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

H2020 RenoZEB project

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 642384.

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.

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The H2020 RenoZeb project

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

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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!

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The importance of window functions

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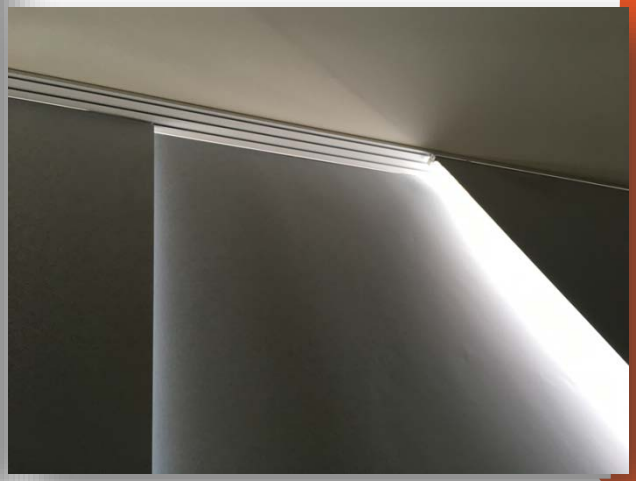
The importance of window functions



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The importance of window functions

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Control strategy: manual

Mardaljevic, Radiance Workshop 2014

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Control Strategy: automated

- Low occupant acceptance
- User dissatisfaction might be caused by the lack of consideration of facade functions in the control strategy.

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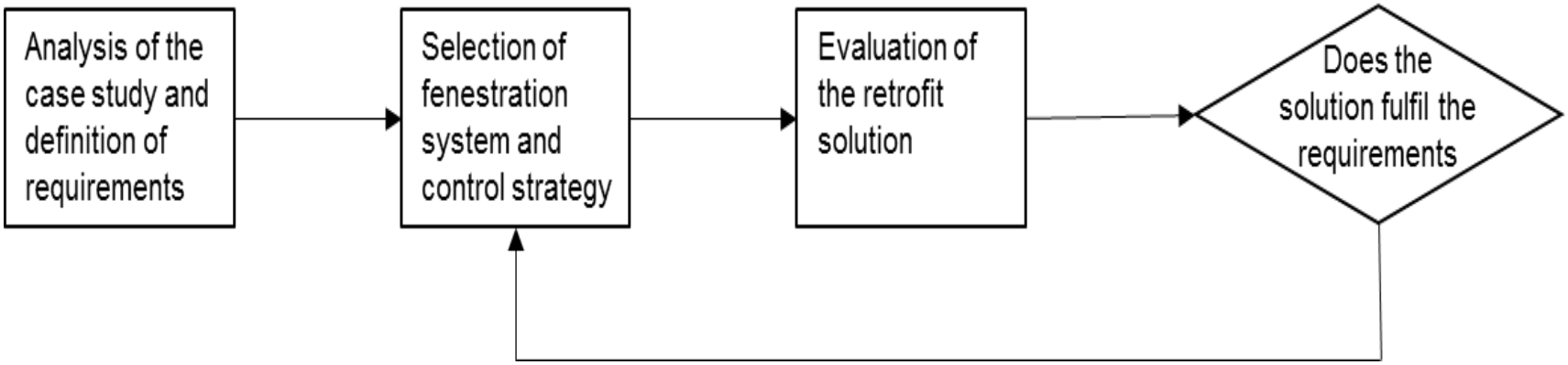
Workflow for the conceptual planning of façade systems



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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.

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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.

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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.

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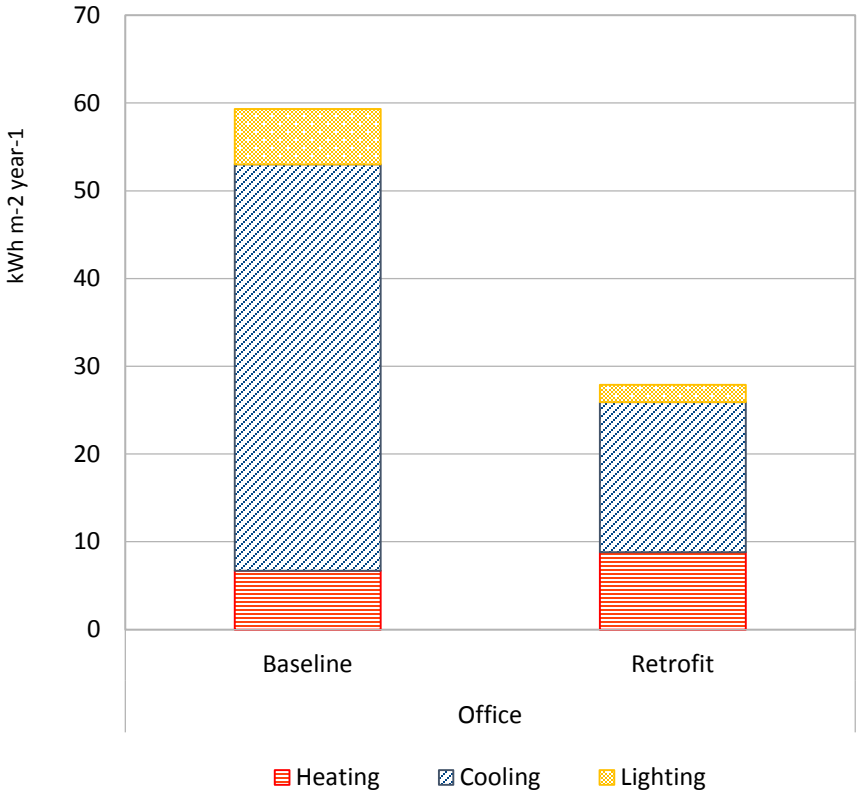
Evaluation of the retrofit solution



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

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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.

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Thank you for your attention!

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