Photovoltaics in urban area: energy for smart cities

Background: Long history and experience in PV

SUPSI PVlab: only ISO 17025 accredited test laboratory in Switzerland

Challenges to overcome barriers for the use of PV in buildings and urban areas

- To Create new building components for a truly integration of PV in the building (projects with start-up companies)
  - New regulatory request, standards and testing procedures
- To explore new technologies for PV modules for aesthetic effects
- To develop new tools and to introduce technological features
- To convince the architects and investors of the aesthetic
  - Tools and best practice and dissemination
- Bring BiPV to the urban scale

Demonstration of BIPV module for the opaque part of the envelop in a European Project

Outdoor testing for new BiPV elements

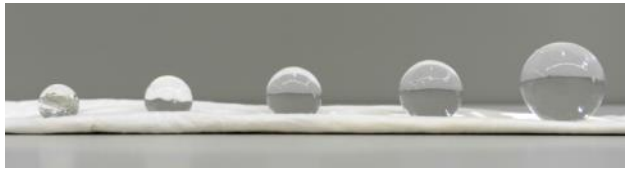
- Energy yield measurements a STC
- Rooftop integrated elements with rain testing

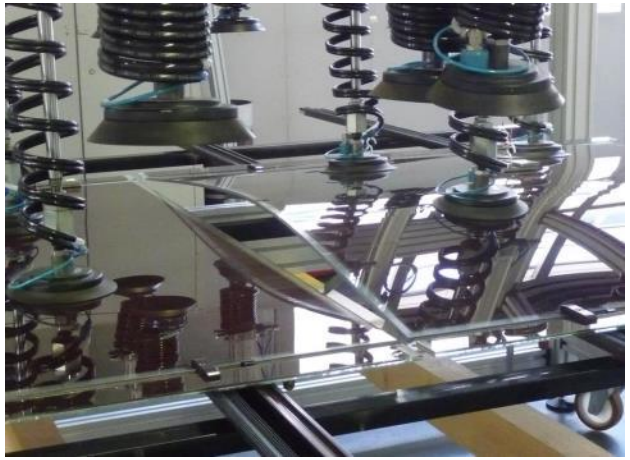
- PV-Modules with integrated building insulation

- Test stand for BiPV façades

Mechanical tests on new products

- Mechanical load test under STC
- and beyond
- Testing of complete mounting structures (roof and façade) to detect problems with fixing and limits of the structure
- Hail test up to 60mm





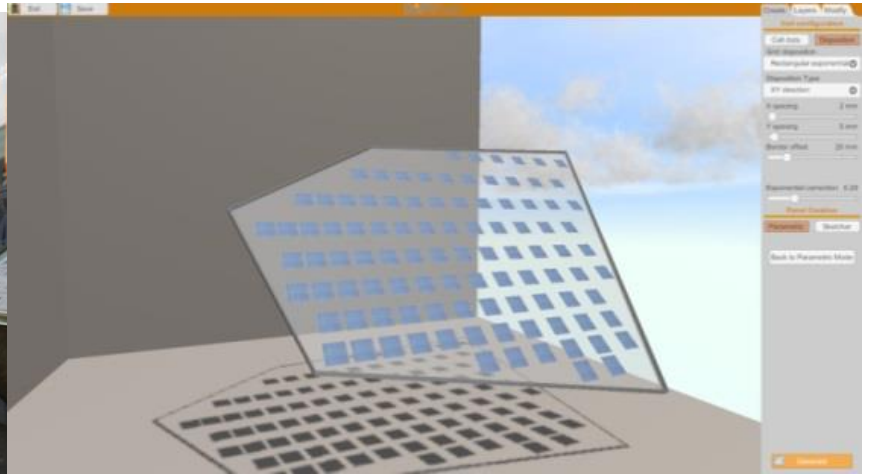
European Project – Construct PV

Development and demonstration of standardized building components

- *Collaborative project*
(large consortium, different stakeholders)

- *Demonstration project (TRL 7)*

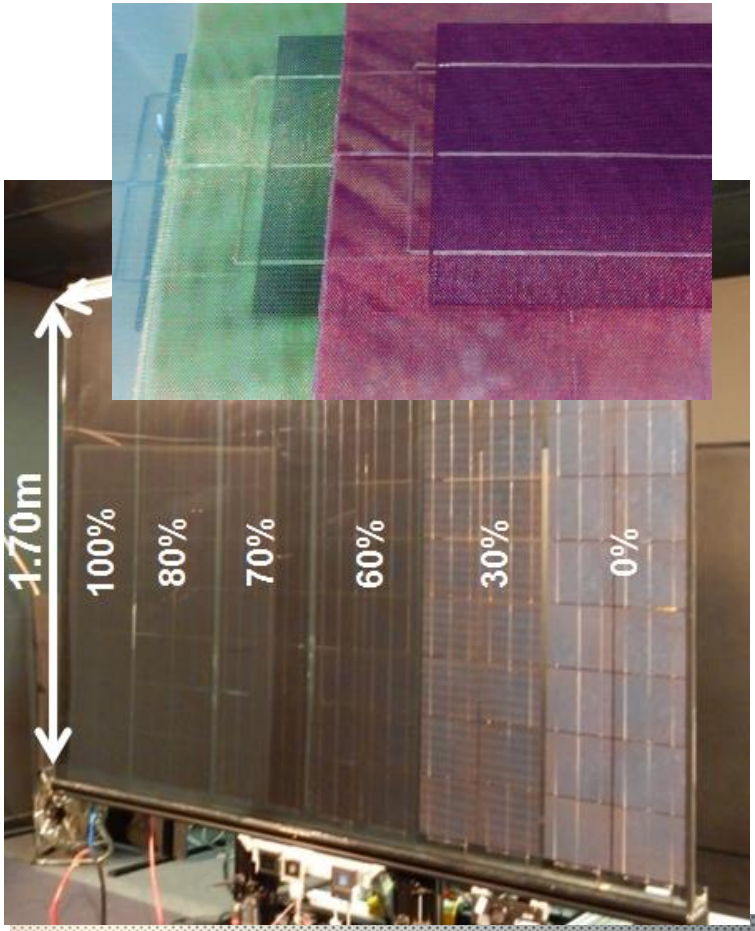
Duration: 2011 (Proposal + Kick-off)
February 2013 – February 2017
Estimated project budget: 12Mio. €.

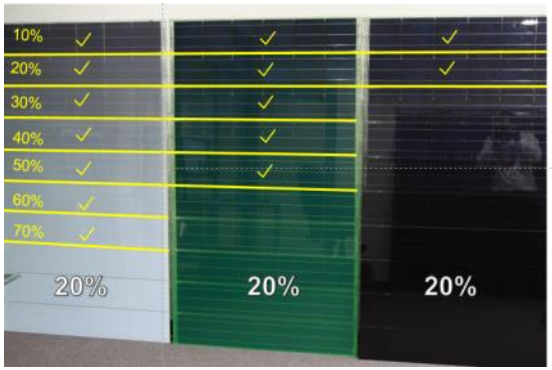


Integration in the rooftop and façade

European project SmartFlex

- SMART-FLeX provides custom made solution for façade integration (digital printed flexible components)
- Investigations (outdoor/indoor):
  - Aesthetics vs energy
  - Color and Printing degree
  - Color mismatching



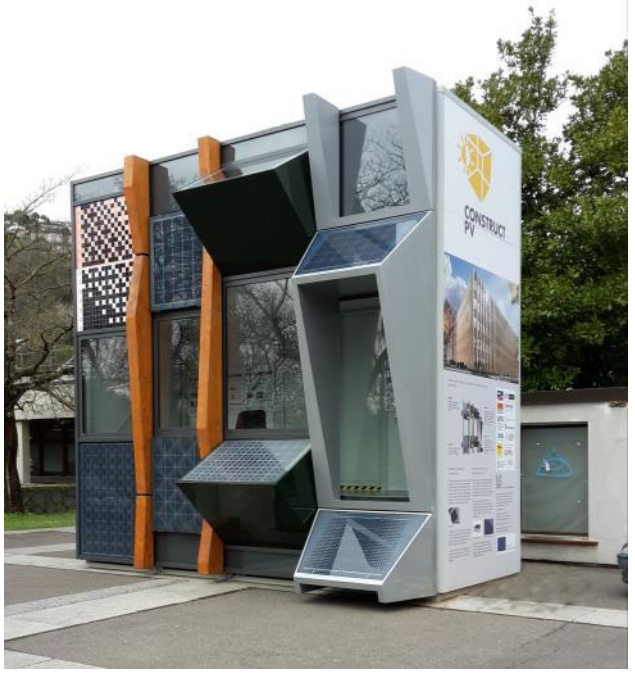


SmartFlex: SMART Façade (PV plus aesthetics)

SmartFlex
Solarfacades


GLASSBEL
GLASSBEL

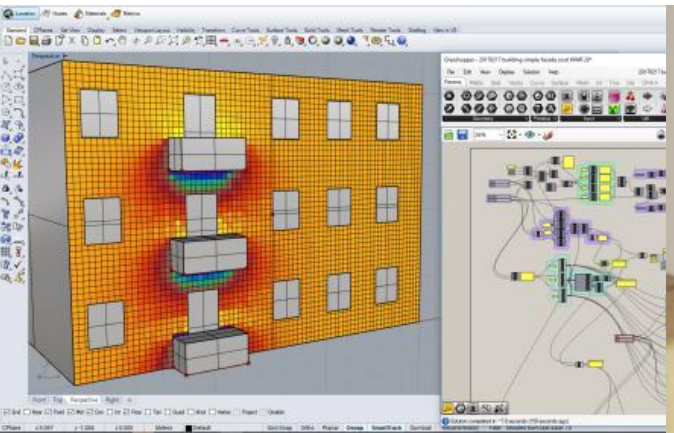
Mock-up with different solutions for the façade

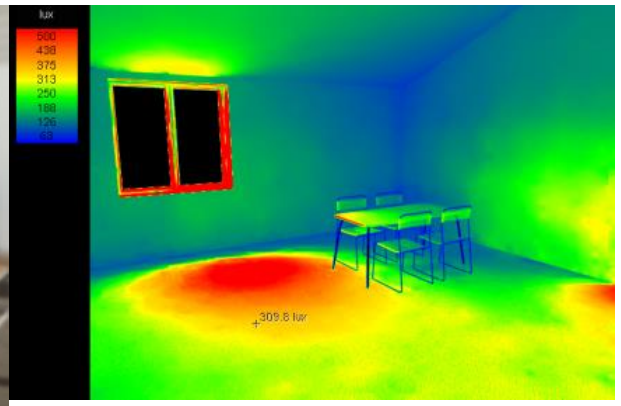


Digital Tools and simulation

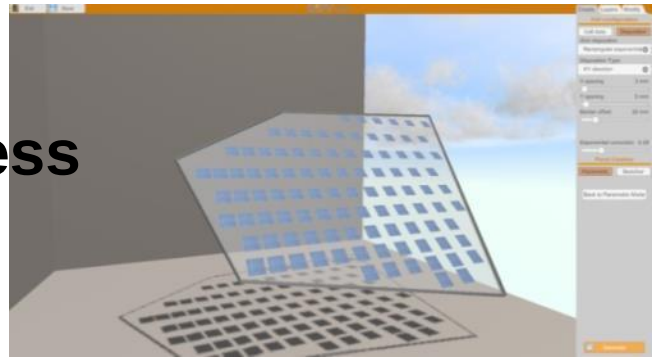
- Digital representation and simulation:
- Computational design
- Energy and lighting Simulation
- Optimization tools for planning and installation

- Visualization (VR and Rendering)
- Validation and user perception



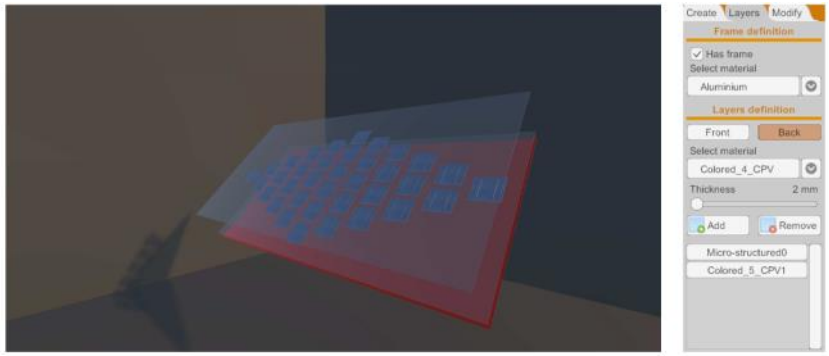


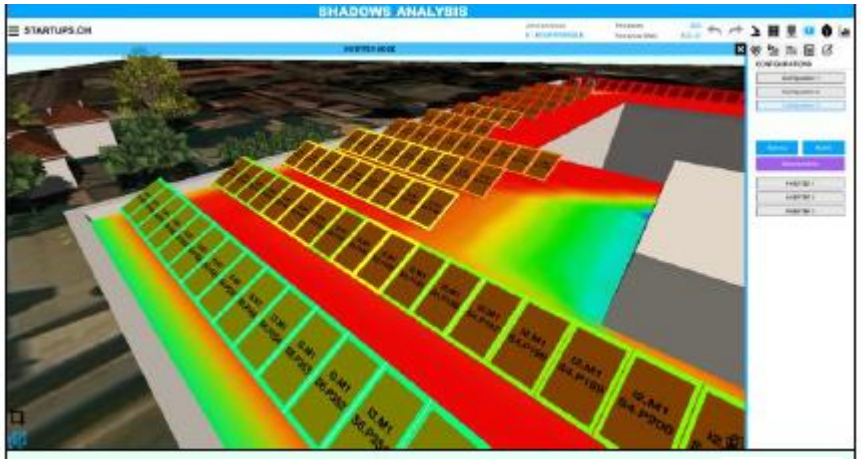
BIPV…transfer to Architecture, Engineering and Construction process



Innovative tools for supporting:

- BIPV design in the early design phase
- Interoperability in a BIM-based process
- Algorithms for BIPV performance (detailed mismatch losses, shading, string optimization)





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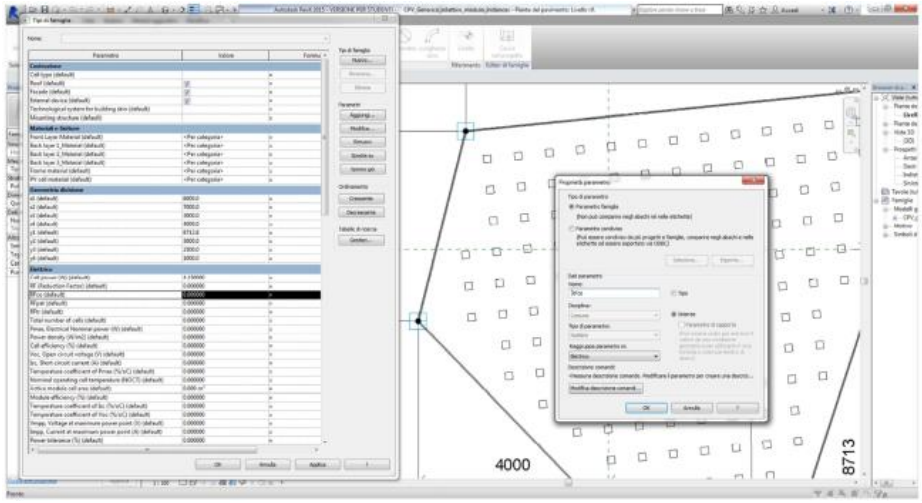
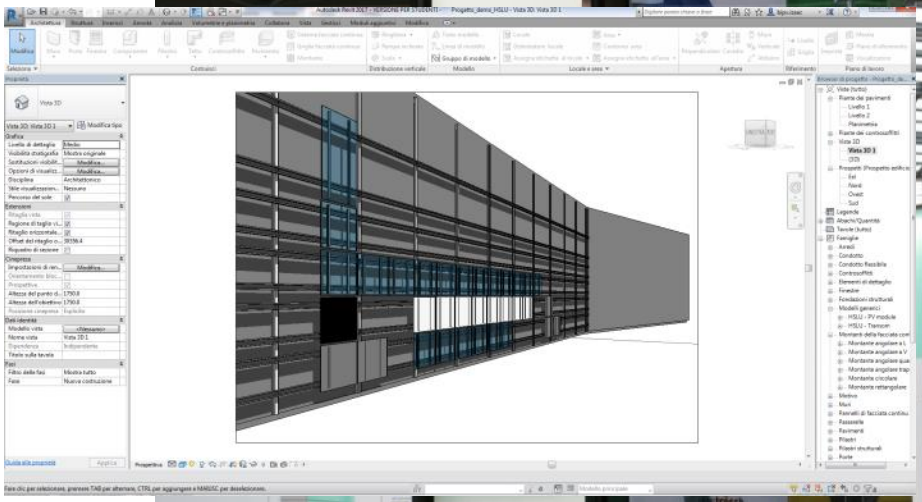


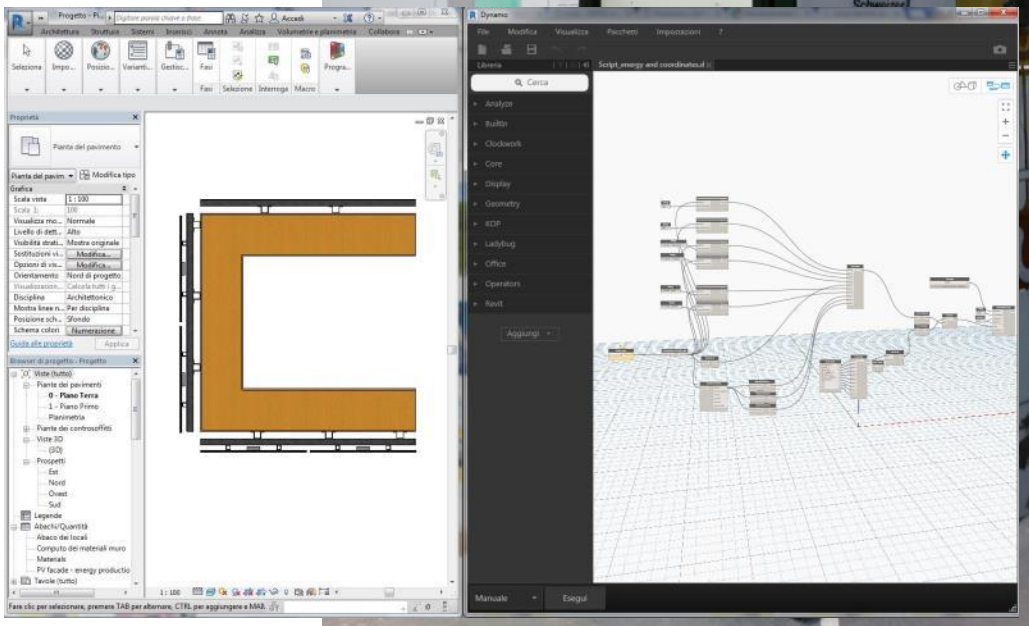
BIM and BIPV

Digitalization, Information Modeling and Information Management (IM) of a BIPV façade for:

- design
- quantity take off
- early energy analysis
- LCA

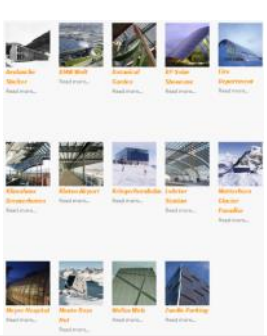
BIM libraries
BIM-based tools

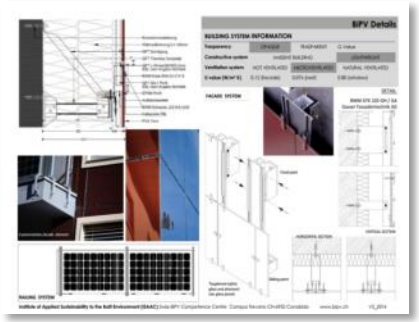


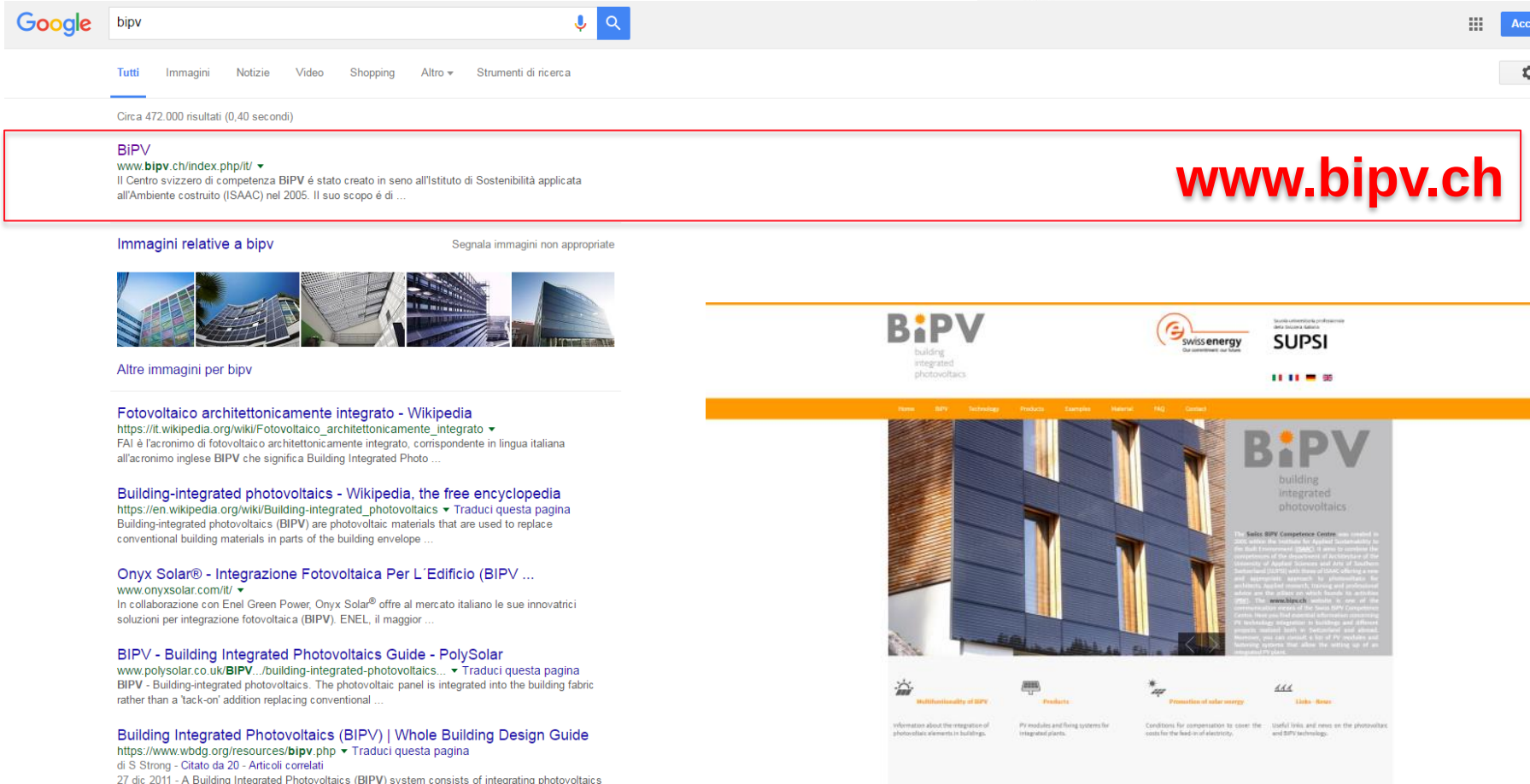


Energy Totem (Photo: HSLU-Schweizer)

BIPV…our communication and dissemination platform for the Swiss Federal office of Energy

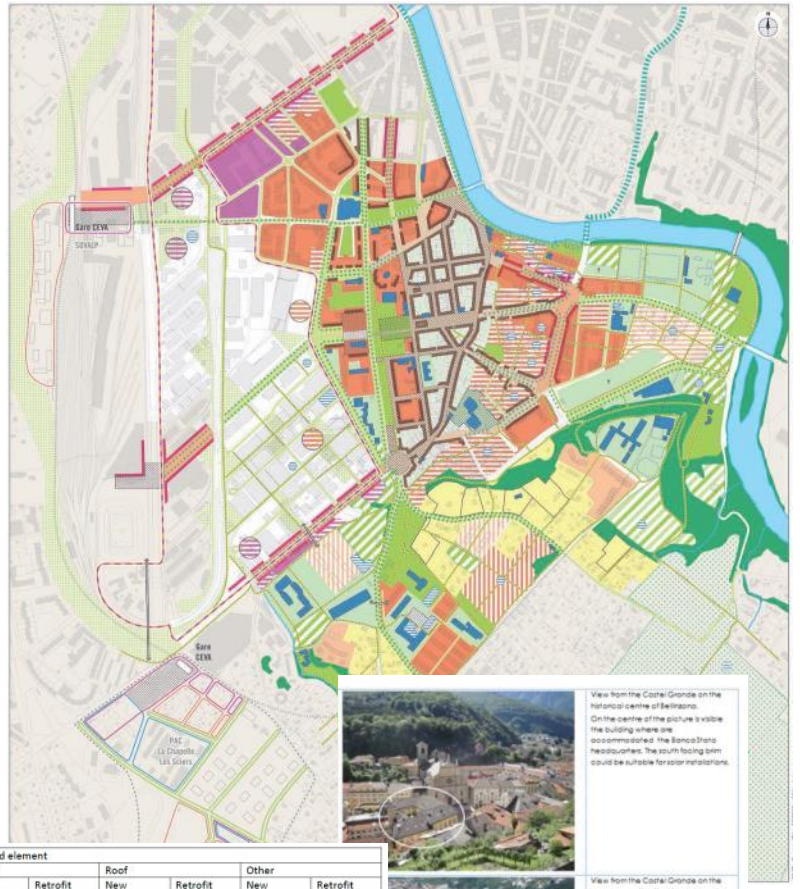


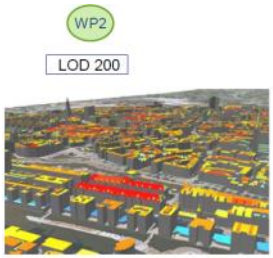


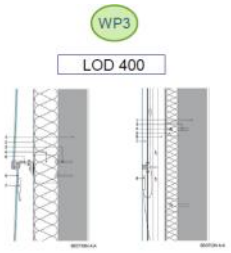


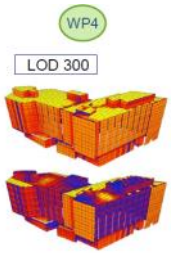
BIPV at urban scale and in sensitive areas

- Global solar planning in the city of solaire Carouge -Geneva (HEPIA + SUPSI)
- b-FAST: Analysis of solar façades potential in Ticino (FER)









				Installed element					
				Façade		Roof		Other	
				New	Retrofit	New	Retrofit	New	Retrofit
OUTPUT	AIR	Air heating & ventilation	Active						
			Passive						
		Space heating	Active						
			Passive						
		Combined air and water heating	Active						
			Passive						
	WATER	Water heating	Active						
			Passive						
		Cooling & ventilation	Active						
			Passive						
	ELECTRICITY	PVT	Active						
			Passive						

WP2 LOD 200

WP3 LOD 400

WP4 LOD 300

FAST- FAÇADE ACTIVE SOLAR TICINO

Conclusions

- PV and in particular BiPV has a high potential for urban areas
- PV technologies for the building integration are still a strange planet for many architects and a lot of conviction has to be done
- New tools and simulation instruments are capable to integrate PV in an early planning stage
- Space for a lot of innovation and research

Thank you for your attention

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