Façade Integration
Challenges and Solutions for BIPV

BIPV2 / BRE conference 2011

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BIPV solutions require building understanding and architectural Design

Interface between inside and outside

Aalst Hospital (BE), Sapa Building System - Scheuten
PV on facades?
Are you serious about that?
Solar Irradiance

Difference between roof / facades
Challenges to integration

Why and how

BIPV on this facade?

1. Focus on electricity only?
2. Focus on Aesthetics?
3. Improve building quality and energy performance?
4. ...
BIPV in conceptual phase

Case of a swimming pool project

- Rather simple
- 18 kWp on 35 identical rectangular modules
  → Budget is ok
  → But what if the customer wanted something more powerful or more aesthetic?
BIPV in conceptual phase

Case of a swimming pool project

- Original pattern!
- 25 kWp on different rectangular and trapeze modules
  - Budget is higher, more tricky wiring
  - But what if the customer wanted something less expensive or just less power?
BIPV in conceptual phase

Case of a swimming pool project

- Other approach with Solar Canopies
- 25 kWp
  - Lower budget with different aesthetic, shading effect of the canopies, better yield
  - But what if the architect wanted something more high tech?
BIPV in buildings facades

Building Process
Building Physics
Energetic Design
Esthetical Concept
Economical Concept

Efficiently merging 2 worlds
BIPV in buildings facades

Design requirements

- Design life: higher than standard PV
- Building: Static, movements, dilatations, water, air-tightness, thermal efficiency
- PV: wiring the pv array and components in the skin, shadow analysis
- Safety consideration
  - Fall, shock
  - Electricity
  - Fire
  - Other: vandalism, bomb blast
- Certifications: for modules, but also CE label for “bipv curtain walls” ...
- Others: acoustic, ...
BIPV in buildings facades

Construction detailing

Perfect air & water tightness and building connections is extremely important in any BBIPV façade solution.
Our BBIPV approach is to

- Close relationship with architects and fabricators
- Harvest the best from the building envelope
- From high quality curtain walls, windows, glass roofs, sun control to balustrades
- Adapted room for PV wires and connectors, easier PV wiring paths...
- Bespoke products and projects
- Certified modules and system profiles.
Photovoltaics into facades by Sapa Building System
“Be visible, or be invisible.”

– Andy Sernovitz
Photovoltaics into facades

General facts of PV on facades

- Obviously less yield, but surface potential exists, especially when crowded roof areas, and in ‘northern’ cities
- Better protection
- Most visible solution
- Shadow analysis advised
- Lot of possibilities, including refurbishment

Vaxjo Sweden, Sapa Building System
Photovoltaics into facades
General facts of PV on facades

ERTEX Insulated modules aSi in Sapa Building System CW 4150 system
Lisboa – Curtain wall
Poly c-Si glass-glass modules – 24 kWp
Khartoum – Curtain wall
a-Si Thin-Films – 100 kWp
Photovoltaics into facades

Important points on design

- Tilted façade? Good idea to increase yield, whilst paying attention to overheating
- Where to integrate. In vision and/or non-vision? If transparent, what is required? g-factor, \( \tau \), etc...
- Shadows often exist, study to carry
- Determine zones not allocable to pv: near doors, trees, details, terraces ...
- Insulated modules are not back-ventilated
- Where and how are the wiringways going inside the building? Construction details.
Photovoltaics into facades

Stick System curtain walls

- Aluminium mullions and transoms profiles system (eg Elegance 52)
- BIPV modules replace glass windows (vision zone) or opaque elements (eg. in spandrel zone)
- Connectors, cables and junction boxes are concealed and protected in the adapted profiles. Specific cap profiles are used to reduce close shadow effects

Reducing amount of extra milling and machining is also the requirements of our fabricators. This keeps cost, timing and surprises down.
Photovoltaics into facades

Unitized System curtain walls

- Usually storey height pre-assembled elements, used for medium and large facades (eg Elegance 72)
- Evolutive and element design allow the fabricator to prepare the different elements, including glazing and other sub-elements, in a workshop
- Allowing better jobsite planning, use of more efficient building technique per storeys, or when scaffolding is unavailable or impractical
- Interesting solution for BIPV where all parts of the facade element including the PV modules are pre-mounted allowing better quality control
Photovoltaics into facades

Large Windows systems

- Integration of large bbipv modules in large windows
- Same principle as curtain walls

Science Center Norway - Sapa Building System
700 Wp ERTEX modules, triple glazing, safety laminated
Photovoltaics into facades

Ventilated Cladding facade / “Cold Facade”

- Profiles or brackets are mounted on the main bearing wall. Cassettes or panels are attached using cladding profiles rails and hook on system.
- PV modules are fit into/onto the panels or by means of creating a pseudo-cassette with adapted framing.
- Use of non insulated bespoke opaque modules. Or even standard modules (if accepted by safety rules, architect lines etc...)
- Easy wiring, the wires are running behind the modules. Generally back junction boxes. Somewhat back ventilation.
BAPV Facades applications

REC factory Norway – Sapa Building System

Building Lyon (FR) – Tenesol, Sapa
Engineering & Design

BIPV Design : Shadows analysis

- Assessment is important, for correct yield calculation, to fine tune the bypass diodes strategies, avoiding hot spots on cells etc...
- Use of “Smartboxes” can help by improving the mismatching tolerance.
BIPV project concept
BIPV project concept

On site requirements

- Facade fabricators are key actors too. They know the building envelope, facades, and willing to be empowered on bipv and other passive/active technologies.

- No standard glass break tolerance for bbipv...
  Idea for big jobs: 1-2% spare modules to be ordered. For smaller jobs: Pay attention!
Like a glass pane, yes but...

If you think about how to do the wiring right during installation... Then you have a problem!

- Junction boxes, wires, connectors... interconnected together with direction changes and U-turns... all this must fit the structure, and compatible with structure integrity, air and water tightness!
BIPV projects

Project process can be long, designs may change...

... this is part of the project life ;-)}