

Advanced Building Skins

BIM for Design, Simulation and Optimization of BIPV Systems

Philippe Alamy

EnerBIM

and

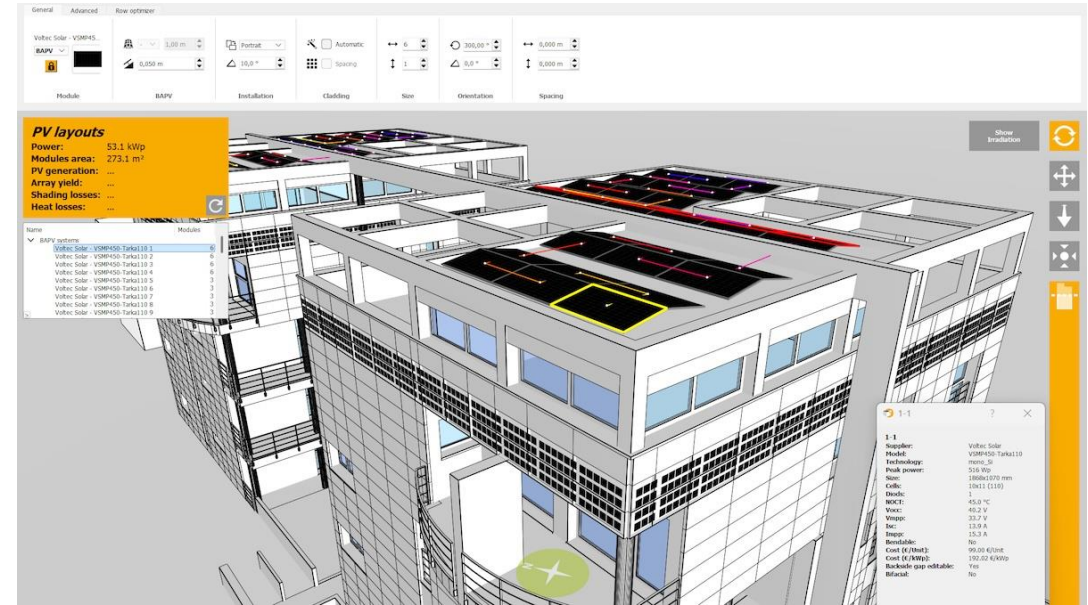
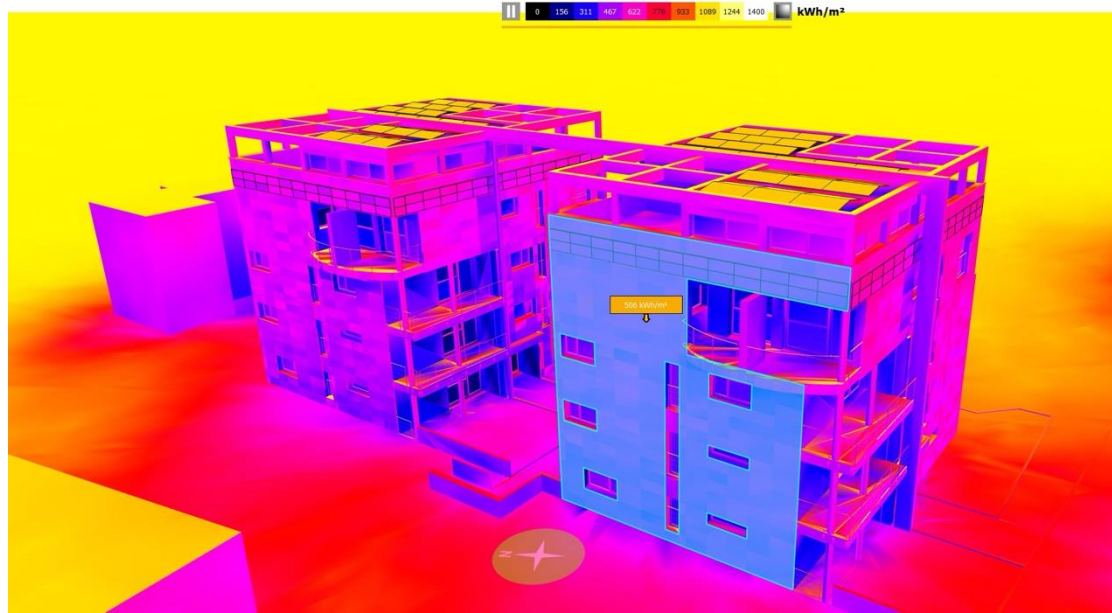
Astrid Schneider

TU Wien

ABS 2025 BERN - 04/11/2025

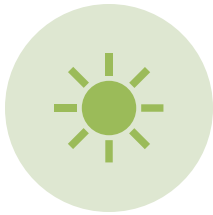
IEA PVPS T15 – Subtask C

Introduction and Background



- Philippe Alamy is founder of EnerBIM
- Development of BIMsolar as a BIM-based platform for BIPV-planning and simulation towards Digital Twin

Introduction and Background



Solar energy as a driver for decarbonized architecture



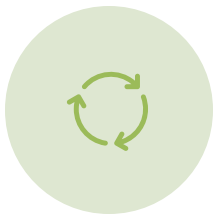
Multifunctionality and Envelope Performance in Solar Architecture



BIM as a key enabler for solar-integrated design



Emergence and importance of BIPV systems



Performance-based and collaborative workflows: BIM moves from iconic to current projects



European R&D projects addressing BIM+BIPV: PVSITES, BIPVBOOST, BIM4BIPV, MASS-IPV

Our Research Scope and Objectives

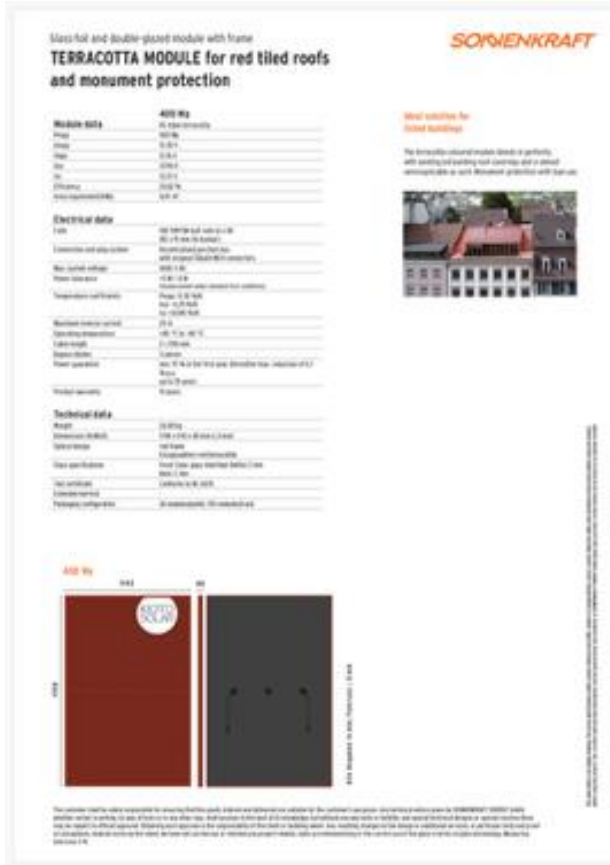
International Collaboration on digitalization of BIPV within the IEA PVPS Task 15 group of experts:

- **Definition of an BIPV information model for open BIM-exchange via IFC**
- **Analyze the role of BIM in BIPV design and optimization**
- **Assess multifunctional potentials of BIPV systems**
- **Evaluate the impact on building envelope performance**
- **Review representative case studies**



IEA PVPS Task 15 group of experts

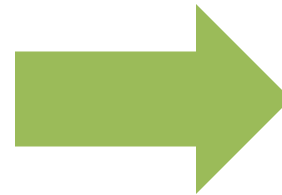
PV-Module Product Data



.pdf



.ifc



Model , type	
Number of bypass diodes	7.0000
Number of cells	70.0000
With frame	False
Performance	
Module efficiency factor (STC)	17.0000
MPP power by STC	359.0000
Temperature coefficient I _{sc}	0.0600
Temperature coefficient P _{mpp}	-0.3600
Temperature coefficient U _{oc}	-0.3600

Source: ETIM – Photovoltaics Module in bSDD

Source: Sonnenkraft GmbH

Goal: Product information useful for PV-simulation

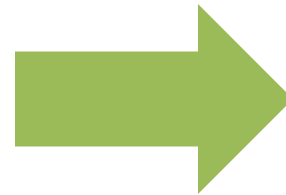
Reference 1: Astrid Schneider et. Alii, TU Wien

PV-Module Product Data



.pdf

PDF



**open
BIM-Data**



.ifc

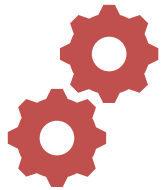
**„dead data“:
informative**

**„living data“:
workable**

Goal: Product information useful for PV-simulation and multidisciplinary evaluation

Reference 1: Astrid Schneider et. Alii, TU Wien

BIM for Solar Design



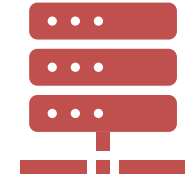
**From 3D modelling
to energy-aware
design processes**



**Integration of
geometry, materials
and performance
data**



**Early-stage
optimization via
parametric BIM**



**Data exchange:
IFC, proprietary
(rvt, pln), XML
based (gbXML),
JSON**

New Workflow for BIPV-modules in BIM-software

PV material -Producer

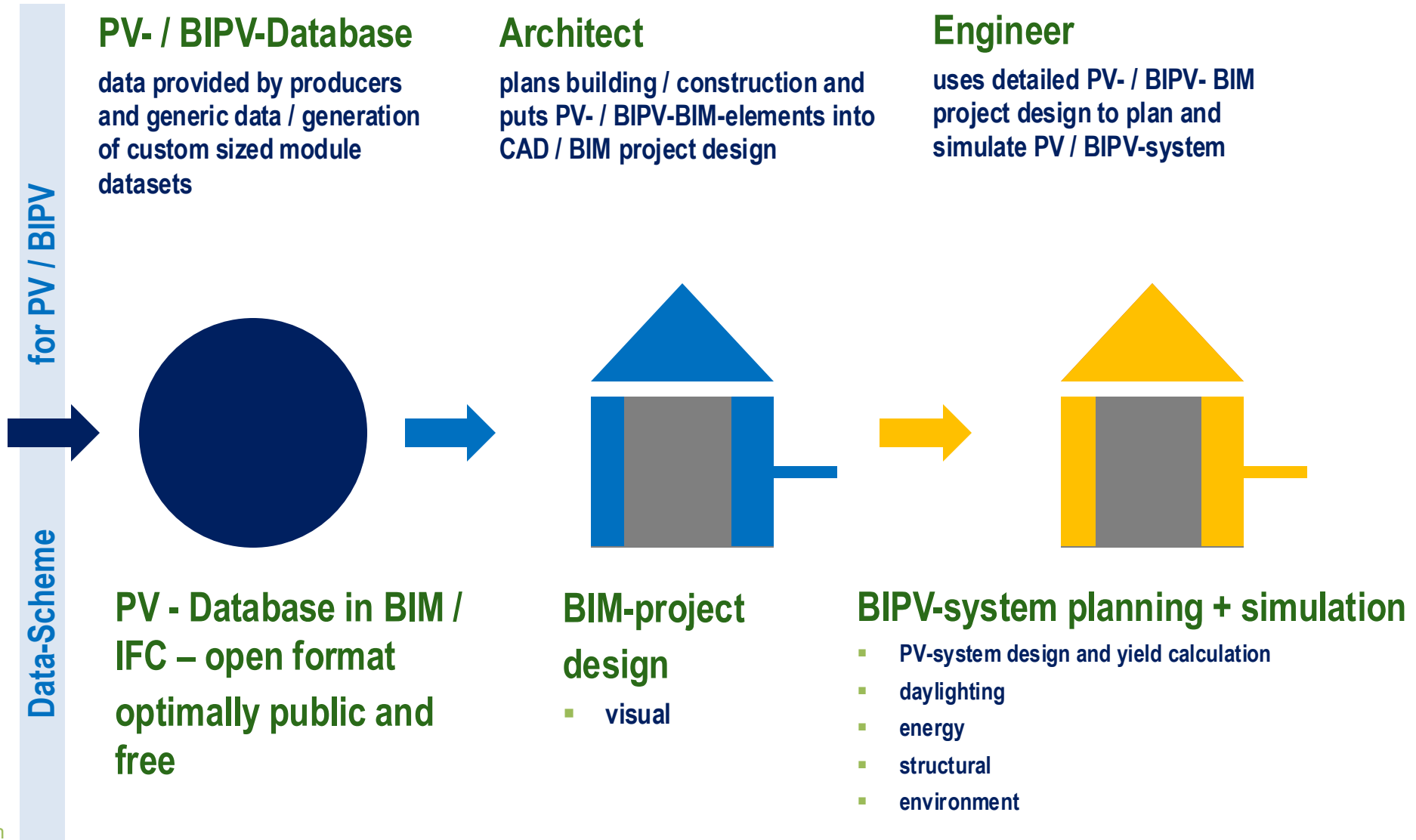
is responsible to provide use case specific relevant product data



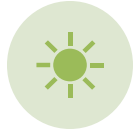
Sonnenkraft

PV-BIPV-Product

Reference 1: Astrid Schneider et. Alii, TU Wien



BIM-Based Simulation for BIPV



Solar radiation and energy performance simulations



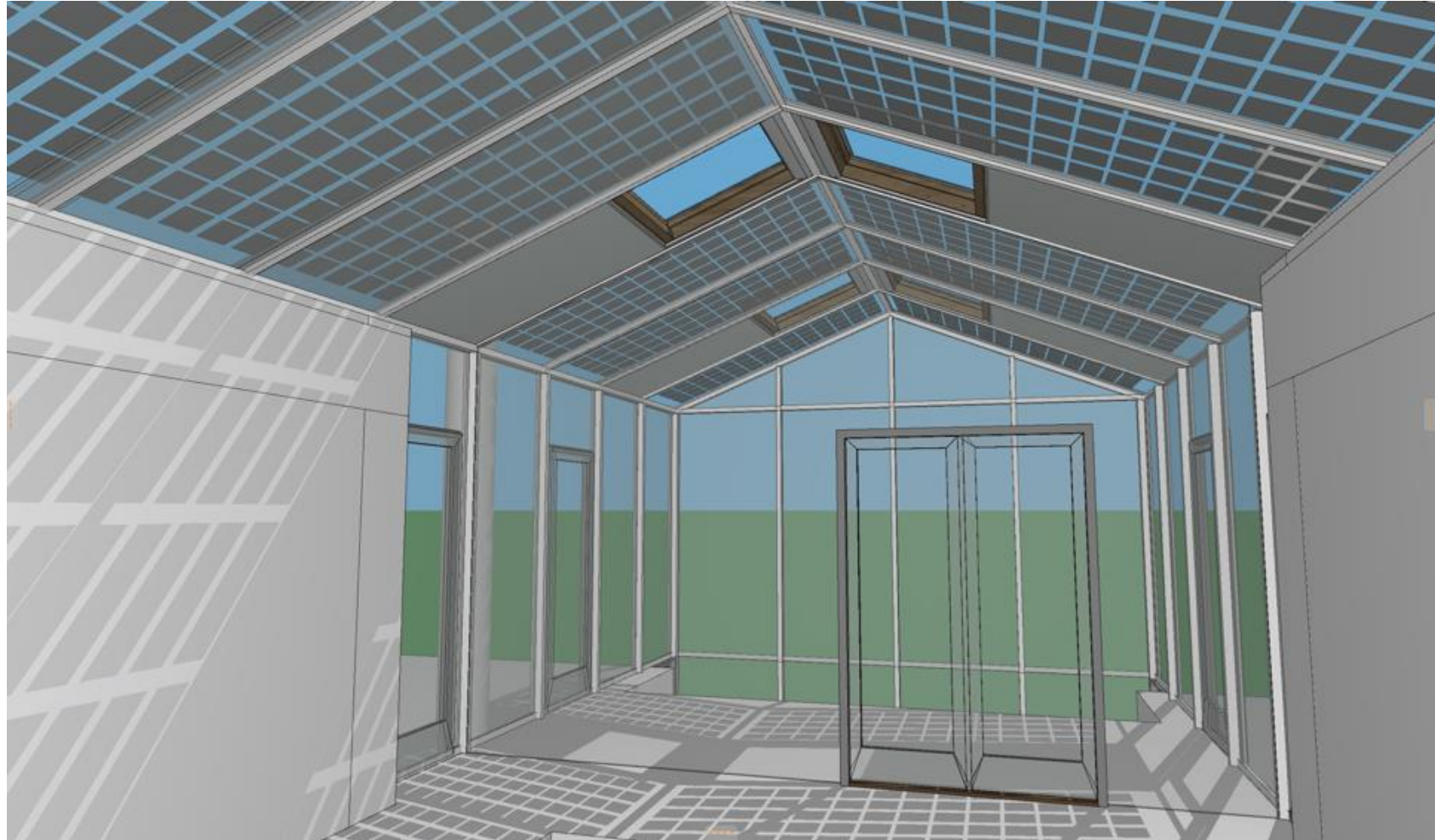
Daylight and PV yield co-simulation



Integration of simulation tools in BIM environments



Interoperability issues and data consistency challenges



Reference 1: Astrid Schneider et. Alii, TU Wien

Architecture: Design Impact of BIPV – light – shade - structure

BIM-Based Simulation for BIPV



Solar radiation and energy performance simulations



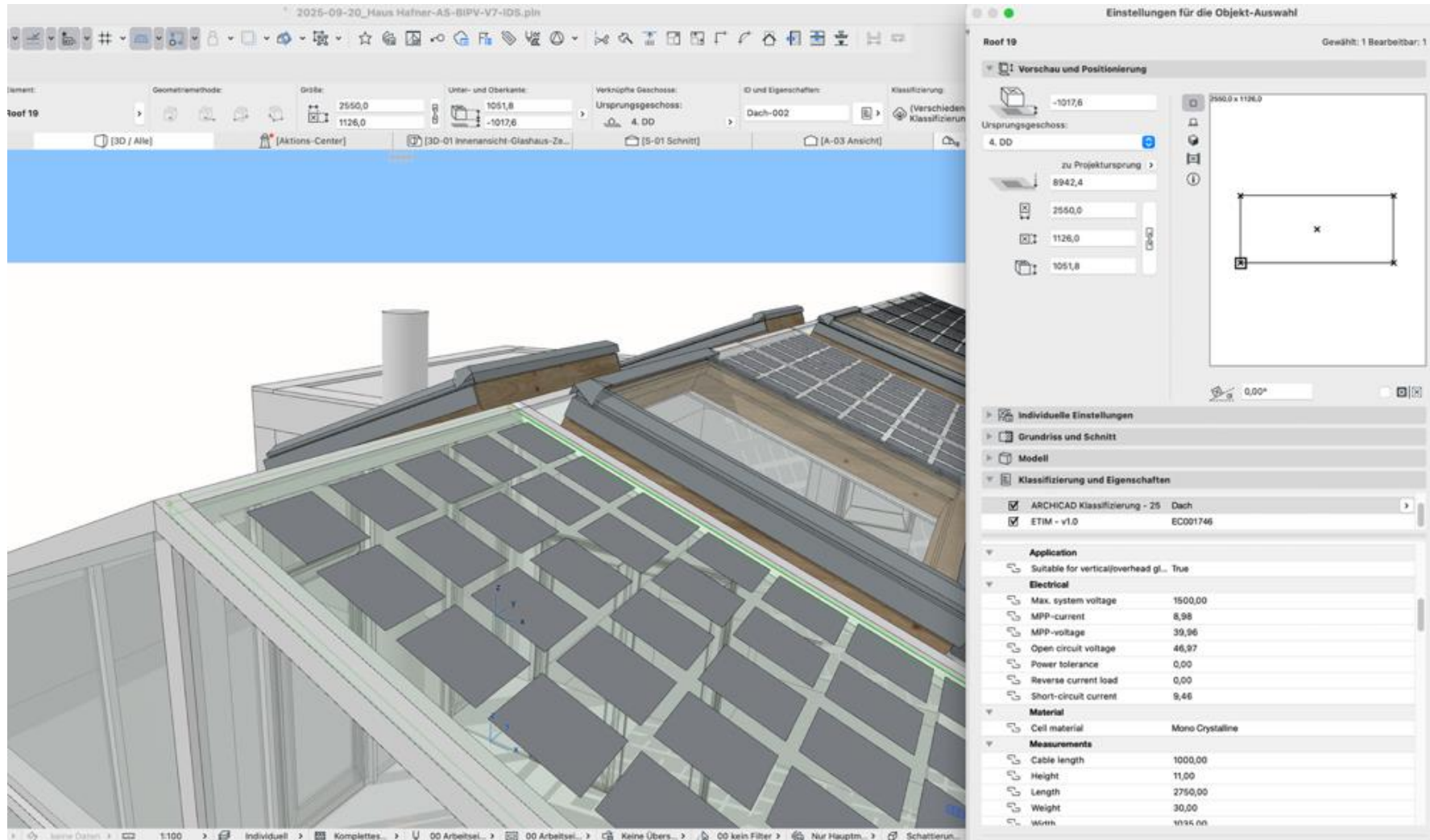
Daylight and PV yield co-simulation



Integration of simulation tools in BIM environments



Interoperability issues and data consistency challenges



Reference 1: Astrid Schneider et. Alti, TU Wien

BIM-Design: values of BIPV in the architect's BIM-software

BIM-Based Simulation for BIPV



Solar radiation and energy performance simulations



Daylight and PV yield co-simulation



Integration of simulation tools in BIM environments



Interoperability issues and data consistency challenges

The screenshot displays the usBIM.browser v.3.6.27 interface. The central view shows a 3D model of a building with BIPV panels installed on the roof. The left sidebar shows a project tree for '2025-09-20_Haus Hafner-AS-BIPV-V7-IDS'. The right sidebar shows the properties of the selected 'IfcRoof' element, including application, electrical, material, measurements, and performance data.

Eigenschaften	
Application	
Suitable for vertical/overhead glazing	True
Electrical	
Max. system voltage	1500.0000
MPP-current	8.9800
MPP-voltage	20.4800
Open circuit voltage	24.1600
Power tolerance	0.0000
Short-circuit current	9.4600
Material	
Cell material	mono crystalline
Measurements	
Cable length	1000.0000
Height	11.0000
Length	2450.0000
Weight	20.0000
Width	625.0000
Model, type	
Number of bypass diodes	3.0000
Number of cells	36.0000
With frame	True
Performance	
Module efficiency factor (STC)	21.0000
MPP power by STC	184.0000
Temperature coefficient Isc	0.0600
Temperature coefficient Pmppt	-0.3600
Temperature coefficient Uoc	-0.3600
Pset_RoofCommon	
[EXISTING]	[NEWEXISTING,DEM]

Reference 1: Astrid Schneider et. Alii, TU Wien

BIM-Viewer: values of BIPV visible in the IFC-Model export

BIM-Based Simulation with BIPV



Solar radiation and energy performance simulations



Daylight and PV yield co-simulation



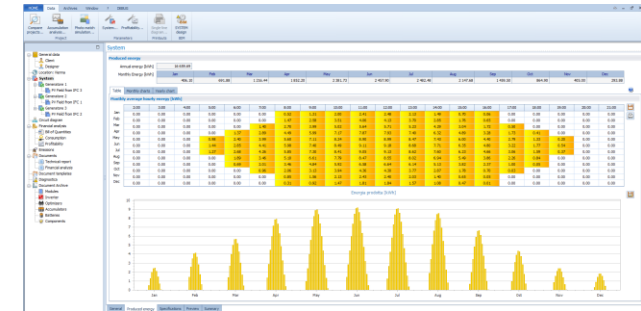
Integration of simulation tools in BIM environments



Interoperability issues and data consistency challenges

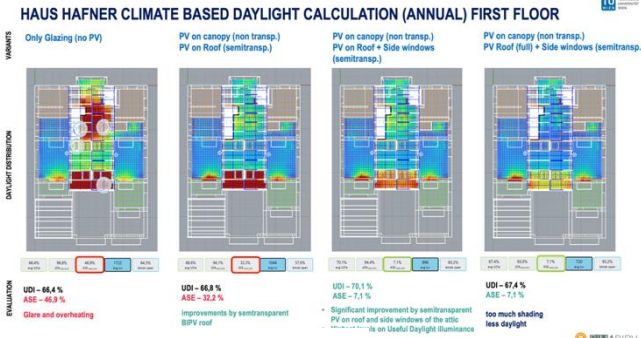


PV-simulation



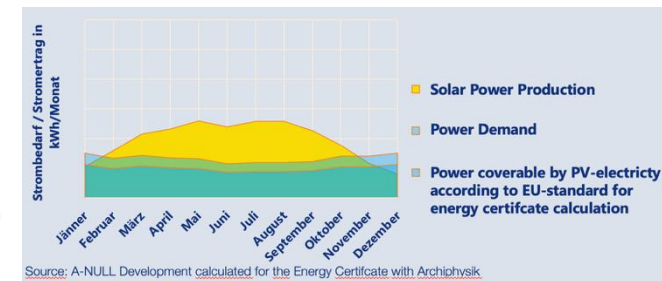
PV-Simulation by ACCA with Solarius PV

Daylight-simulation



Daylight simulation by Bartenbach

Energy Certificate

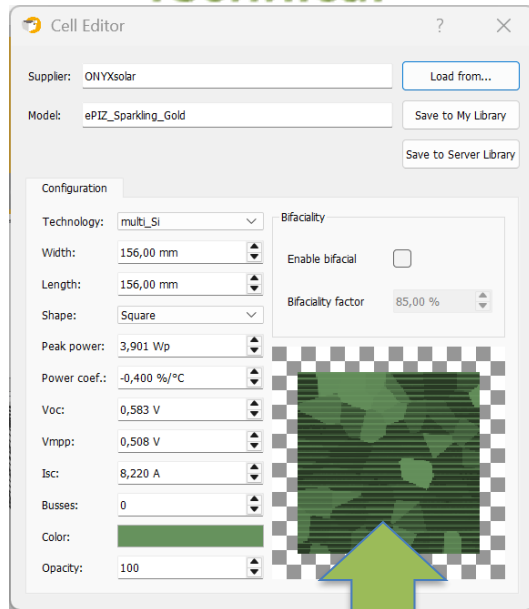


IFC-Model with BIPV-values allows multidisciplinary simulation

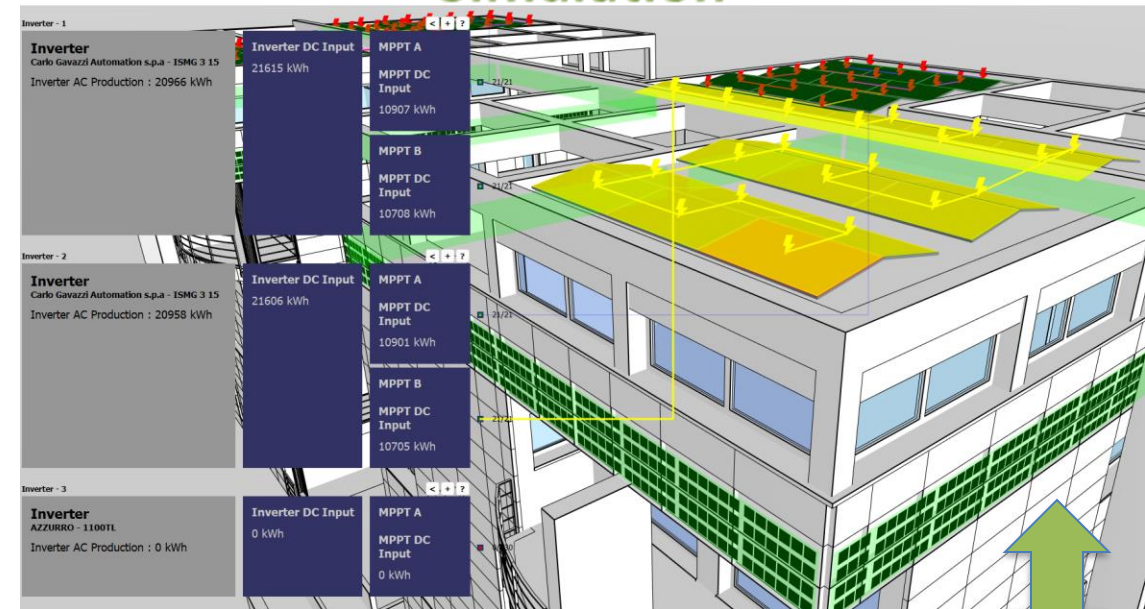
Reference 1: Astrid Schneider et. Alii, TU Wien

BIM-Based Simulation with BIMsolar® R&D

Technical



Simulation



Solar radiation and energy performance simulations



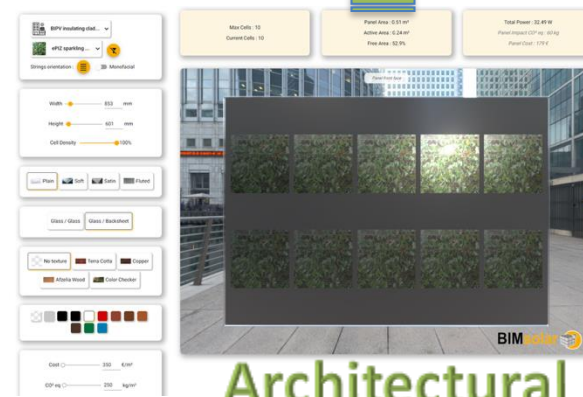
Daylight and PV yield co-simulation



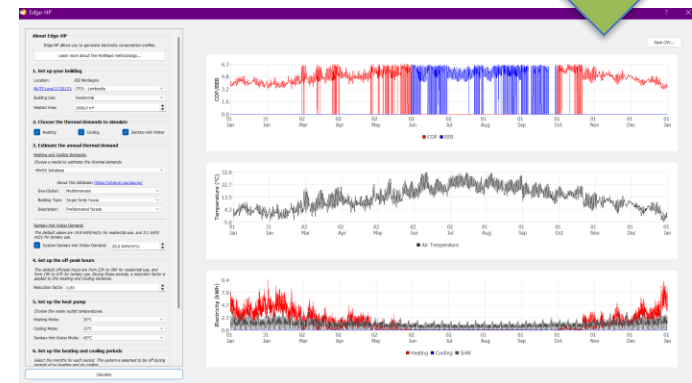
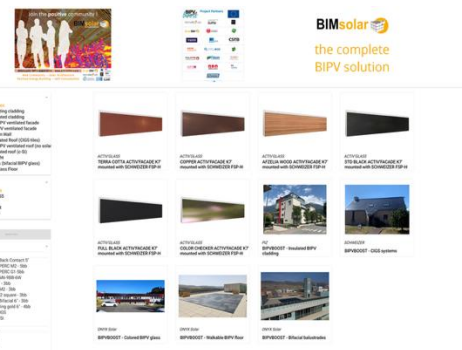
Integration of simulation tools in BIM environments



Interoperability issues and data consistency challenges

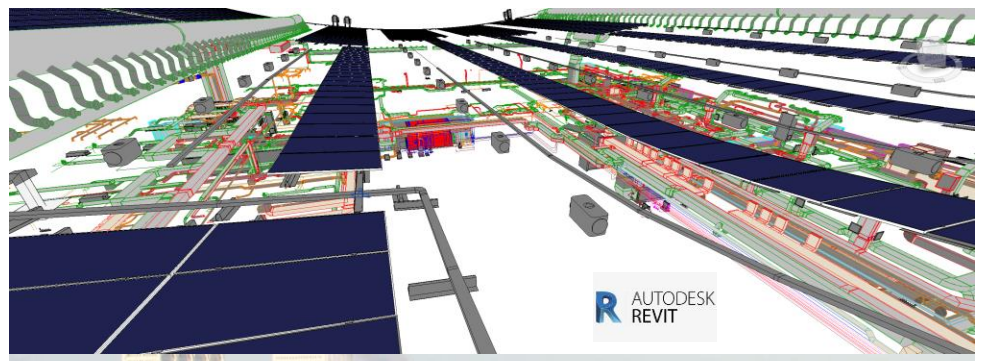
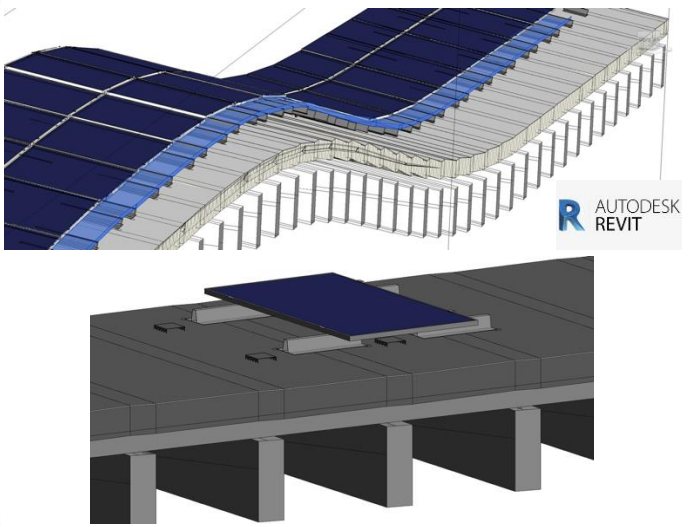
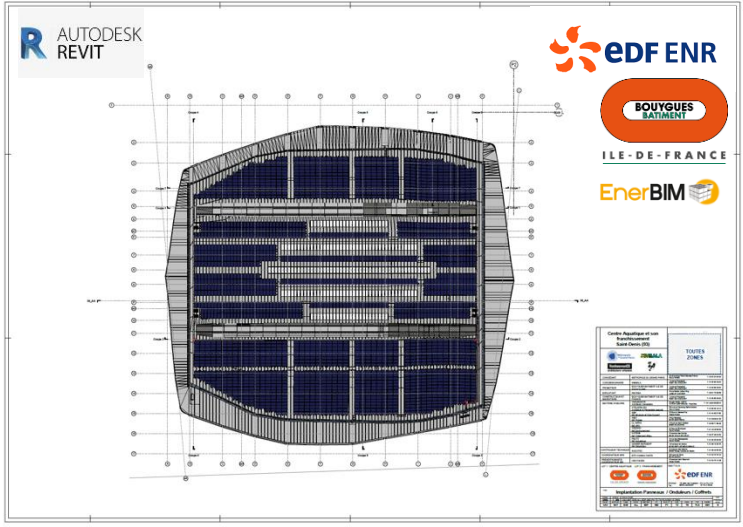


Architectural

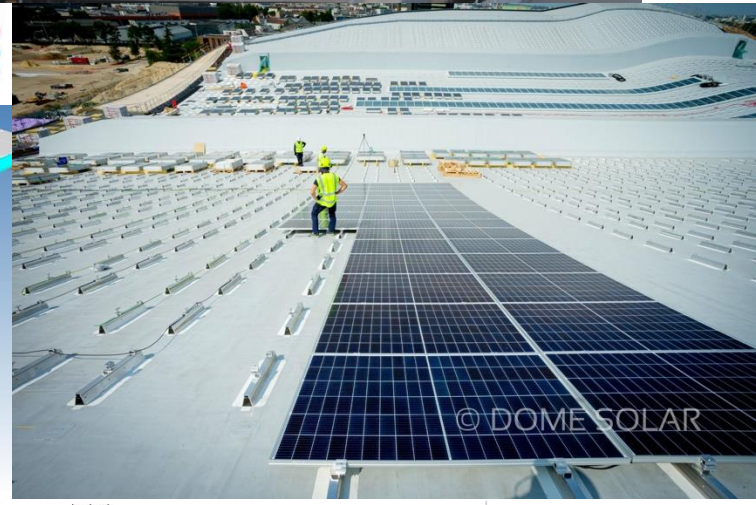
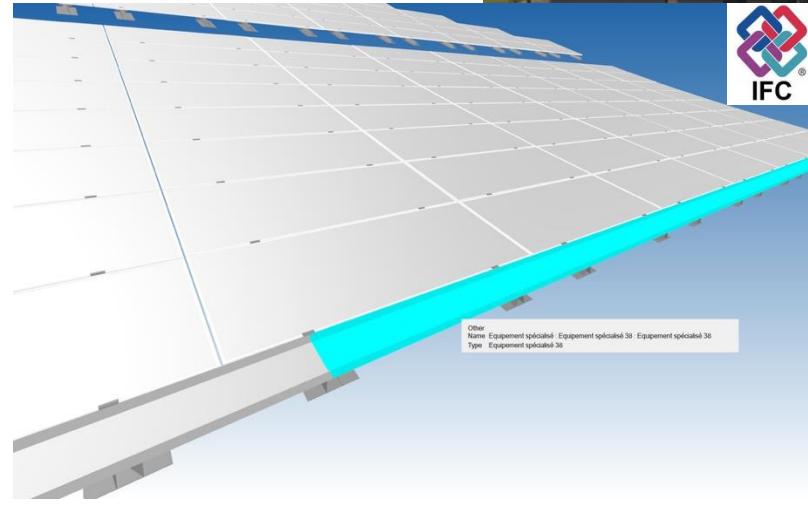
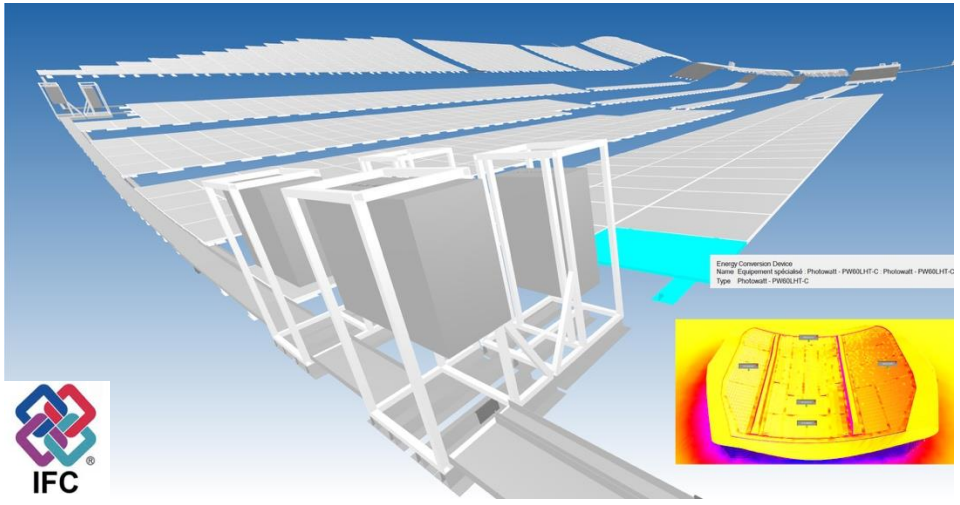


BIM model with BIMsolar databases feed integrated simulation processes

BIPV commercial Projects: BIM-Based modeling

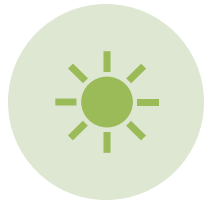


BIMsolar simulation bridges the gap between architecture and construction



Next Development Steps

Next steps in the development of BIMsolar[®]:



Multiple weather data sources. Digital Twin perspective



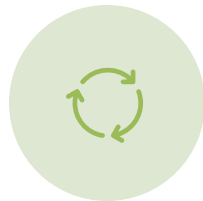
Enhancement of optical modeling for vertical systems



BIMsolar Data Dictionary: eCatalogs of BIPV solar glazing



BIM innovations to boost Digital Twin platforms



Full open CIM-BIM IFC interoperability. REVIT add-ins



European R&D projects addressing BIPV Digital Twin strategies

Our Vision: Digital BIPV-Twin

Our BIMsolar vision for tomorrow: going beyond BIM and simulation!

- Development of a Digital Twin strategy
- “Live” facility management
- Solar PV yield forecast based on accurate weather data and calibrated simulation model
- Full IFC-model integration
- Modern synthetic supervision technos



Grant Agreement :

“Mixed Reality for BIPV: a New Way to Experience BIPV in BIPVBOOST project”



Funded by the Horizon 2020 Framework Programme of the European Union

Visualization of a BIPV scenario overlaid on the real demo building thanks to MR app and HoloLens

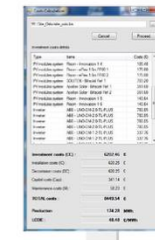
Participation in WP4: task 4.4



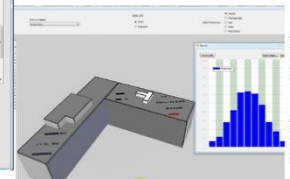
AEC DIGITAL THREAD to connected DIGITAL TWIN



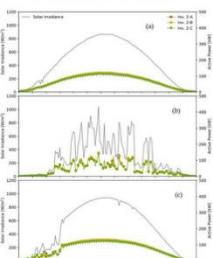
Representation of a product or system (PV integrated system) mimicking its behavior...
...enabled by an «interoperable» Digital Thread



Product & project Twin



Performance Twin



MASS-IPV has received funding from the European Union's Horizon Europe programme under grant agreement 101135299. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency (ECIEA). Neither the European Union nor the granting authority can be held responsible for them.

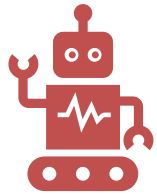


Kanton Bern
Canton de Berne



ADVANCED
BUILDING SKINS

Future Perspectives



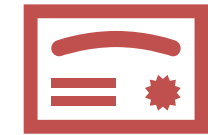
Integration of AI and
real-time digital twins



Semantic BIPV BIM
objects and open data



Urban-scale BIPV
modelling and planning



Standardization and
certification of workflows

Synthesis and Recommendations



BIM enables systemic and holistic solar design



Multifunctionality enhances architectural quality



Need for interop, validation and professional training



Roadmap for future BIPV–BIM integration

Any questions?

Thank you very much for your attention

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IEA PVPS T15 – Subtask C2

Sources and useful links

References:

- 1) Astrid Schneider, Karin Stieldorf, Christian Schranz et. alii: **“PV-Planning and Simulation, Daylight Simulation and Energy-Certificate Calculation based on an Open-BIM-Building-Model”**, Presentation and Paper 4BO.17 @EUPVSEC 2025 in Bilbao, WIP Munich
- 2) Philippe Alamy: **“BIM supports and secures BIPV Design & Engineering”**, Presentation 4BO17-6 @EUPVSEC 2024 in Vienna, WIP Munich

Sources and useful links

Useful links:

IEA PVPS Task 15 – Enabling Framework for BIPV: <https://iea-pvps.org/research-tasks/enabling-framework-for-the-development-of-bipv/>

EnerBIM: <https://enerbim.com/en/solutions-4/>

BIMsolar: <https://www.bim-solar.com/>

BIM4BIPV-research project: <https://bim4bipv.project.tuwien.ac.at/en/>

Astrid Schneider: <https://www.astrid-schneider.de/>

PVSITES: <https://www.pvsites.eu/>

BIPVBOOST: <https://bipvboost.eu/>

MASS-IPV: <https://massipv.eu/>