Scuola universitaria professionale della Svizzera italiana
Dipartimento ambiente costruzioni e design
Istituto sostenibilità applicata all'ambiente costruito

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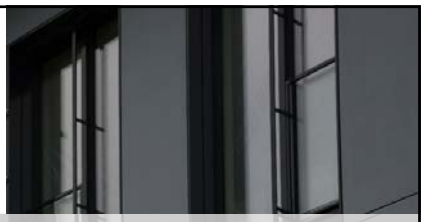

Transforming a conventional cladding in an energy-producing façade

The BIPV facade of Centro Polis in Lugano

Dr. Pierluigi Bonomo

Head of Innovative Envelope Team
Swiss BIPV competence centre
SUPSI-ISAAC

30 marzo 2022

In partnership with:

SOLARCHITECTURE sun as a building material

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(https://solarchitecture.ch/polis/)

Centro Polis in Lugano: the active surfaces

Year of construction: 2017 – 2021

PV façade (rainscreen façade)
- PV power: 173 kWp - **1'675 m2**

PV roof (BAPV on flat roof)
- PV power: 112 kWp - **603 m2**

(more details on **https://solarchitecture.ch/polis/)**

30/03/2022

Decision making

"Regarding the PV façade, it was simply an adaptation of a fiber-cement ventilated façade, which we then converted during the design phase together with the city of Lugano, aiming to maintain the same style and the same architectural concept".
Architect Rosario Galgano -Studio Mario Campi SA

"The Polis building was a challenge on several counts. We started with a project that was already well advanced and designed using a traditional non-active cladding. Replacing the traditional cladding with our BIPV modules required a major effort to find the best possible solution in terms of aesthetics and efficiency"
Gazmend Luzi -Manager at Sunage SA

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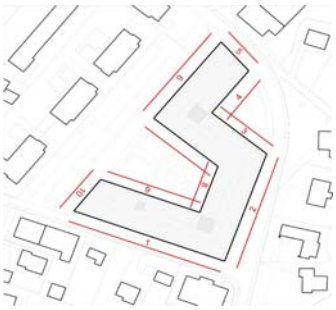
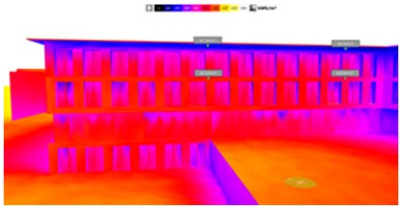
See complete interview on www.solarchitecture.ch

Solar potential

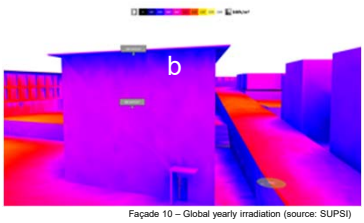
Yield from 215 to 835 kWh/kWp

Max difference between the most and less irradiated points: Δyearly (kWh/m2):
65% (Façade 7)
50% (Façade 10)

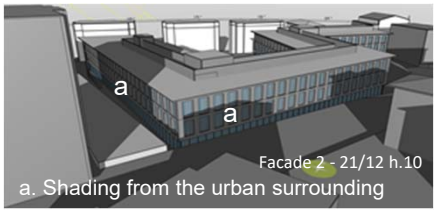




Façade 7 – Global Spring irradiation (source: SUPSI)

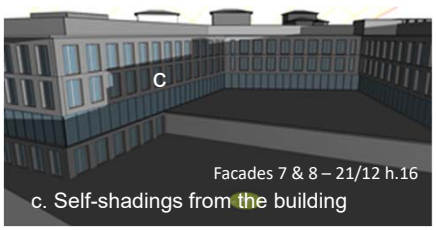


Façade 10 – Global yearly irradiation (source: SUPSI)



a. Shading from the urban surrounding

b. Shading from the roof overhang



c. Self-shadings from the building

Building skin: cladding (module) electrical concept

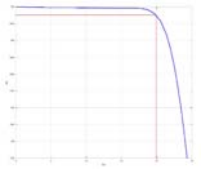
- Sunage Suncol glass-glass modules (custom-made)

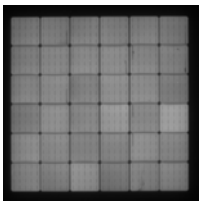
Aesthetic customization:

- Effect of glass colour (compared to a transparent front glass): reduction of 25-30% power output in STC

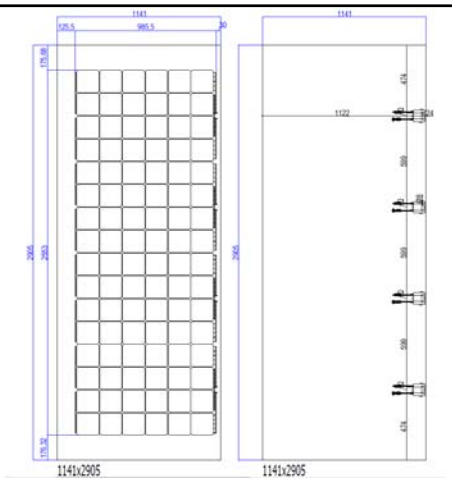
Module electrical features:

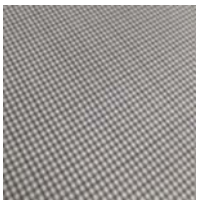
- C-Si mono
- 4 horizontal sub-modules 48cells (4 JB)
- 4 diodes
- Specific power: 110/130 Wp/m²





(Source: SUPSI)





(Source: Sunage-Alsolis)

Building skin: cladding (system) electrical concept

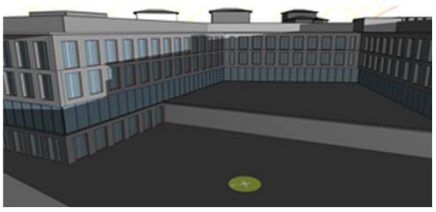
String-level electrical layout :

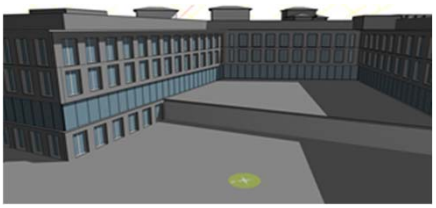
- Power optimizer for different modules area.

  E.g. Groups of modules (horizontal bands) are connected to the same power optimizer

- Strings of modules with their power optimizers are connected to inverters

(Source: SUPSI)





(Electrical layout concept –Facade 7- Source: Alsolis)

The research project: Verso-EST

Main goals:

- Monitoring of facade energy performance in operation
- Simulation of PV-energy and performance-gap
- Techno-econimic analysis of costs and revenues
- Citizens sensitization and communication

Impact:

- Development of an operative model, to promote the implementation of BIPV technologies on the façade

Co-financed by:

Fondo Energie Rinnovabili

In partnership and with the support of:

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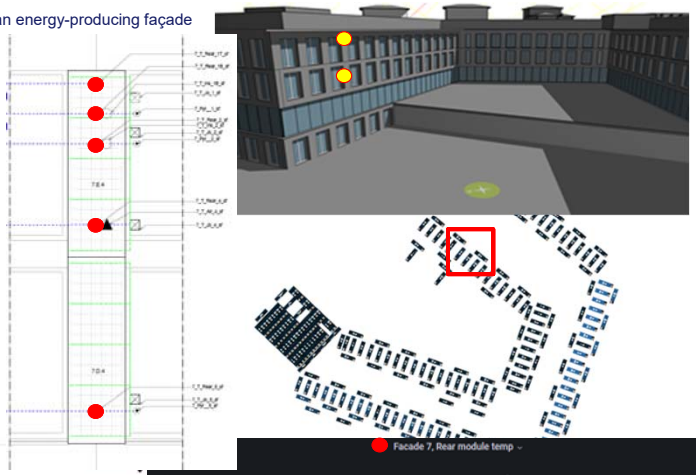
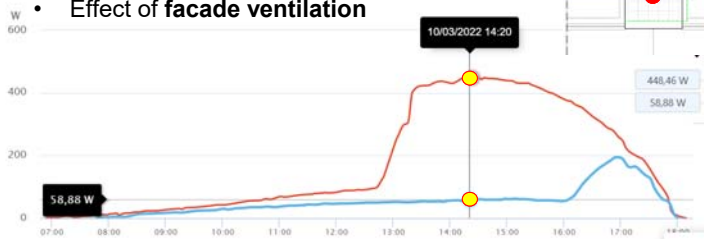
Monitoring of global

- Monitor the **global PV production** (roof/facade) and **energy demand**
- Comparison between **simulated and real data** (power data)
- Effects of **repeated shadows** on short- and long-term performance
- Effect of **facade ventilation**





(Facade 7 – power production profiles- Source: SUPSI)

(Facade 7 – back of glass temperature profiles- Source: SUPSI)

Cost competitiveness

Single/aggregated facades analysis
(Facades 1&7 South)
- Co: +46 CHF/m2 (PBT: 13 years)*

Global analysis:
- Co: -78 CHF/m2 (PBT >30years)*

*analysis are based on energy simulated data
- Co=NPV/A = €/m2
- Simulated energy data, 30 years, 100% SC

Analysis will be validated with real data

(Source: SUPSI –Bequerel)

242 CHF/m²

Extra cost
in comparison to a rainscreen facade with a fibercement composite panel (alternative of the original project) –VAT excluded.

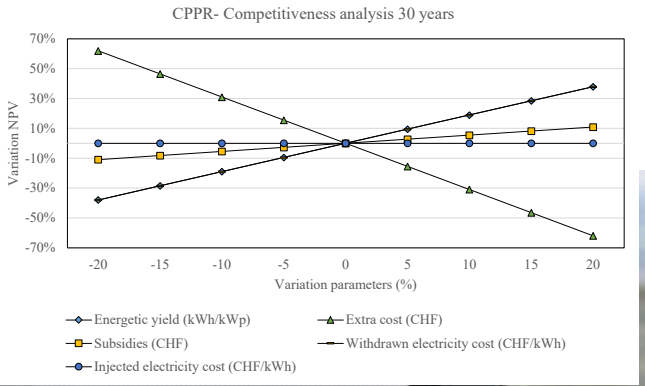
(Source: SUPSI **For more details see: BIPV Status Report 2020**)

Costs

Sensitivity analysis
- The parameters influencing the Net Present Value (NPV) are, in order:
  - Extra cost of investment (CHF)
  - Energy yield (kWh/kWp)
  - Withdrawn energy (kWh)

Small variations – High competitiveness
- -20% extra cost → +60% NPV
- +20% yield → +40% NPV

(e.g. 500 > 600 kWh/kWp)



(Source: SUPSI)

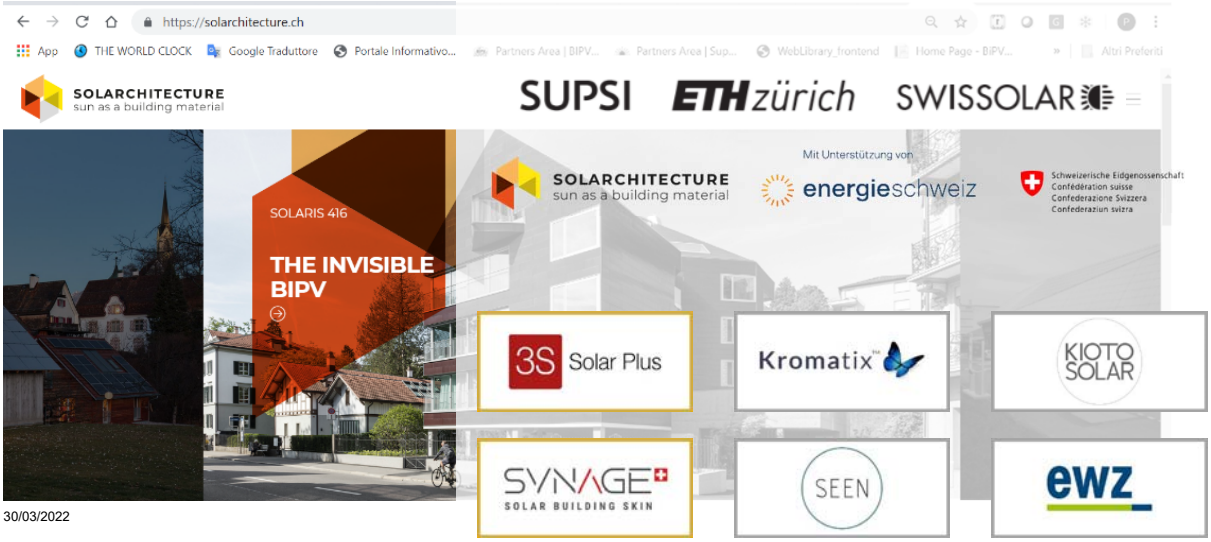
Lessons learned

"I want a solar building"

- Decision making, makes the difference
- Multifunctionality is the starting point…

…**interdisciplinarity** is all the rest:
- Architecture & PV energy concept
- Construction and PV technologies
- Building and electric engineering
- Energy and economy optimization
- Construction and PV processes

More details ? On the platform of «sun as a building material»: www.solarchitecture.ch



Thanks for your attention!

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