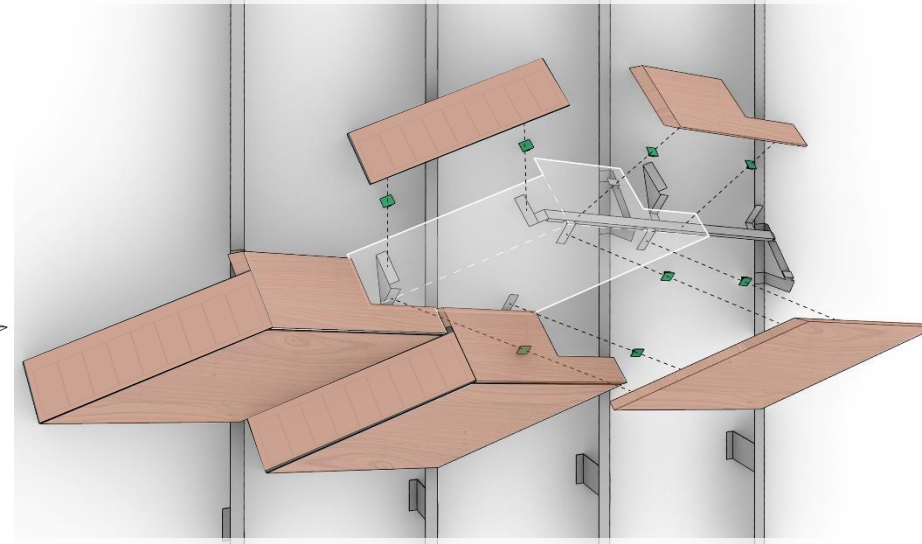


Concrete / PV non coloured

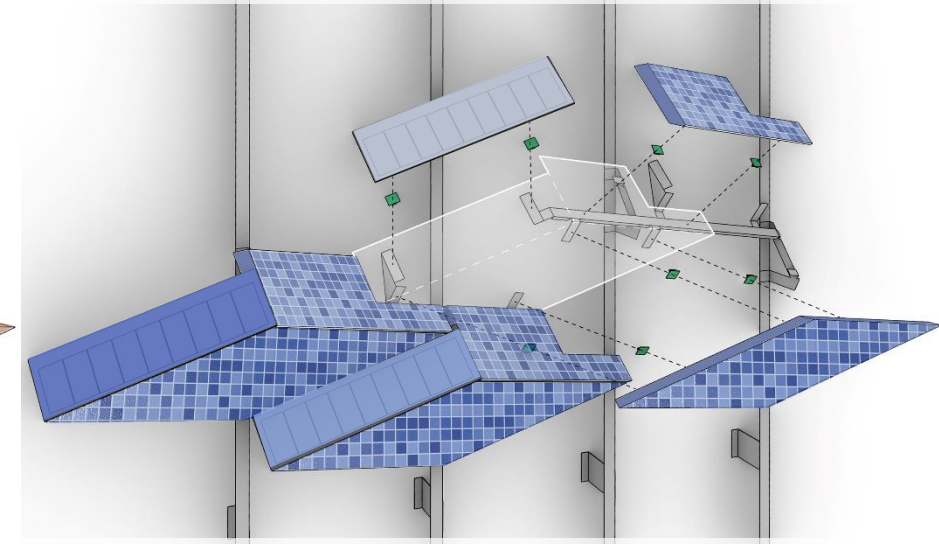


Steel / Aluminium / PV multicoloured

CGI: Stefan Huth, Frank Hulsmeier, ai:L

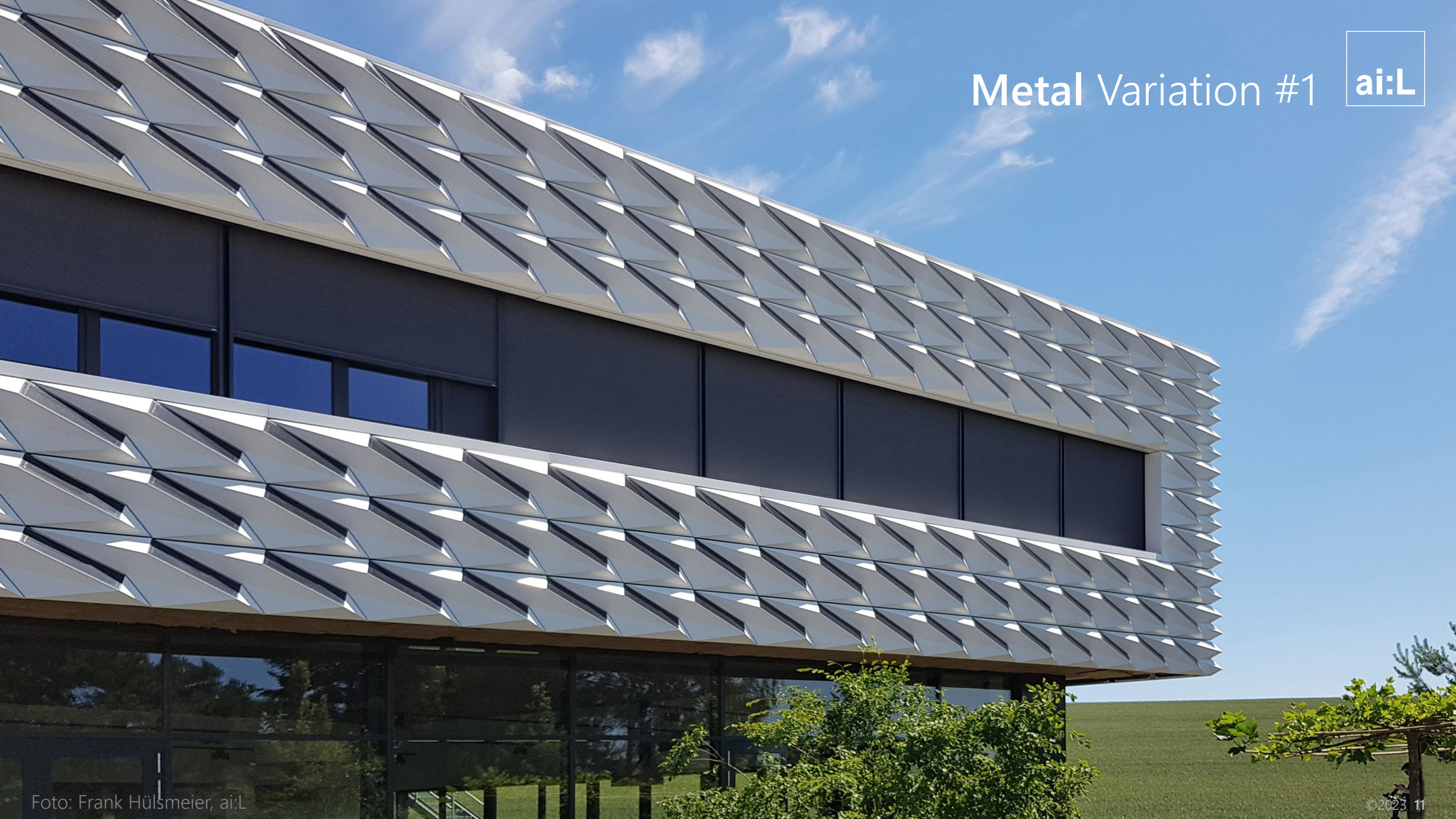


Wood / PV unicoloured



Tiles / PV colour family

Metal Variation #1



Profile

Project:
SOLAR.shell

Location:
74906 Bad Rappenau-Bonfeld
Germany

Client:
Aluform
Alucobondverarbeitungs-GmbH

Architect Facade:
ai:L Architektur-Institut Leipzig

Factsheet

- **monocrystalline solar cells**
efficiency: 20 % | performance
peak: $200 \text{ W}_p/\text{m}^2$ | yield
(Frankfurt, DE): $100 \text{ kWh}/\text{m}^2_{\text{PV}}$
p.a. on west-facade
- **active solar surface**
depending on design
($> 20 \%$ possible)
- **costs** rear-ventilated facade
from 450 €/m^2
- **amortisation PV** from 2 years
- **cleaning** once a year like
typical glass facade

Integration Option

- **LED light sources** integrated into the aluminium facade element
- **building appearance** at night
- **illumination** of surroundings
- **increase of safety**

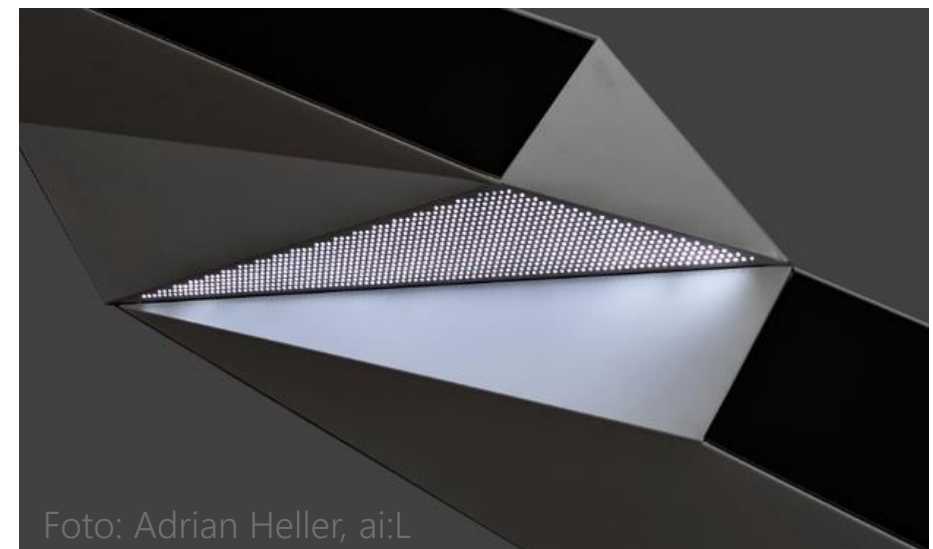


Foto: Adrian Heller, ai:L

Realisation Focus

- **facade elements** of aluminium polymer-core composite panels with integrated glass/foil solar modules
- **standard subconstruction** made of aluminium
- **installation** of facade and PV in one hand
- **short construction time** due to prefabrication

PV-Modules

- **module type:** glas-backsheet without frame
- **quantity:** 153 pieces, black
- **dimension:** 820/212/4,5 mm
- **power:** 20 Watt_{peak}
- **cell:** monocrystalline; 9 x 79,3/158,75 mm
- **front cover:** 3,2 mm low iron tempered float glass
- **back cover:** backsheet, black
- **electrical connection:** 2 x 900 mm cable with MC4 connector; 1 x diode in junction box
- **special features:** black taped busbars and cross connectors; long sides of the glass without backsheet to accommodate adhesive fixings
- **mounting:** glued aluminium frame on the back
- **producer:** OPES Solutions GmbH

Metal Variation #2



Profile

Project:
SOLAR.shell

Location:
74906 Bad Rappenau-Bonfeld
Germany

Client:
Aluform
Alucobondverarbeitungs-GmbH

Architect Facade:
ai:L Architektur-Institut Leipzig

Factsheet

- **monocrystalline solar cells**
efficiency: 20 % | performance
peak: $200 \text{ W}_p/\text{m}^2$ | yield
(Frankfurt, DE): $150 \text{ kWh}/\text{m}^2_{\text{PV}}$
p.a. on south-facade
- **active solar surface**
depending on design
($> 50 \%$ possible)
- **costs** rear-ventilated facade
from 450 €/m^2
- **amortisation PV** from 2 years
- **cleaning** once a year like
typical glass facade

Realisation Focus

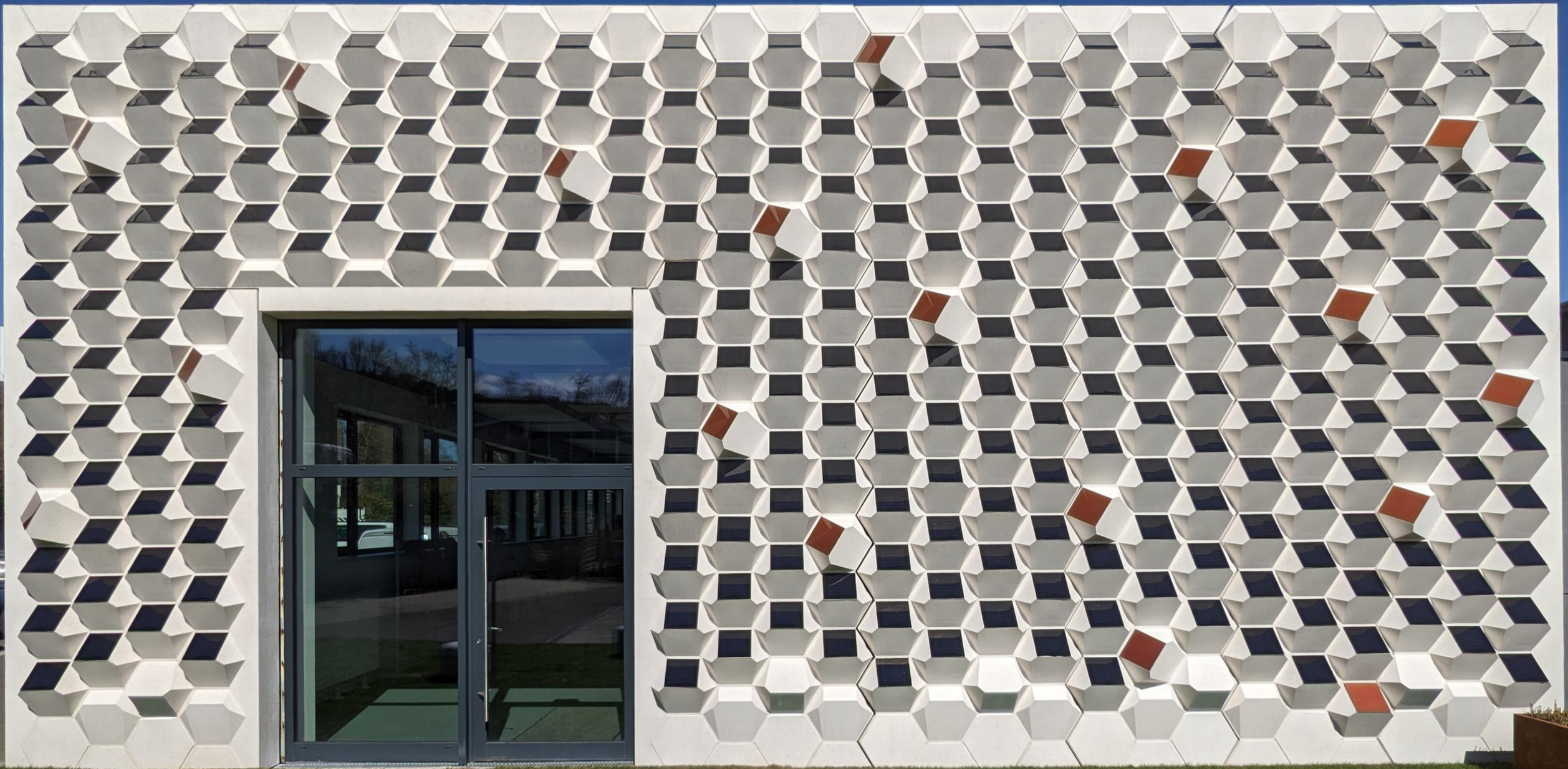
- **facade elements** of aluminium polymer-core composite panels with integrated glass/foil solar modules
- **standard subconstruction** made of aluminium
- **installation** of facade and PV in one hand
- **short construction time** due to prefabrication

PV-Modules

- **module type:** glas-backsheet without frame
- **quantity:** 201 pieces, black
- **dimensions:** 1.380/212/4,5 mm
- **power:** 36 Watt_{peak}
- **cell:** monocrystalline; 16 x 79,3/158,75 mm
- **front cover:** 3,2 mm low iron tempered glass, patterned
- **back cover:** backsheet, black
- **electrical connection:** 2 x 900 mm cable with MC4 connector; 1 x diode in junction box
- **special features:** black taped busbars and cross connectors
- **mounting:** mechanically fixed on long side with coloured anodised aluminium profiles
- **producer:** OPES Solutions GmbH

Concrete Variation #1

ai:L





Profile

Project:
SOLAR.con

Location:
57299 Burbach
Germany

Client:
Hering Bau GmbH & Co. KG

Architect Facade:
ai:L Architektur-Institut Leipzig

Factsheet

- **monocrystalline solar cells**
efficiency: 20 % | performance
peak: $200 \text{ W}_p/\text{m}^2$ | yield
(Frankfurt, DE): $150 \text{ kWh}/\text{m}^2_{\text{PV}}$
p.a. on south-facade
- **active solar surface**
depending on design
(up to 25 %)
- **costs** rear-ventilated facade
from 800 €/m^2
- **amortisation PV** from 2 years
- **cleaning** once a year like
typical glass facade

Integration Option

- **LED light sources** integrated into the concrete facade element
- **building appearance** at night
- **illumination** of surroundings
- **increase of safety**

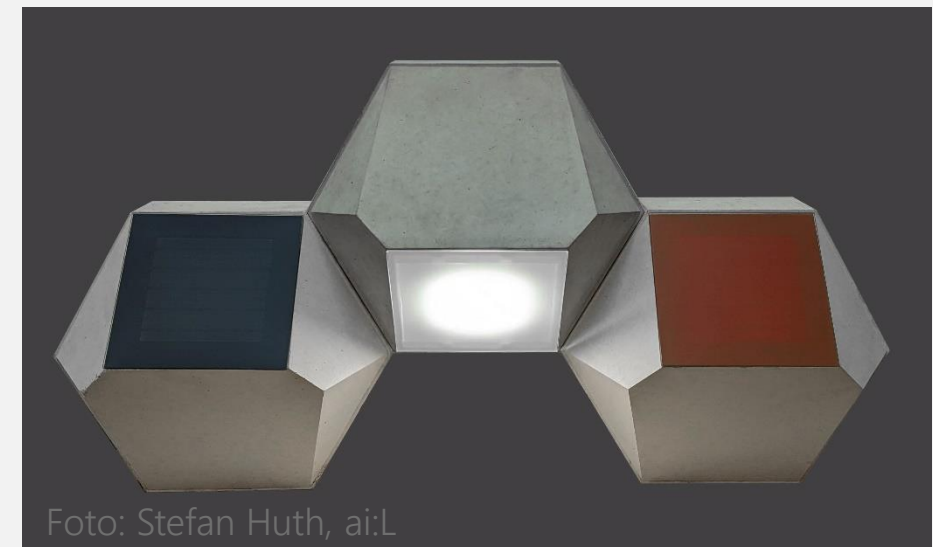


Foto: Stefan Huth, ai:L

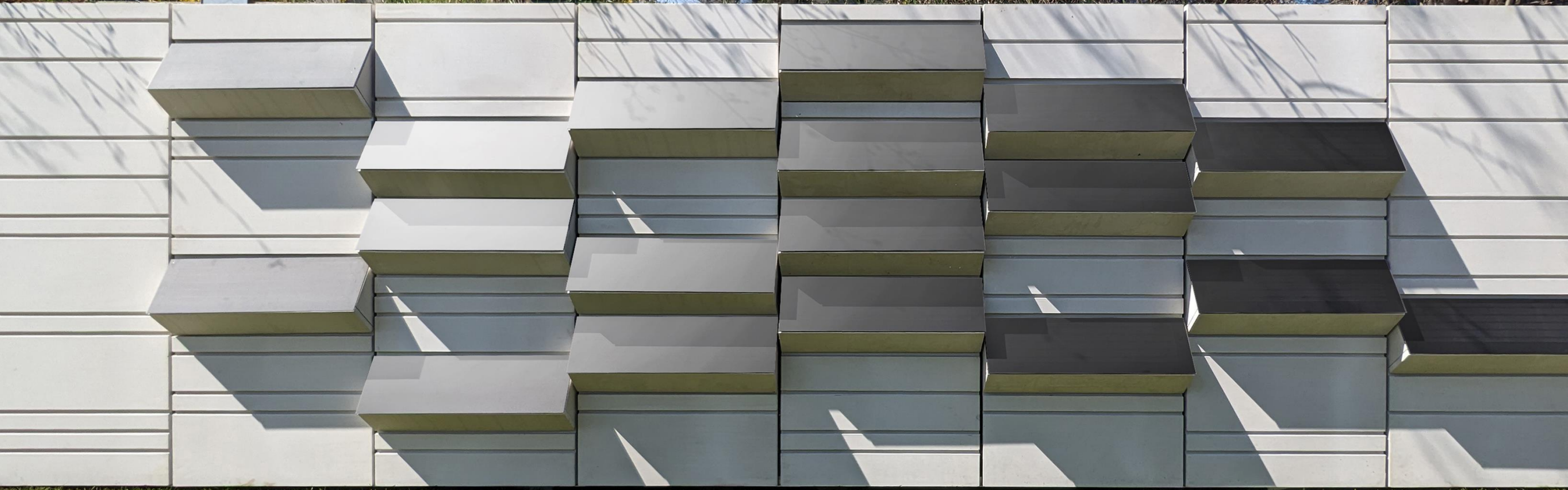
Realisation Focus

- **facade elements** of architectural concrete with integrated glass/glass solar modules
- **standard subconstruction** made of steel
- **installation** of facade and PV in one hand
- **short construction time** due to prefabrication

PV-Modules

- **module type:** glas-glas without frame
- **quantity:** 252 pieces, black; 17 pieces, red
- **dimension:** 239/239/10 mm
- **power:** 5 Watt_{peak}
- **cell:** monocrystalline; 2 x 79,3/158,75 mm
- **front cover:** 4,0 mm low iron partly tempered float glass; black/red ceramic print
- **back cover:** 4,0 mm partly tempered float glass; black ceramic print
- **electrical connection:** 2 x 200 mm cable with MC4 connector; 1 x diode in junction box; pre-installed cable bridges
- **special features:** stepped glazing
- **mounting:** mechanical with invisible plastic clips
- **producer:** SUNOVATION GmbH

Concrete Variation #2



Profile

Project:
SOLAR.con

Location:
57299 Burbach
Germany

Client:
Hering Bau GmbH & Co. KG

Architect Facade:
ai:L Architektur-Institut Leipzig

Factsheet

- **monocrystalline solar cells**
efficiency: 20 % | performance
peak: $200 \text{ W}_p/\text{m}^2$ | yield
(Frankfurt, DE): $150 \text{ kWh}/\text{m}^2_{\text{PV}}$
p.a. on south-facade
- **active solar surface**
depending on design
($> 50 \%$ possible)
- **costs** rear-ventilated facade
from 650 €/m^2
- **amortisation PV** from 2 years
- **cleaning** once a year like
typical glass facade

Realisation Focus

- **facade elements** of lightweight textile-reinforced concrete with integrated glass/glass solar modules
- **standard subconstruction** made of steel
- **installation** of facade and PV in one hand
- **short construction time** due to prefabrication



PV-Modules

- **module type:** glas-glas without frame
- **quantity:** 18 pieces, matt black
- **dimension:** 742/230/10 mm
- **power:** 20 Watt_{peak}
- **cell:** monocrystalline; 4 x 158,75/158,75 mm
- **front cover:** 4,0 mm etched low iron partly tempered float glass; black ceramic print
- **back cover:** 4,0 mm partly tempered float glass; black ceramic print
- **electrical connection:** 2 x 200 mm cable with MC4 connector; 1 x diode in junction box; pre-installed cable bridges
- **special features:** stepped glazing
- **mounting:** invisible suspension mounting
- **producer:** SUNOVATION GmbH



Our Network

- **experienced partners** from research, planning, production and assembly
- **new local partners** can be integrated
- **complete service** from initial consultation to commissioning

join us !



Adrian Heller

Stefan Huth

Frank Hülsmeyer

Contact

ai:L architektur innovation labor

Heller, Huth, Hülsmeyer Architekten PartGmbB

Karl-Liebnecht-Straße 88

D-04275 Leipzig

+49 341 9098 181

info@ail-studio.com

www.ail-studio.com

Managing Directors

Adrian Heller

Dipl.-Ing. (FH) Architect

Saxony Chamber of Architects No. 6403

Stefan Huth

M.A. Architect

Saxony Chamber of Architects No. 5487

Frank Hülsmeyer

Prof. Dipl.-Ing. Architect

Saxony Chamber of Architects No. 4406

Partnership Register, District Court

Leipzig No. PR 271

Business Register, Saxony Chamber of

Architects No. GesV 0341

Designing the Transition

ai:L

