A workflow for retrofitting façade systems for daylight, comfortable and energy efficient buildings

H2020 RenoZEB project

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Challenges in building retrofitting
The H2020 RenoZeb project

• Complex and expensive building retrofitting processes, with many uncertainties.
• Building retrofit is very disturbing for building occupants.
• Building retrofit is inefficient: Information is not properly shared, which leads to multiple errors + duplicated efforts.
The H2020 RenoZeb project

- Multifunctional modular “plug and play” façade solutions.
- A well-designed renovation methodology.
- Cloud collaborative environment (BIM).
The importance of window functions

- Daylight provision
- Visual contact with the outside
- Privacy
- Glare protection
- Thermal management
- Solar gain management
- Aesthetics
- Energy generation
- Security
- ...

These functions oppose each other... aargh!
The importance of window functions
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Control strategy: manual

Mardaljevic, Radiance Workshop 2014
Control Strategy: automated

- Low occupant acceptance
- User dissatisfaction might be caused by the lack of consideration of facade functions in the control strategy.
Workflow for the conceptual planning of façade systems

1. Analysis of the case study and definition of requirements
2. Selection of fenestration system and control strategy
3. Evaluation of the retrofit solution
4. Does the solution fulfil the requirements?
Analysis of the case study and definition of requirements

• A west-oriented office room in Bilbao.
• Existing fenestration system: DGU with vertical interior textile blinds.
• Sufficient daylight.
• High cooling energy demand.
• Manual control and inconvenient operation -> blinds constantly closed.
Analysis of the case study and definition of requirements

- The hours of uncovered façade should be maximized.
- For when the façade is covered, a certain contact with the outside should be allowed.
- The system must preserve a glare-free space.
- Daylight should be preserved or improved.
- Cooling energy demand must be reduced.
Selection of fenestration system and control strategy

• Chosen system: Exterior roller blind.

• Exterior shading devices are more effective to prevent solar heat gains.

• The chosen textile has an openness coefficient that allows a view through the textile material.

• The openness coefficient is small enough to prevent glare.

• Automated control strategy:
  • Occupation: priority visual and thermal comfort.
  • No occupation: priority energy efficiency.
Evaluation of the retrofit solution

- Cooling energy demand reduced by 63%.
- Daylight improved by 48%.
- Glare deteriorated by 5%.
- View contact with outside significantly improved.
Conclusions

The study highlights that:

- The multifunctional nature of building façades in the design of retrofitting solutions.
- How advanced building simulations can be used very targeted to assist in the design process without replacing expert decision making by the designer.
Thank you for your attention!

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