

SHEP 2025 – FINAL REPORT

Sustainable Housing from a European Perspective

Summer School | 1–11 July 2025 | TU Delft



Architecture and
the Built Environment

**SUSTAINABLE
HOUSING** from a
**EUROPEAN
PERSPECTIVE**

2025 SUMMER SCHOOL



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1. Introduction

The **Sustainable Housing from a European Perspective (SHEP)** Summer School 2025 brought together an international group of students, researchers, and young professionals to explore the urgent challenges of housing in Europe. Over **11 intensive days**, participants engaged with leading experts in sustainable architecture, energy transition, circularity, social housing, behavioral science, and innovative financing.

Hosted by **TU Delft's Faculty of Architecture and the Built Environment (ABE)**, SHEP25 provided a dynamic, hands-on environment where theory met practice. Students not only learned from lectures and workshops but applied their knowledge directly through a tender **game**, mirroring real-world processes in European renovation projects.

The program emphasized:

- Social housing renovation,
- Privately owned condominiums renovation,
- Energy transition,
- Circular design strategies,
- Sustainable finance,
- Behavioral and social dynamics,
- and new business models for integrated home renovation services.

The rich diversity of students and lecturers turned SHEP25 into an incubator for fresh ideas, cross-cultural dialogue, and collaborative innovation.



SHEP25 Group photo TU Delft orange stairs

2. WHY SHEP?

Europe today faces a dual housing crisis:

an urgent need for climate-neutral renovation and a shortage of affordable, high-quality homes.

The SHEP Summer School was created to:

- explore how to make Europe's housing stock more sustainable,
- equip participants with interdisciplinary knowledge,
- connect future professionals with real cases in the Netherlands,
- and promote scalable, equitable solutions for the European context.

EU climate targets and national energy transition goals require massive renovation efforts. SHEP25 addressed these challenges head-on through real case studies in Delft.

With an interdisciplinary approach, SHEP offers a unique holistic approach to sustainable housing, one that reflects the complexity of Europe's built environment.



SHEP25 Group photo TU Delft BK

3. WHY TU DELFT?

TU Delft is internationally recognized for its leadership in:

- sustainable building design,
- circularity and industrialized construction,
- housing management and policy,
- energy systems science,
- and cutting-edge innovation in architecture.

Participants gained access to:

- state-of-the-art facilities,
- expert lectures from TU Delft and international partners,
- field visits to exemplary renovation districts and timber construction sites,
- and hands-on tender simulations designed by researchers.



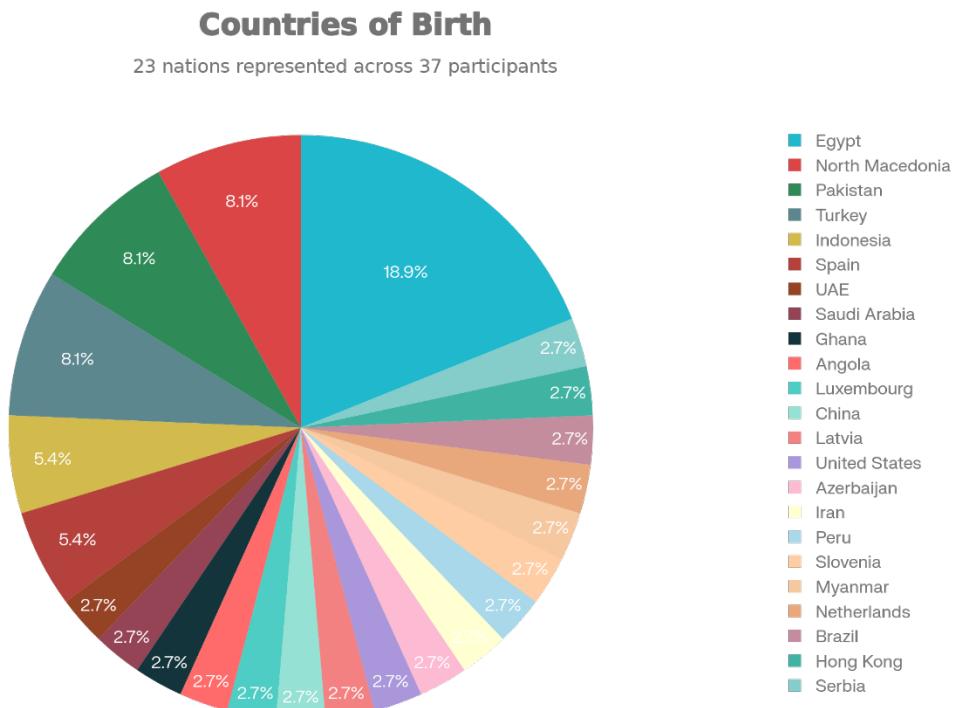
SHEP25 Opening ceremony Aula

4. The Class of 2025

SHEP25 welcomed **37 participants from 23 countries**, representing disciplines such as:

- architecture
- civil engineering
- energy engineering
- urban studies
- real estate
- environmental design
- policy and governance
- project management

From 23 nations: United Arab Emirates, Saudi Arabia, Ghana, Angola, Luxembourg, China, Latvia, United States of America, Azerbaijan, Iran, Peru, Slovenia, Netherlands, Brazil, Hong Kong, Serbia, Myanmar, Egypt, North Macedonia, Turkey, Indonesia, Pakistan, and Spain.



The diversity of backgrounds enriched discussions and strengthened interdisciplinary collaboration.

Participants were joined by a team of tutors and lecturers who guided them through technical workshops, behavioral sessions, finance modules, and business model development.



SHEP25 Group photo - Moerwijk, The Hague

5. Curriculum & Themes

The SHEP 2025 curriculum was structured around **seven main themes**:

1. Policies & Governance

Energy transition governance, EU directives, housing regulation, and multi-level decision-making.

2. Energy Transition

Heat pumps, district heating, deep renovation strategies, passive design, performance modeling.

3. Circularity & Health

Indoor environmental quality, low-tech heating and cooling, circular design frameworks (R-ladder).

4. Industrialization & Digitalization

Prefabrication, modular construction, BIM, IoT for performance monitoring.

5. Human Behavior & Decision-Making

Behavioral bottlenecks, user comfort, communication strategies, stakeholder coordination.

6. Sustainable Finance

Green bonds, EPCs, EU taxonomy, funding mechanisms for renovation and retrofits.

7. Housing Markets & Affordability

Affordability indicators, land policy, supply-side interventions, cross-subsidies.

Each day combined lectures, group work, field visits, and experiential learning.



6. Daily Activities & Learning Experience

This section summarizes the main insights from the daily diaries submitted by students.

Day 1 — Opening Day & Site Visits (Delft)

In collaboration with the TU Delft Urban Energy Institute and the municipality of Delft, students began with introductory lectures on sustainable housing and Dutch renovation challenges, followed by site visits to **Chopinlaan**, **Bosboom-Toussaintplein**, and **Aart van der Leeuwlaan**, meeting residents and building managers directly.



Day 2 — Governance & Policy + Field Visit (The Hague)

Lectures introduced governance structures and renovation policies, both at the EU and Dutch levels.

A field trip to **Moerwijk, The Hague** allowed students to see prefabricated renovations in progress.



Day 3 — Energy Transition, Customer Journey Workshop & Special Lecture on Geothermal Heating

Sessions included energy-efficient design, roof extensions, and geothermal systems. Teams worked on their **homeowner renovation journey** for the tender game.

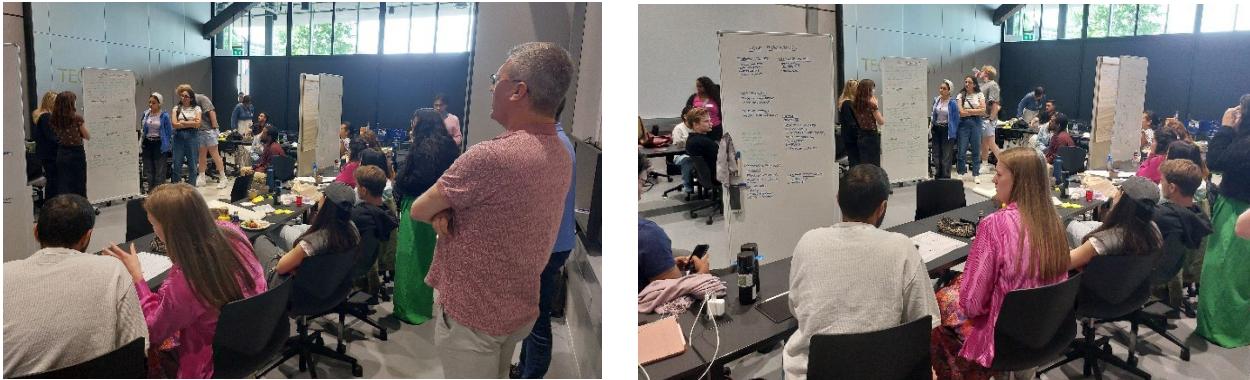


Day 4 — Circularity and Health & Business Models

A deep dive into:

- Indoor Environmental Quality (IEQ)
- Circular frameworks (R-ladder)
- Business Model Canvas

Students ran a tender-game simulation as companies competing for renovation contracts.



Day 5 — Amsterdam Noord Field Trip

A full-day exploration of: Overhoeks, Eye Filmmuseum area, Van der Pekbuurt, De Ceuvel, Schoonschip, Bosrankstraat / Monnikskapstraat, NDSM-Werf



Key insights: circularity, community-based design, floating housing, material reuse, and sustainable neighborhood development.

Day 6 — Industrialisation & Digitalisation, Energy Transition, & the Green Village tour

Lectures explored:

- Industrialized construction
- Linking industrialized practices with digital innovation
- Decision-support frameworks to support preparing Dutch homes for the heating transition



A field trip to **the Green Village, TU Delft**, where new technologies are being developed and tested on site.



Students also visited the geothermal well that powers the heating in the **ECHO building**, TU Delft, which was introduced to them on day 4.

Day 7 — Sustainable Finance, Behavioral Science & Urban Woods

Lectures explored:

- financial barriers
- green funding structures
- real-life user behavior
- social dynamics in renovation



The day ended with a guided tour around the city center of Delft and a construction site tour of the **Urban Woods timber housing project**.



Day 8 — Housing Affordability & Poster Development

Sessions unpacked: affordability definitions, systemic strategies, and long-term financial planning



Groups finalized their poster content and visualizations.

Day 9 — Submission & Presentation Preparation

Posters were submitted in the morning, followed by slide development and rehearsals.



Day 10 — Project Presentation & Closing ceremony



Fred Hobma presenting the MBE Masters Track



Homeowner engagement in the discussion of renovation proposals for their buildings prepared by the SHEP participants



SHEP Tender game Winning Group

7. Student Reflections & Testimonials



Srgjan Spasenovski

"I am Srgjan from Macedonia, for two years I live in Slovenia. Where we are facing massive housing problems. When I was searching, this summer school spoke to me the most. Sustainability is a popular theme... I wanted to broaden my perspectives on sustainable housing. So, this was the perfect summer school to take some things I learned to my hometown. I came alone to the summerschool, only to figure out we were with a big group of Macedonians. But I was also excited to meet people from all over the world. And I will bring back home their perspectives too."



Tuğçe Güz

"I was looking for summer schools during my bachelor studies in Italy. And I am happy to share this experience with a friend. I chose this summer school as the TU Delft is well known. And this was my opportunity to explore Delft and the University. I learned a lot, and I met a lot of amazing people... I learned a lot about Reuse. Which in my country in Turkey, is not so common. It is a different way of thinking that I will take home. An awareness that we can prolong the lifespan of buildings and their materials."



Kosti Lubarsky

"I am from the States, and it was the idea to come to Europe but also do something with architecture. I looked up summer schools related to architecture, and SHEP was one of the only ones on the list focused on sustainability. Which I found that I did not learn enough about in my undergraduate. So, this summer school filled in a gap in my education. One of the things I learned which was surprising, is how complex it is. There is a lot of different ways to solve sustainability issues. And we need to research the pathways to formulate a solution... The Urban woods visit was super interesting. And the fact that this kind of construction is very applicable in the US too."



Vitor Martinez Arruda Campos

"There were lectures, workshops, and site visits. They were all complimentary and helpful. During the lectures you got the theory and experience from the professionals. They brought their huge background. And during the site visits you could see how it worked in practice. The homeowner associations explained to us how the housing works here in the Netherlands. Especially for me, this was interesting to see, as I am from Brazil. It was interesting to see and experience the differences in housing. These are experiences that I will bring back home."



Jill Ries

"I am from Luxembourg. When I came here, I had some insecurities about my future as an architect. This summer school helped me have a clearer vision about what I want to do and position myself in the field. And to think about what I want to do next. It gave me a lot of inspiration to create a better future, for us as architects."

8. Achievements & Future Ideas

SHEP25 achieved:

- 37 new ambassadors for sustainable housing
- Strong international academic–practice–policy connections
- A complete set of innovative group proposals
- Strengthened partnership with the municipality of Delft
- Strengthened partnerships with stakeholders across the Netherlands
- European research embedded in frontrunner education

Future directions include:

- expanding partner institutions,
- increasing engagement with municipalities and housing associations,
- integrating more digital tools (BIM, LCA, AI-enabled renovation evaluation),
- developing a broader alumni network for sustainable housing.

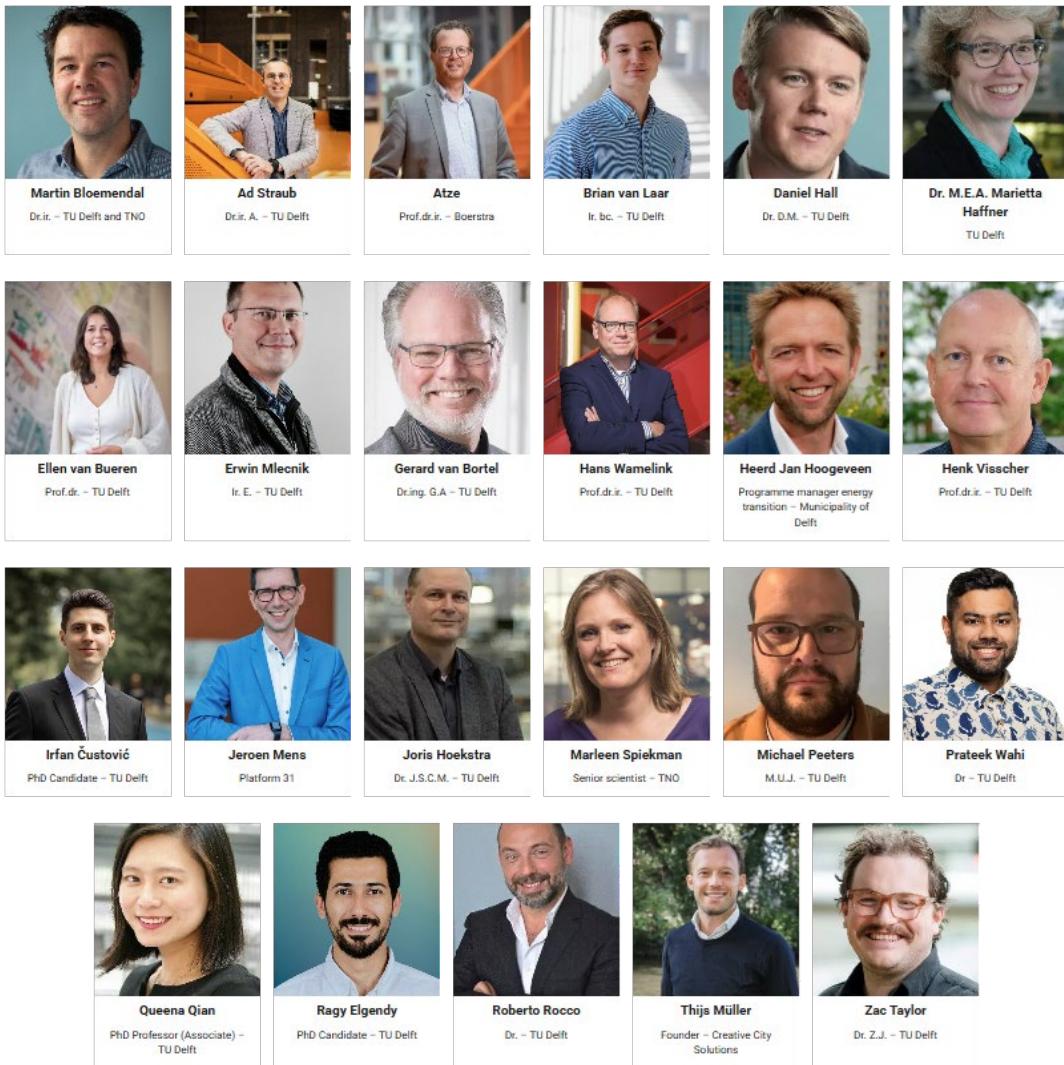


9. Partners & Acknowledgements

9.1 SHEP Teachers:

We would like to express our sincere gratitude to all SHEP teachers, the MBE department, and the secretariat for their valuable contributions. Their time, expertise, and support were essential in making this summer school vibrant and diverse, enriched by a wide range of topics and multidisciplinary perspectives.

Featured speakers



9.2 SHEP Partners

We extend our sincere gratitude to all our partners for their invaluable contribution to SHEP 2025. Their collaboration, expertise, and support have played a vital role in shaping a meaningful and impactful program for our participants. As we continue to expand the SHEP network and strengthen international cooperation in sustainable housing, we warmly welcome new partnerships. If you are interested in becoming a partner or supporting future editions of the summer school, please feel free to contact us — we would be delighted to collaborate with you.

If you would like to become a partner of SHEP, please contact Ragy Elgendi at: r.elgendi@tudelft.nl



—PLATFORM31—



Green.
Building.
Solutions.



Appendix — Group Projects (Posters)



GREENNest /Aart van der Leeuwen 16, 206

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 Christine Harty - christineharty@gmail.com

OUR GOAL

To transform Shellflats into a safe, energy-efficient, and user-friendly building. Offering each property owner modular renovation packages suitable for their budget, improving the EPC rating and reducing energy costs.

BUILT
 Apartments: 96
 Living area: ~103m² + 32m² terrace
 Rooms: 3 bedrooms, living room, kitchen, bathroom
 Heating: Central block heating
 VvE fee: €268/month (includes reserve fund, insurance)

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 JULY 2025

BUILDING INFORMATIONS



where are we?



Aart van der Leeuwen 16, 206



BUSINESS MODEL

KEY PARTNERSHIPS
 VvE management, energy engineers, suppliers (window film, heat pumps), Wammelbonds & ISDE, municipal technical unit

KEY ACTIVITIES
 Financing applications, Energy analysis & simulation, Installation & inspection, Package design, Results monitoring

CUSTOMER RELATIONSHIP
 Communication tailored to all age groups, brochures, meetings, digital info, inclusive & simple language

CUSTOMER SEGMENTS
 home owners

| | |
|---|--------------------------------|
| 1 | 30-40 years (20% of residents) |
| 2 | 40-60 years (50% of residents) |
| 3 | 50+ years (30% of residents) |

CHANNELS
 30, 40, 50, 60+
 email, brochure, meeting, face-to-face, calling

REVENUE STREAMS
 ISDE grant, Wammelbonds, VvE contributions, EPC-based payment model

PACKAGES

SAFETY PACKAGE
 fire exit, budget

ENERGY LABEL: E TO C/B

program: fire exit
 timeline: budget
 budget: budget

Phase 1: Engineering & Planning – 2 weeks
 Phase 2: Permit Application & Approval – 3–4 weeks
 Phase 3: Installation of Fire Protection System – 1 week
 Phase 4: Inspection on Site – 2 weeks
 Phase 5: Final Safety Checks & Commissioning – 1 week
 Total Time Required: approx. 2.5 to 3 months
 Total Estimated Cost: €75,000–95,000
 Cost per apartment: ~€780–910
 (VvE savings: 40–50%)
 per month: ~€635–825

BASIC ENERGY PACKAGE
 windows + insulation, budget

ENERGY LABEL: G/B TO A

program: windows + insulation
 timeline: budget
 budget: budget

Phase 1: Planning & Surveying
 Phase 2: Energy Audit & Possibility
 Phase 3: Permit & Approval
 Phase 4: Heat Pump System Installation
 Phase 5: Commissioning & Calibration
 Total Time Required: approx. 2.5 to 3 months
 Total Cost (VvE): €112,000 – €115,000
 Cost per apartment: ~€1,180 – €1,210
 (VvE savings: 40–50%)
 per month: ~€920 – 1,120

GREEN FUTURE PACKAGE
 solar panel + sensory led lamps, budget

ENERGY LABEL: G/B TO A

program: solar panel + sensory led lamps
 timeline: budget
 budget: budget

Phase 1: Roof-top Solar PV System Installation
 Phase 2: LED Panel Installation
 Phase 3: LED Light (sensory aware)
 Phase 4: Commissioning & Testing
 Total Time Required: approx. 1.5 to 2 months
 Total Cost (VvE): €112,000 – €115,000
 Cost per apartment: ~€1,180 – €1,210
 (VvE savings: 40–50%)
 per month: ~€835 – 1,035

MID - LEVEL PACKAGE
 heat pump system + central smart energy monitoring panel, budget

ENERGY LABEL: G/B TO A

program: heat pump system + central smart energy monitoring panel
 timeline: budget
 budget: budget

Phase 1: Air-to-Water Heat Pump System Installation
 Phase 2: Energy Audit & Possibility
 Phase 3: Permit & Approval
 Phase 4: Heat Pump System Installation
 Phase 5: Commissioning & Calibration
 Total Time Required: 2 to 2.5 months
 Total Cost (VvE): €112,000 – €115,000
 Cost per apartment: ~€1,180 – €1,210
 (VvE savings: 40–50%)
 per month: ~€920 – 1,120

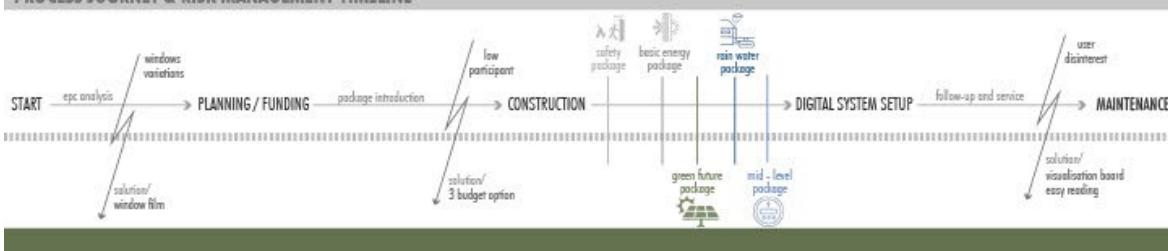
RAIN WATER PACKAGE
 rain water harvesting, budget

ENERGY LABEL: G/B TO A

program: rain water harvesting
 timeline: budget
 budget: budget

Phase 1: Catchment System
 Phase 2: Storage Tank (above Ground or Subterranean)
 Phase 3: Permit & Approval (if needed)
 Phase 4: Installation & Testing
 Phase 5: System Launch & Sign-off
 Total Time Required: approx. 1 to 1.5 months
 Total Cost (VvE): €22,000 – €22,500
 Cost per apartment: ~€235 – €255
 (VvE savings: 40–50%)
 per month: ~€183 – 219

PROCESS JOURNEY & RISK MANAGEMENT TIMELINE



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Prelude Senior Housing Complex, Delft

Association : Woonbron
 Number of Units : 174
 Renovation objective : Sustainability and Energy Transition
 Old Supply Temp : High (90/70 °C) from block heating
 New Supply : Low (55/40 °C) with air-water heat pump (district heating)

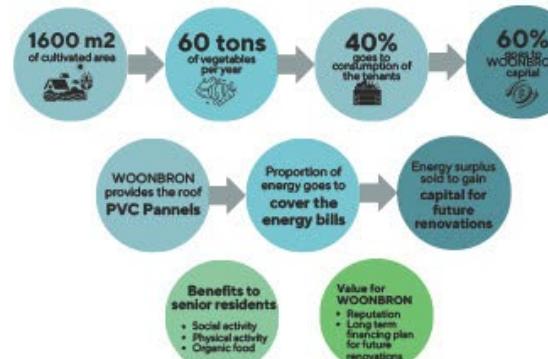
Main Problems



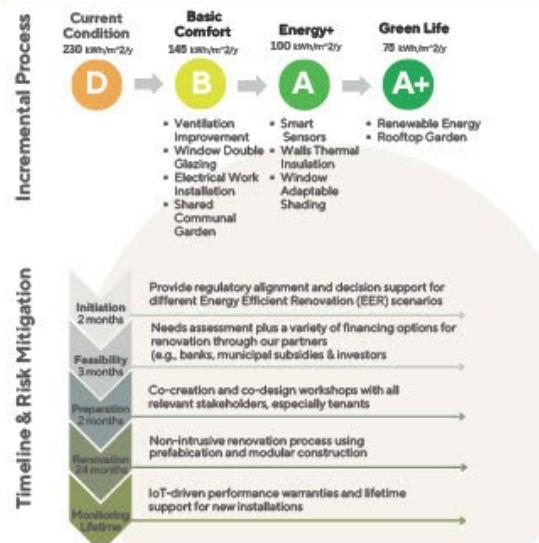
Technical Solutions



Value Proposition



WHAT WE OFFER



For us at WIN-WIN, our business does not only satisfy customers, it also gives a whole new experience with sustainable way.



Prefabricated Renovation of Social Housing Unit on Preludelat Chopinlaan 11-355, Delft

BUILD BRIGHT: Bora Gacal¹, Kirils Goncarovs², Lara Essam Ayad Aziz³
Marija Gavrilovik⁴, Mona Alsaydani⁵, Yin Estelle Chan⁶

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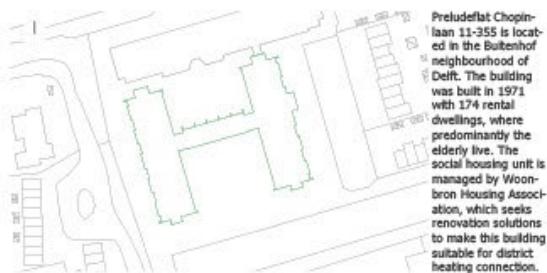
Affiliation/Institutions: ¹ MEF University -Turkey, ² University of Tartu -Estonia, ³ Al Shams University -Egypt
⁴ University American College Skopje -Macedonia, ⁵ UCAM Catholic University of Murcia -Spain, ⁶ Architectural Association School of Architecture -United Kingdom



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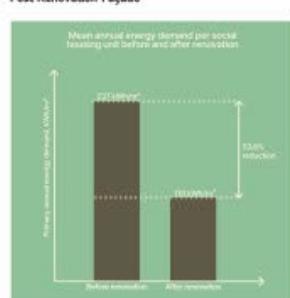
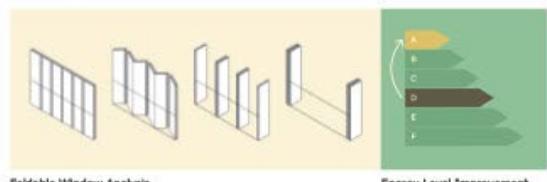
CASE STUDY AREA



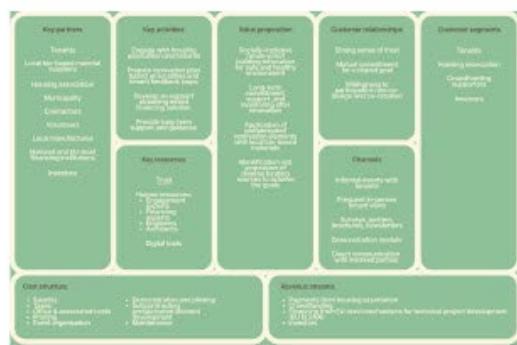
RENOVATION MEASURES

Energy & Structure:

- Prefabricated insulation of the outer side walls
- Prefabricated insulation of the indoor apartments
- Floor insulation
- Ceiling insulation
- Window glass and frame installation
- Balcony movable glass installation
- Mechanical ventilation installation
- Pipe system update



BUSINESS MODEL CANVAS



As the one-stop shop for prefabricated building renovation projects, Build Bright focuses on developing tailored solutions with localities integrated into the project design and implementation. Build Bright offers a range of financing solutions, including crowdfunding, investor matching, and various banking options. The cooperation results in a long-term partnership between all the stakeholder groups.



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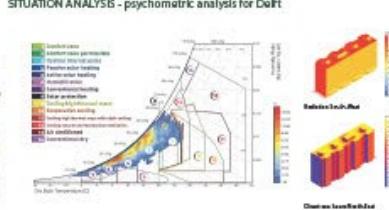
TU Delft

BUSINESS MODEL



HUMAN BEHAVIOUR AND DECISION MAKING

HUMAN BEHAVIOUR AND DECISION MAKING



KEY POLICIES drivers shaping our business model:

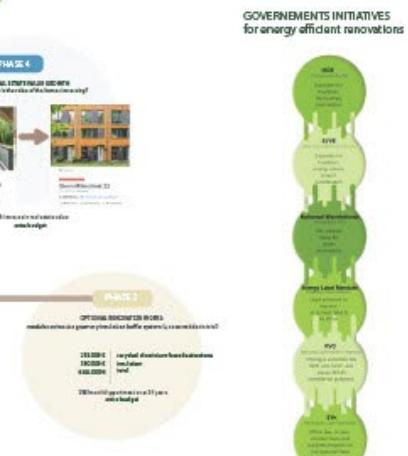
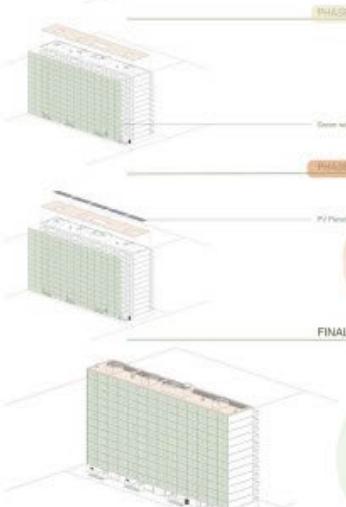
KEY POLICIES drivers shaping our business model:
"We'll support leading-edge decarbonisation efforts across the value chain and drive down
polycarbonate carbon footprint more rapidly and more deeply."



RENOVATION STRATEGIES



RENOMINATION JOUEN

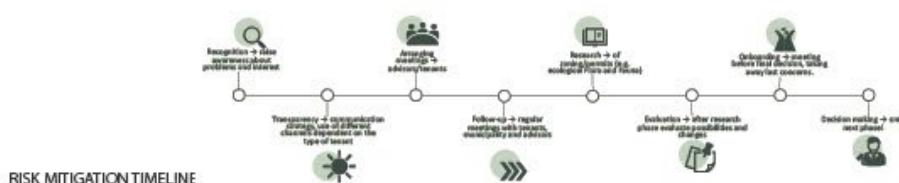
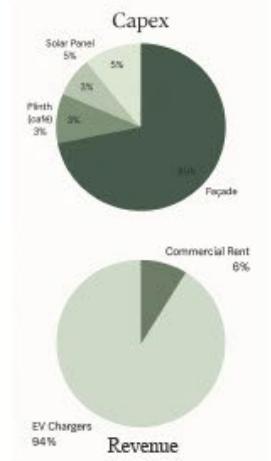
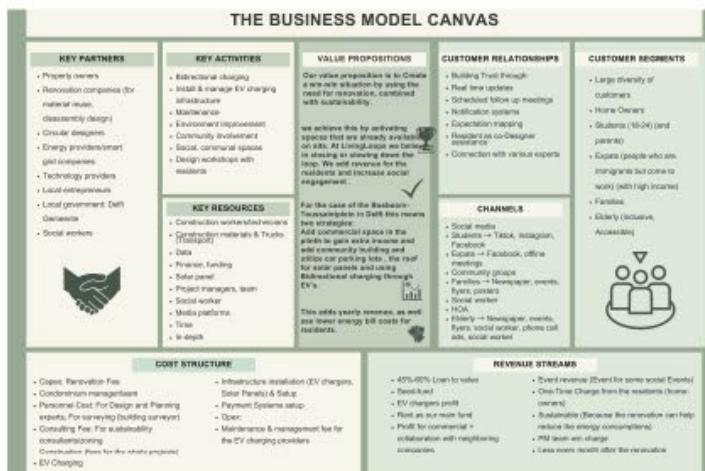
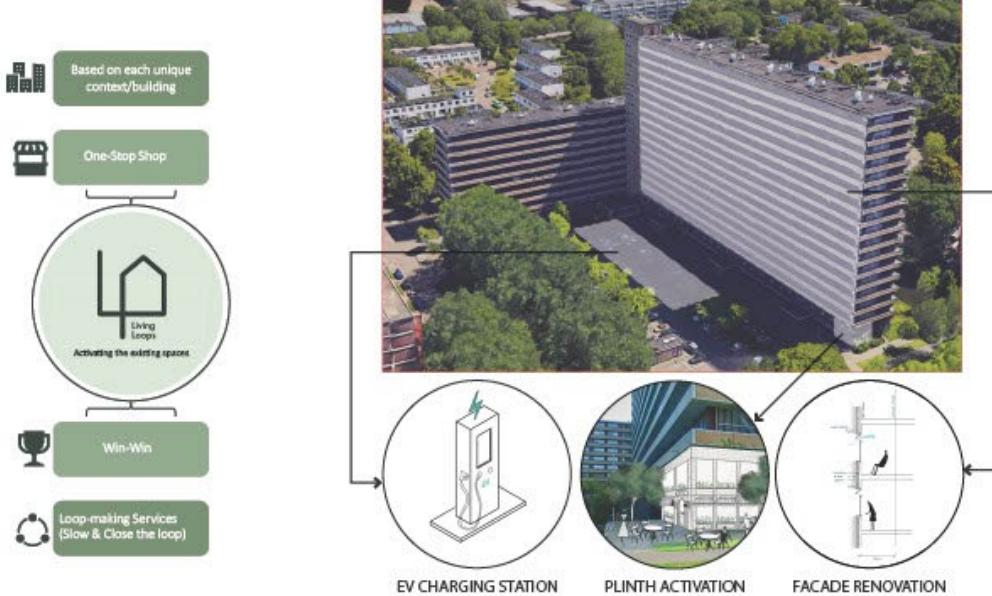


Bosboom-Toussaintplein 17-280 (VvE)

LivingLoops: Thomas van den Eeckhout, Peyvand Taremi, Cecilia Cloe Tarrús Huerta, Kelly Wu, Thada Su, Lara Sameeh Shoukry Sobhey

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RISK MITIGATION TIMELINE

Thank You

We would like to extend our sincere gratitude to everyone who contributed to the success of SHEP 2025: our participants, supporting partners, academic collaborators and university representatives, lecturers and experts, and especially the entire organizing team and tutors. Your dedication, effort, and commitment have been invaluable. We deeply appreciate your engagement and support.

Dankwoord

Wij willen iedereen hartelijk bedanken die heeft bijgedragen aan het succes van SHEP 2025: de deelnemers, de ondersteunende partners, de academische samenwerkingspartners en universiteitsvertegenwoordigers, de docenten en experts, en in het bijzonder het gehele organisatieteam en de tutors. Wij waarderen jullie inzet, ondersteuning en betrokkenheid enorm.

SHEP26 will take place 30 June – 10 July in Delft, The Netherlands

Team and organization for SHEP2025
Summer school coordinators:
Queena Qian & Ad Straub & Ragy Elgendi
Organizing committee:
Eline Baert & Sun Ah Hwang
Scientific Committee:
Henk Visscher & Erwin Mlecnik
Secretary:
Amanda Hagman & Meike Straver-Datema

