2ndSkin

A zero-energy refurbishment approach for residential apartment buildings by applying an integrated façade solution

TU Delft Delft University of Technology

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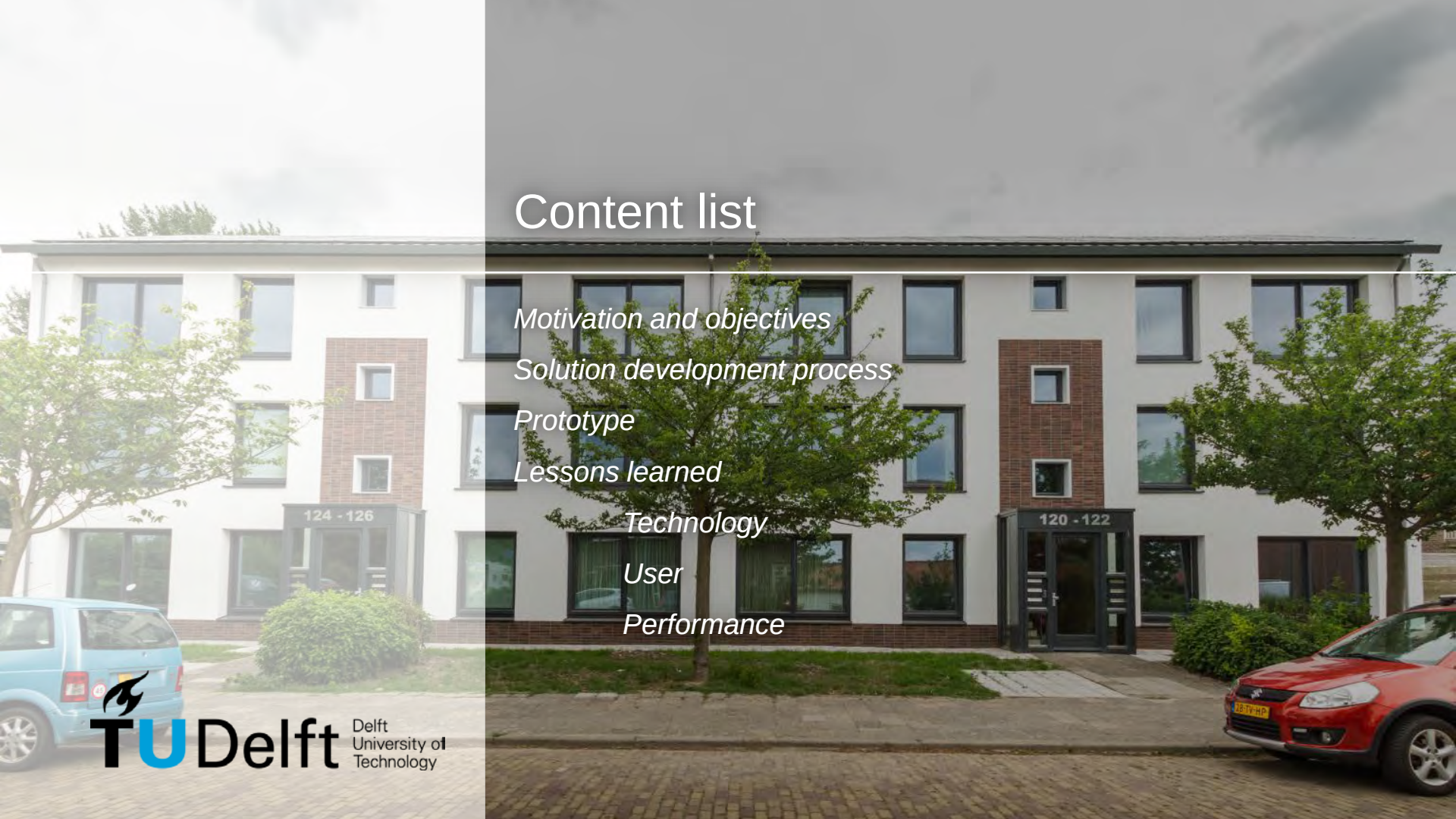
- *Technology*
- *User*
- *Performance*



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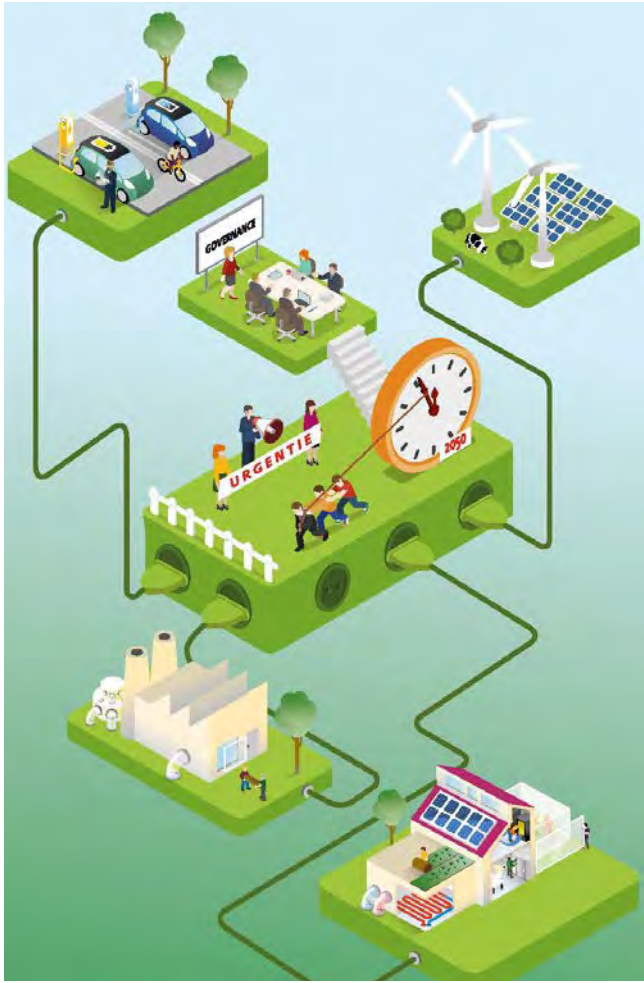
Energy Use and Building Sector

- All new buildings must be nearly zero energy buildings by 31 December 2020
- Zero-Carbon Built Environment by 2050
- Clear ambition to refurbish the building stock

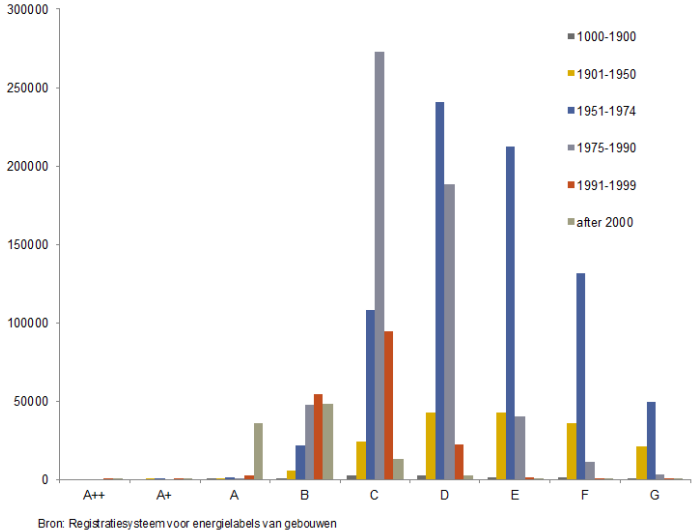
0-op-de-meter



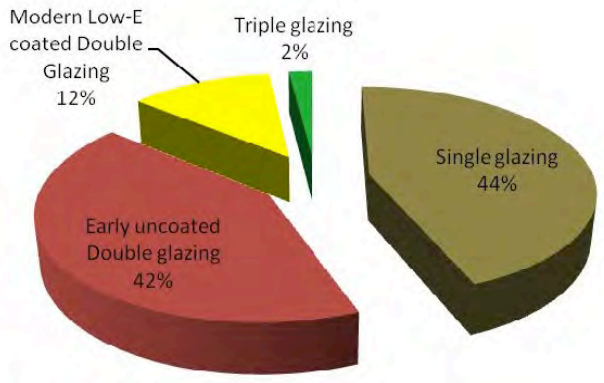
Energieagenda, 2016

Existing buildings

- By 2050, 70% of the building stock
- Built under far lower energy and sustainability standards



Energy labels for non-residential buildings in the Netherlands in 2010 (source: AgentschapNL)



Glazing type distribution in the EU building stock – TNO-60-DTM-2011-00338 report (source: Glass For Europe. (2011). The Future EU Energy Efficiency Plan. Brussels: Europe's Manufacturers of Building, Automotive and Transport Glass)

2ndSkin Project Objectives

Innovative, integrated façade technology

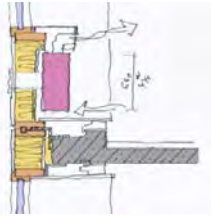
- Zero energy consumption (Null op de meter)
- Minimum intervention to the interior

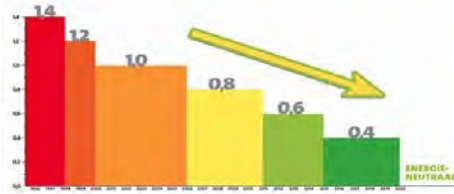
Business Development

- Low cost
- Upscalling
- New business model of supply chain

User Aspects

- Renovation acceptance
- Monitor behaviour and energy use
- Improve interaction with new systems





Post-war, multi-family apartment buildings:

- Post-war 30% of residential building stock
- Bad energy performance and comfort
- High density, limited surface for renewable energy, limited financial resources
- Possibility to use the concept in more building types

2ndSkin Project Phases

- Flagship 2014-2016

2ndSkin Project Phases

- Flagship 2014-2016
- Demonstrator 2016-2018
- Scaler 2018-2019

2ndSkin Project Phases

- Flagship 2014-2016 Mockup

- Demonstrator 2016-2018 12 NOM

- Scaler 2018-2019 180 NOM-ready

Flagship Mockup

Testing technical feasibility

2ndSkin Technical solution

Remove existing windows

Ventilation layer

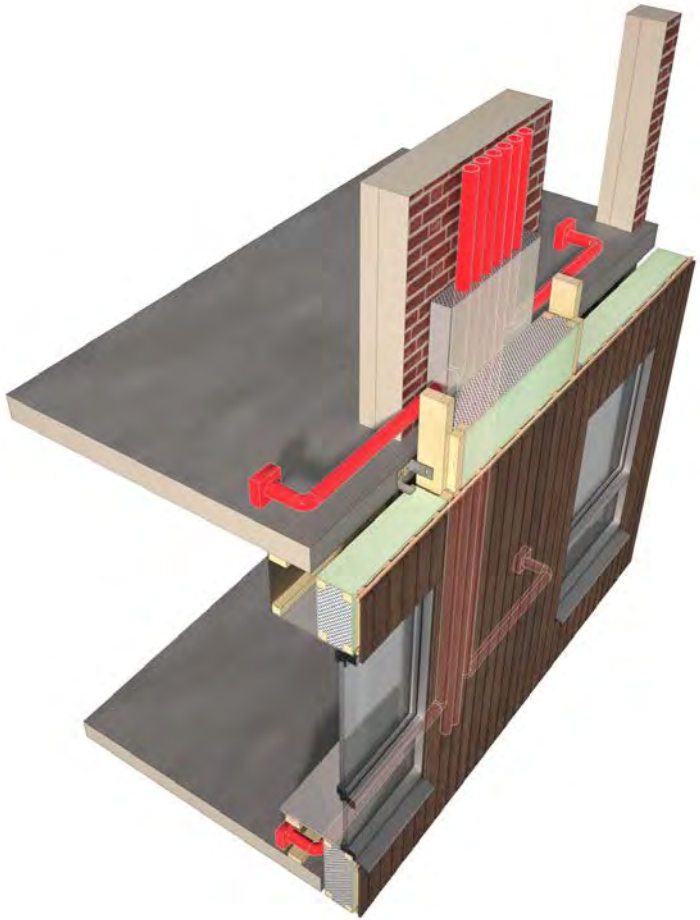
Wall insulation and new windows

Cladding

Roof insulation

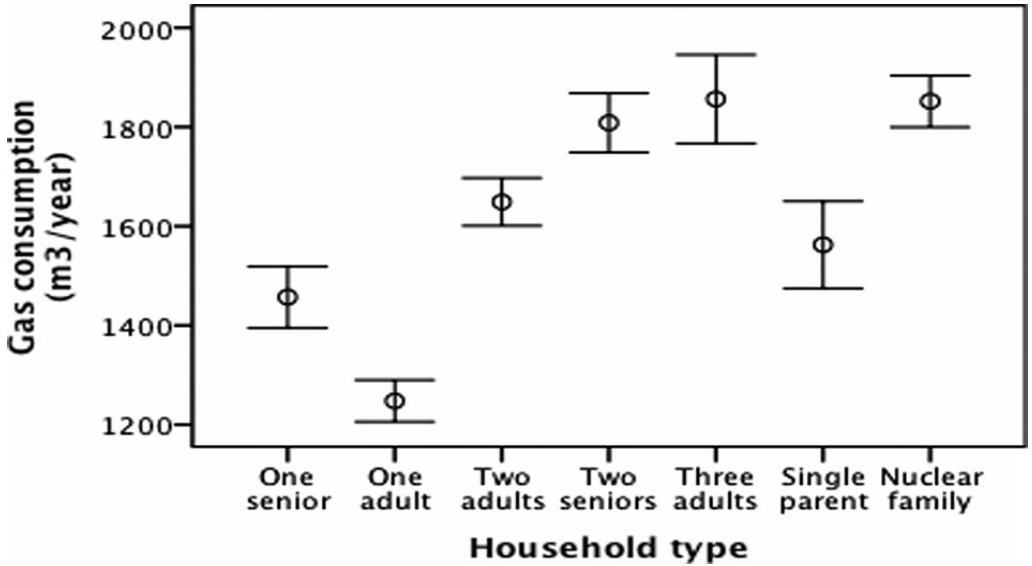
Heat-recovery ventilation

PV panels



Households profiles

Different energy consumption based on demographic household type

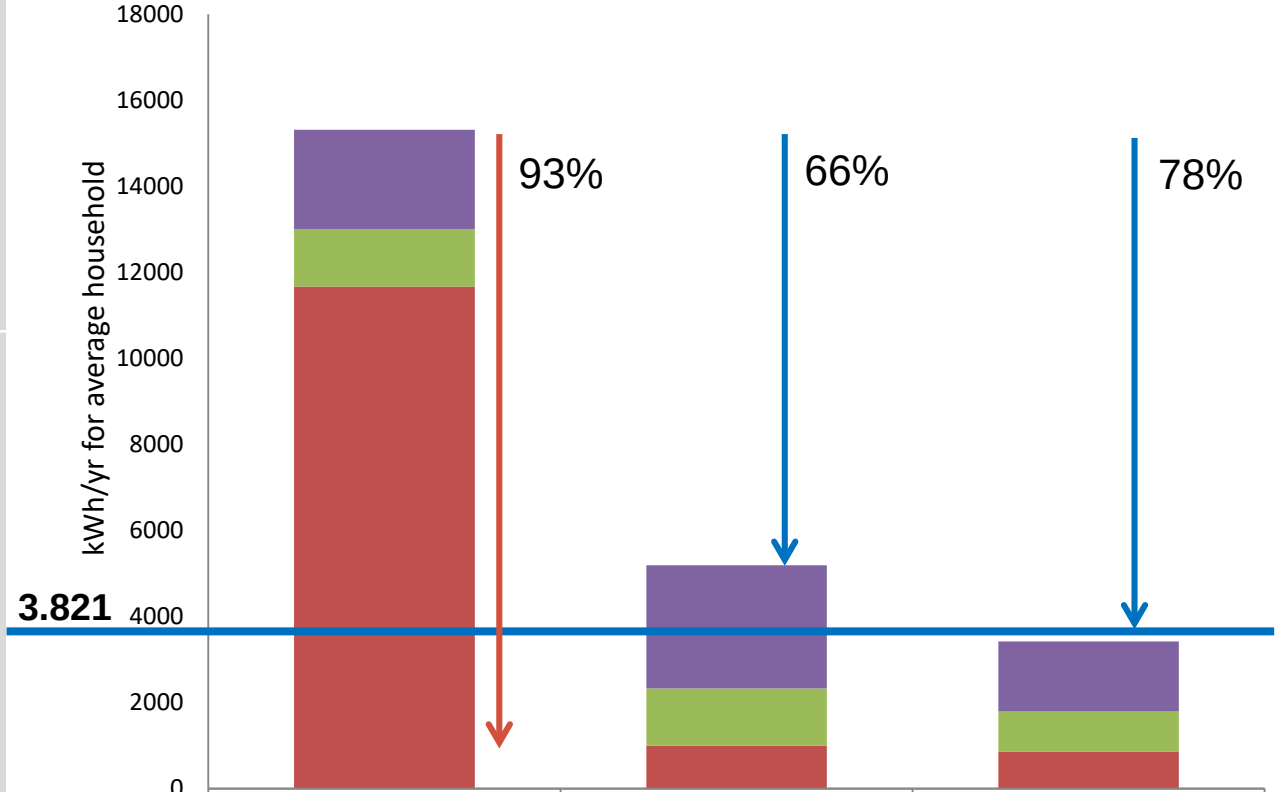


Guerra-Santin, O., & Silvester, S. (2016). Development of Dutch occupancy and heating profiles for building simulation. *Building Research & Information*, 1-18. Retrieved from doi:10.1080/09613218.2016.116056

Energy Performance

Zero-energy target can indeed be met, for specific cases

Heating demand can be covered



	Before renovation (apartment blocks, based on WoON)	After renovation (scenario 1. inefficient appliances, unchanged behavior)	After renovation (scenario 2. efficient appliances,heat recovery shower, adapted behavior)
Appliances	2306.6	2861.2	1625
DHW	1333.11	1333.11	933.18
Heating	11671.0026	997.9	862.5

12-apartment building zero-energy renovation
Soendalaan, Vlaardingen, NL

Urban, architecture, Design Concept

Post war (1952) district with identical blocks

The project focuses on one block of 12 apartments

Existing building

Simplex construction system

Proposed renovation

KAW Architecten

Façade system

External insulation

Façade system

Window replacement

u-PVC frames and

Triple glazing panes.

Façade system

Roof replacement with prefabricated panels

Façade system

Remove and replace balconies

Façade system

Remove and replace balconies

Building systems

New installation installed in an installation box on the balcony

Ventilation with heat recovery

Ground Source heat pump COP6

Building systems

New installation installed in an installation box on the balcony

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Zero Energy guaranty

Zero energy is guaranteed by the building services provider for 25 years

This is achieved with eliminating the demand

And on site energy generation

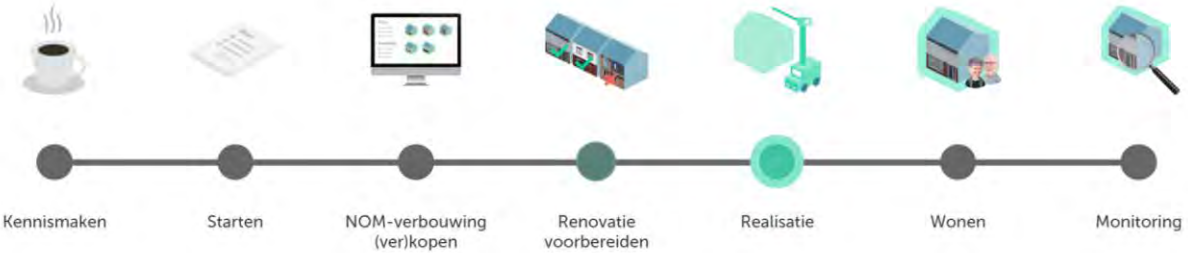
Realised renovation

User

Acceptance

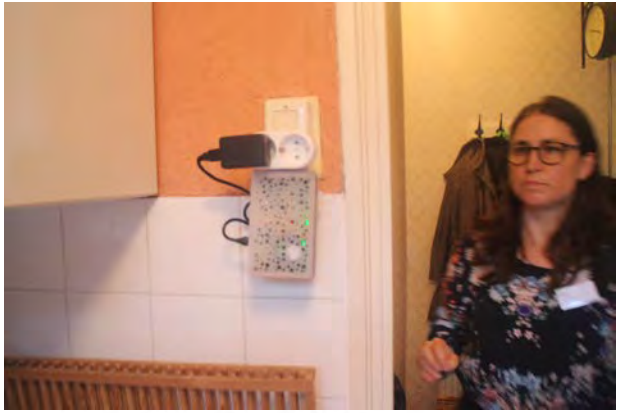
User

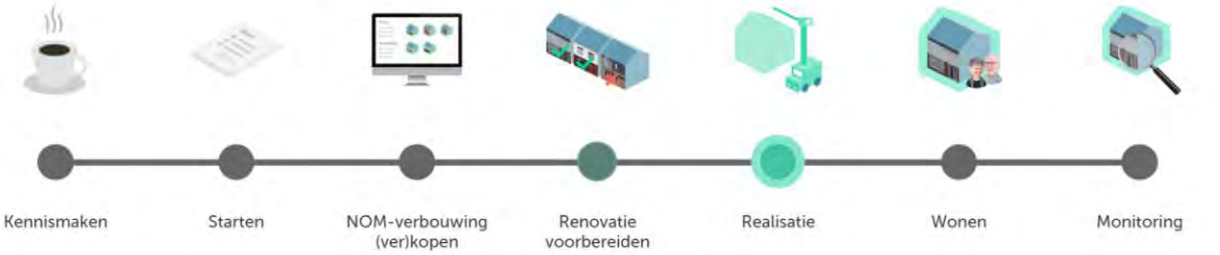
Renovation



User

Monitoring, currently ongoing





Lessons learned

- Zero energy refurbishment is achievable with current technology
- Potential for product development
- Business model with energy contracting
- Role of the user
- Main restriction is the high investment

Potential for upscaling

- Stepped renovation (NOM-ready, no-regret)
- Prefabrication and integration
- Alternative building systems
- Low temperature
- Synergy between building and district

Refurbishment is an integral part of buildings' lifecycle and it going to happen.

The challenge is to realise this task efficiently and effectively

Thank you for your attention

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