

INDU-ZERO TU Delft

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Rahmenlos i



**Smart
Renovation
Factory**
by INDU-ZERO

Interreg
North Sea Region
INDU-ZERO

European Regional Development Fund



EUROPEAN UNION

Green Deal Europe

Achieving Climate Neutrality – Renovation wave

- **2030 – 55% CO2 reduction**
- **2050 – CO2 neutral**
 - Buildings responsible:
 - 40% energy consumption
 - 36% greenhouse gas emissions
- **2030 – 35 million buildings renovated**
- **2050 – 152 million buildings renovated**
- **Need for an industrial approach at lower costs!**



The project

Partners and advisoryboard members



Other companies working with INDU-ZERO



Background

- **Interreg NSR**
- **4,4 Mln**
- **July 2018 - December 2021**
- **14 project organisations**
- **6 countries (NL, D, BE, S, N, UK)**
- **6 members advisory board**



Smart Renovation Factory

by INDU-ZERO

Interreg
North Sea Region
INDU-ZERO
European Regional Development Fund



EUROPEAN UNION

Renovation packages

3 archetypes (1955 until 1985)



Terraced



Semi-detached

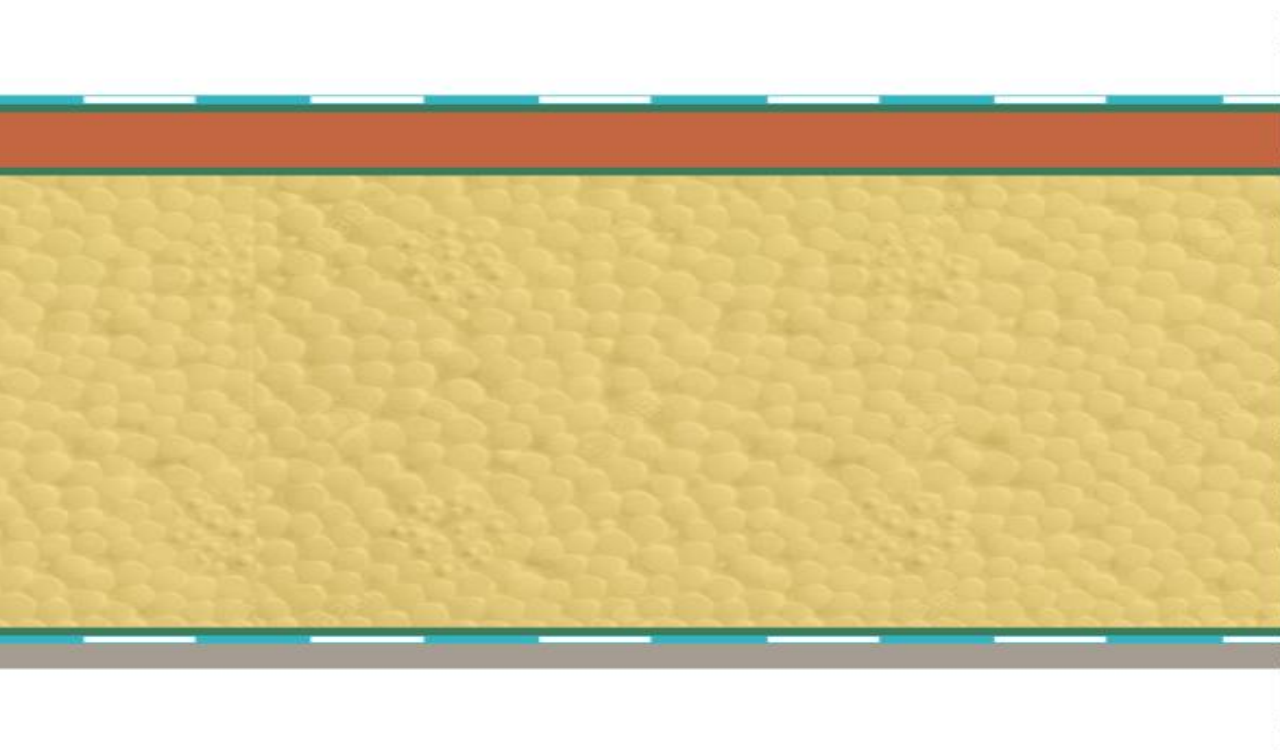


Apartment

Life cycle analysis

Selection of renovation system

Sandwich panel



Glass fibre polyester

Glue

Oriented strand board (OSB)

Glue

Expanded polystyrene (EPS)

Glue

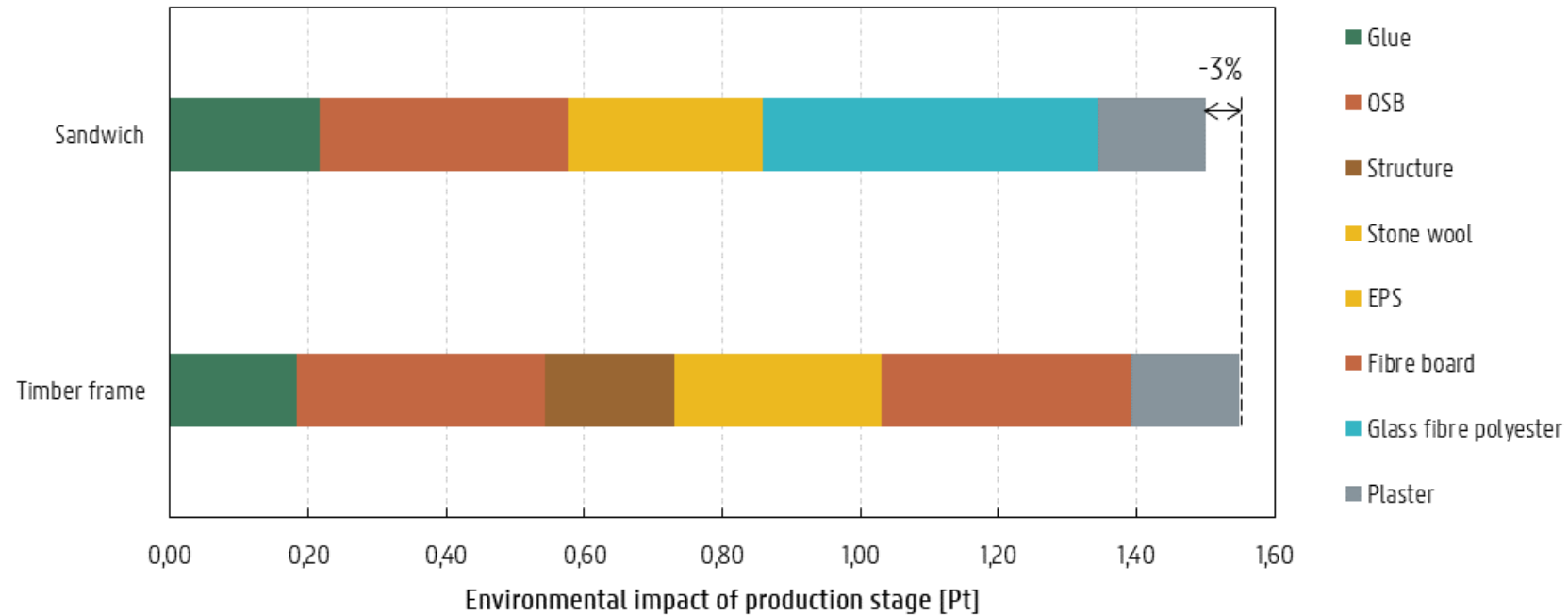
Glass fibre polyester

Base plaster

Glass fibre reinforcement

Cover plaster

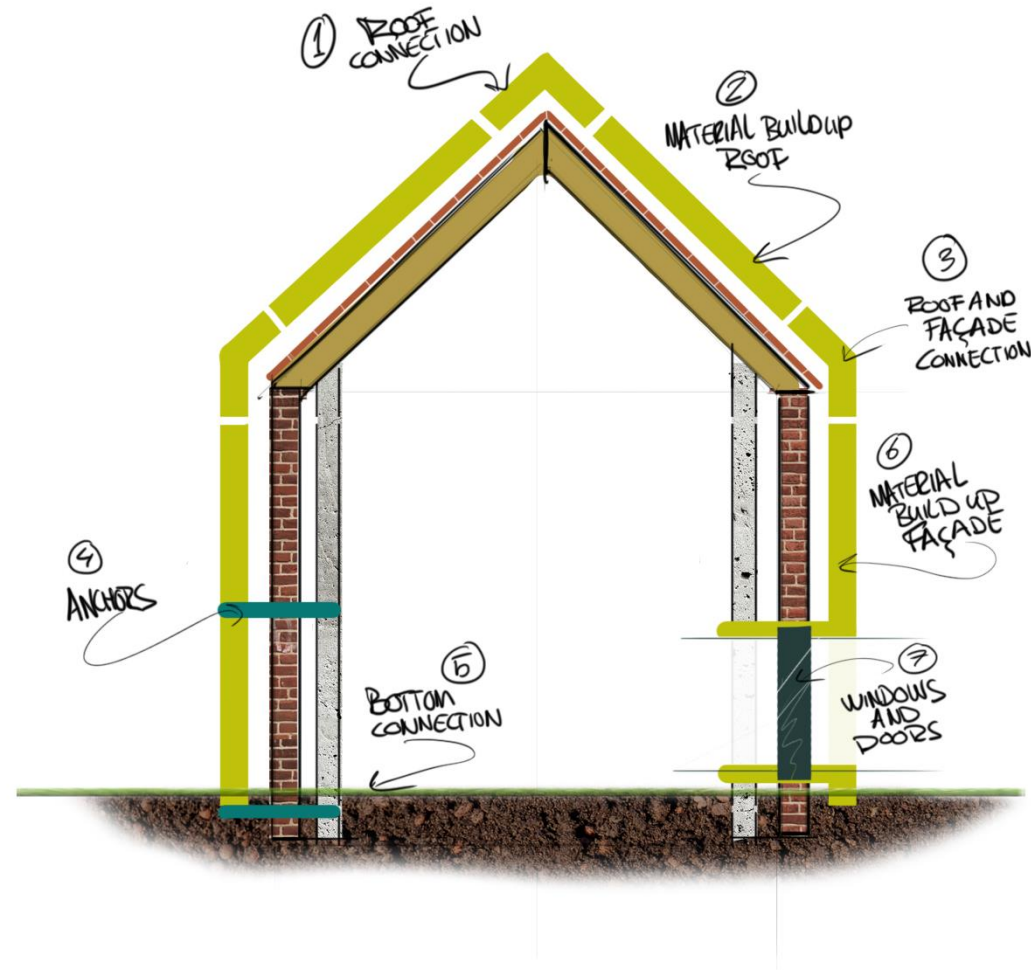
LCA -Selection of renovation system



Comparison between the environmental impact:

- Slight preference for sandwich panel

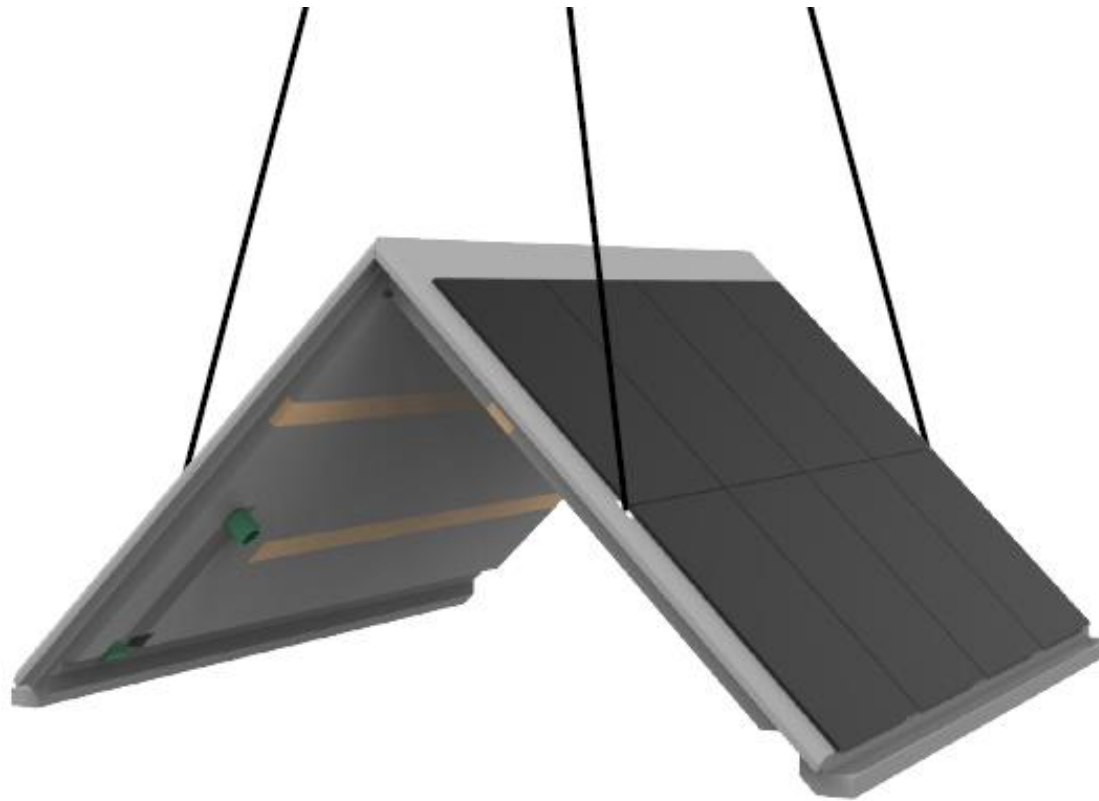
Product development



Development of the renovation packages

- New roof from RC panels

(Sandwichpanel)



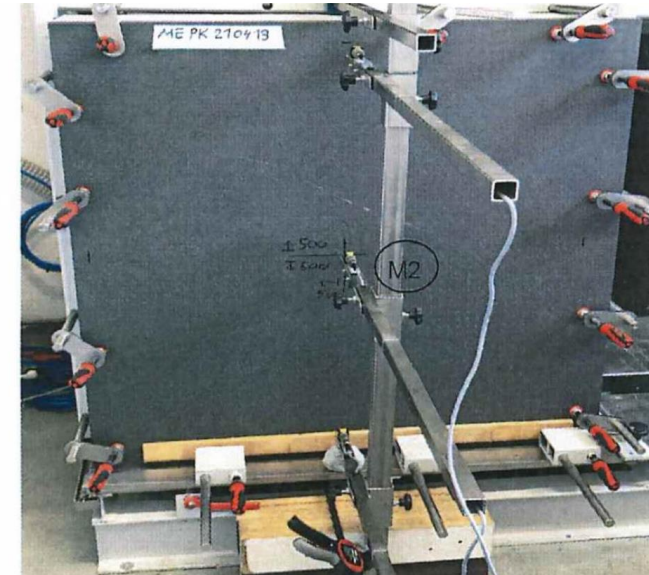
Development of the renovation packages

Building up of product (sandwich panel with low density and high density EPS)



HD EPS

$R_t =$	7,313
$U =$	0,137



Development of the renovation packages

- Anchor System

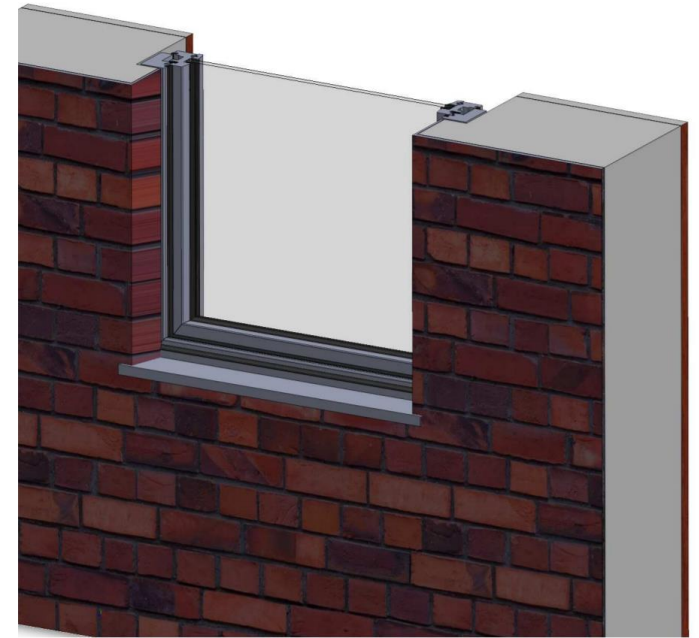


EASY TO
MOUNT
ANCHOR



Development of the renovation packages

- Frameless with vacuum glass and moving parts (open/close construction)



Impression of the Smart renovation factory

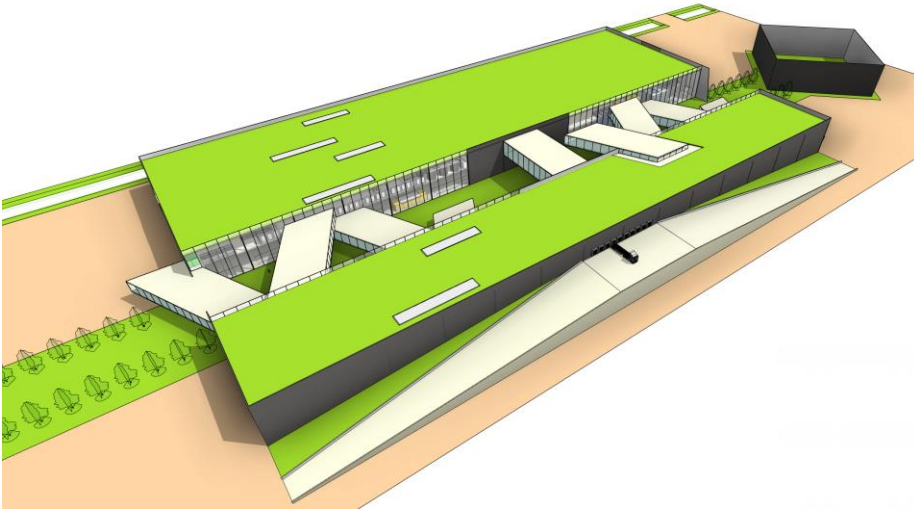
INDU-ZERO Smart factory



- **Factory: ca. 7 ha**
- **Total: 20 ha**
- **Overall tact time 2 min.**
- **540 elements produced/day**
- **Inbound & Outbound Logistics**
- **≈ 150 trucks per day**
- **400 employees**

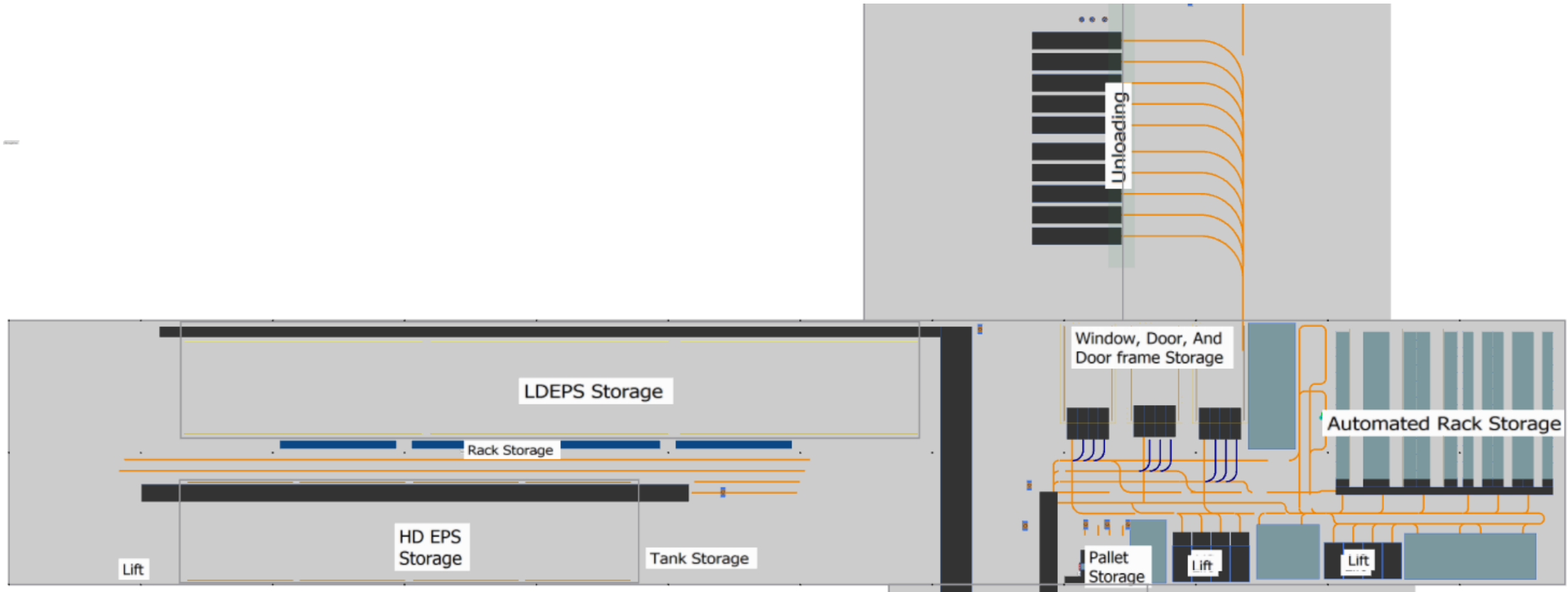
Factory

- Visitors center & Building nature inclusive

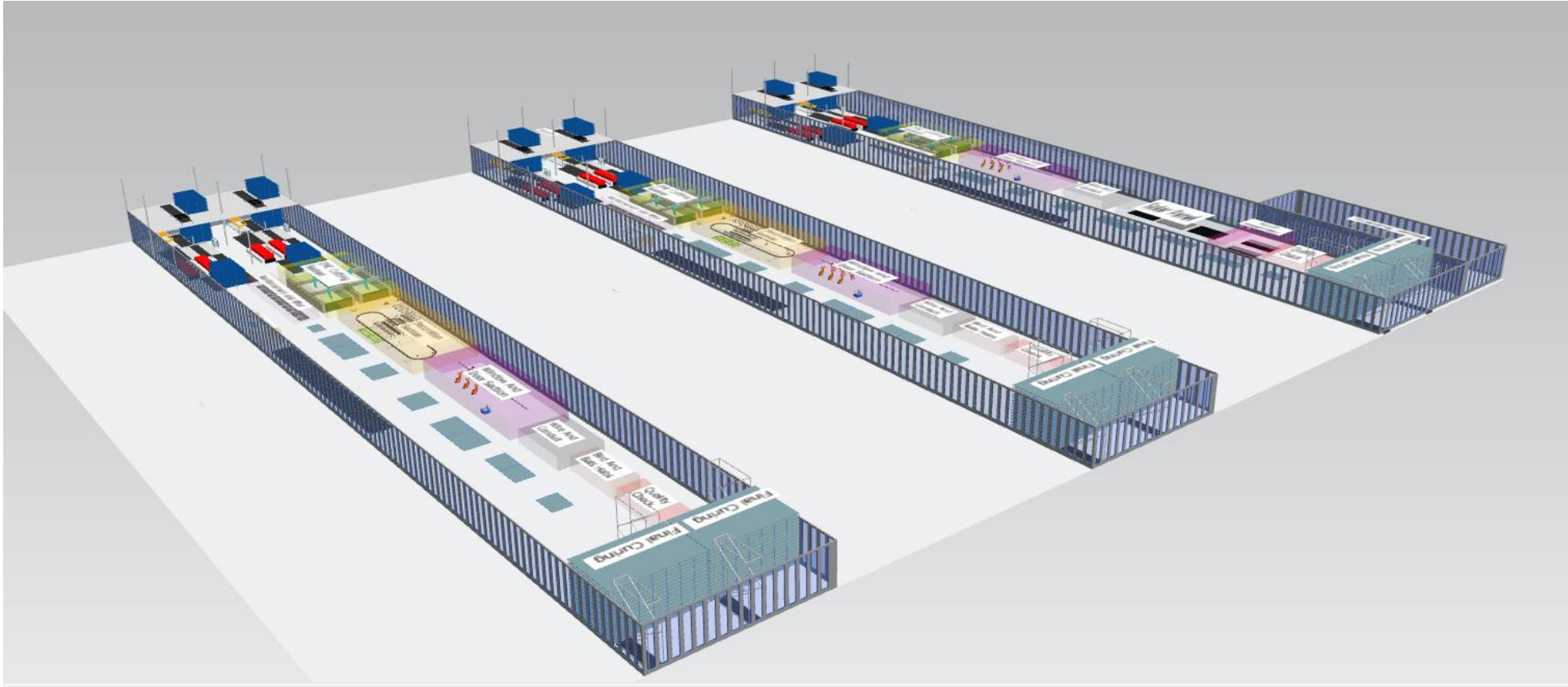




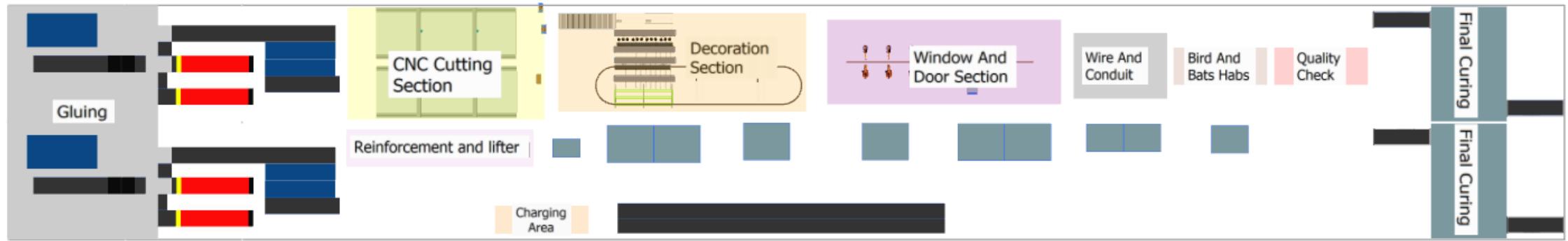
Warehouse (Top floor)



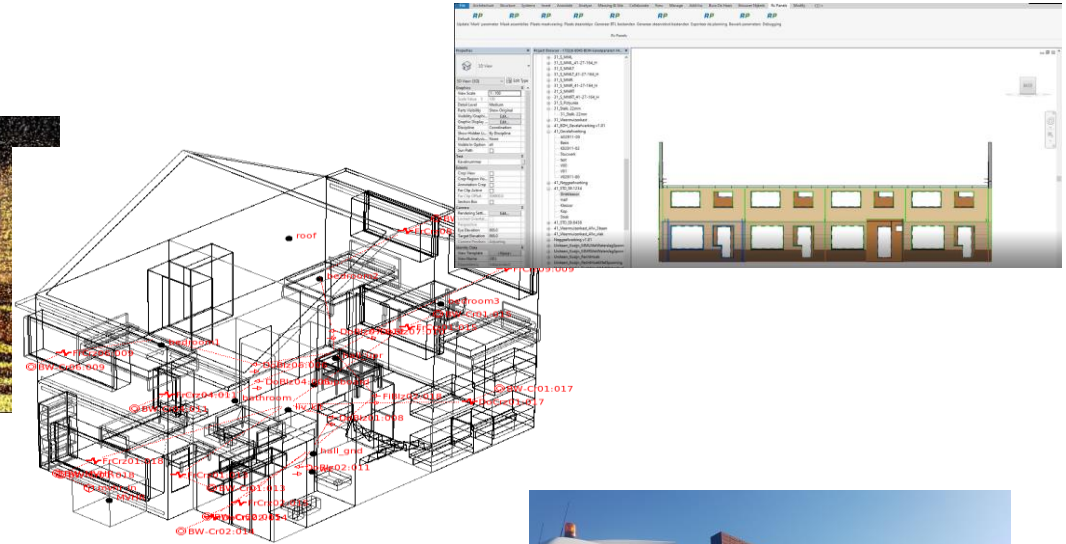
Production (Ground floor)



Production (Ground floor)



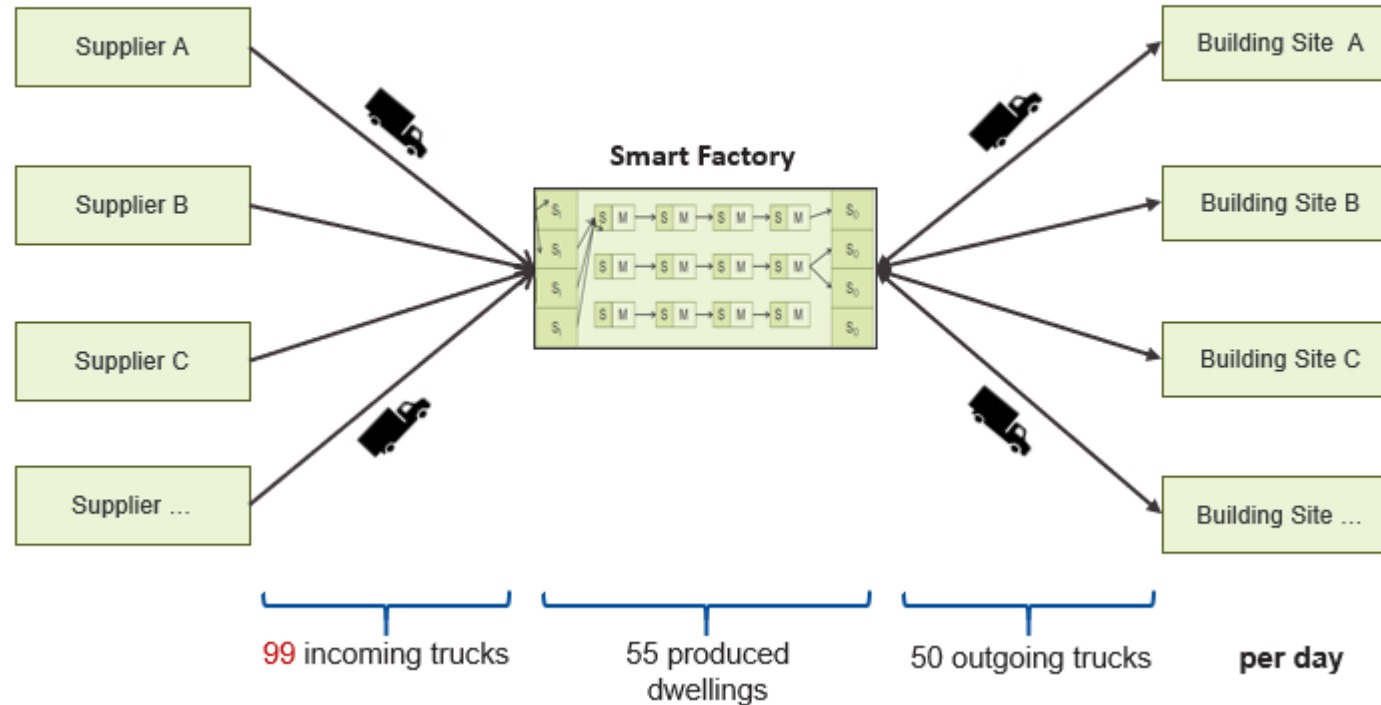
Data stream



Logistics

Logistics

How do we handle 149 truck arrivals per day?

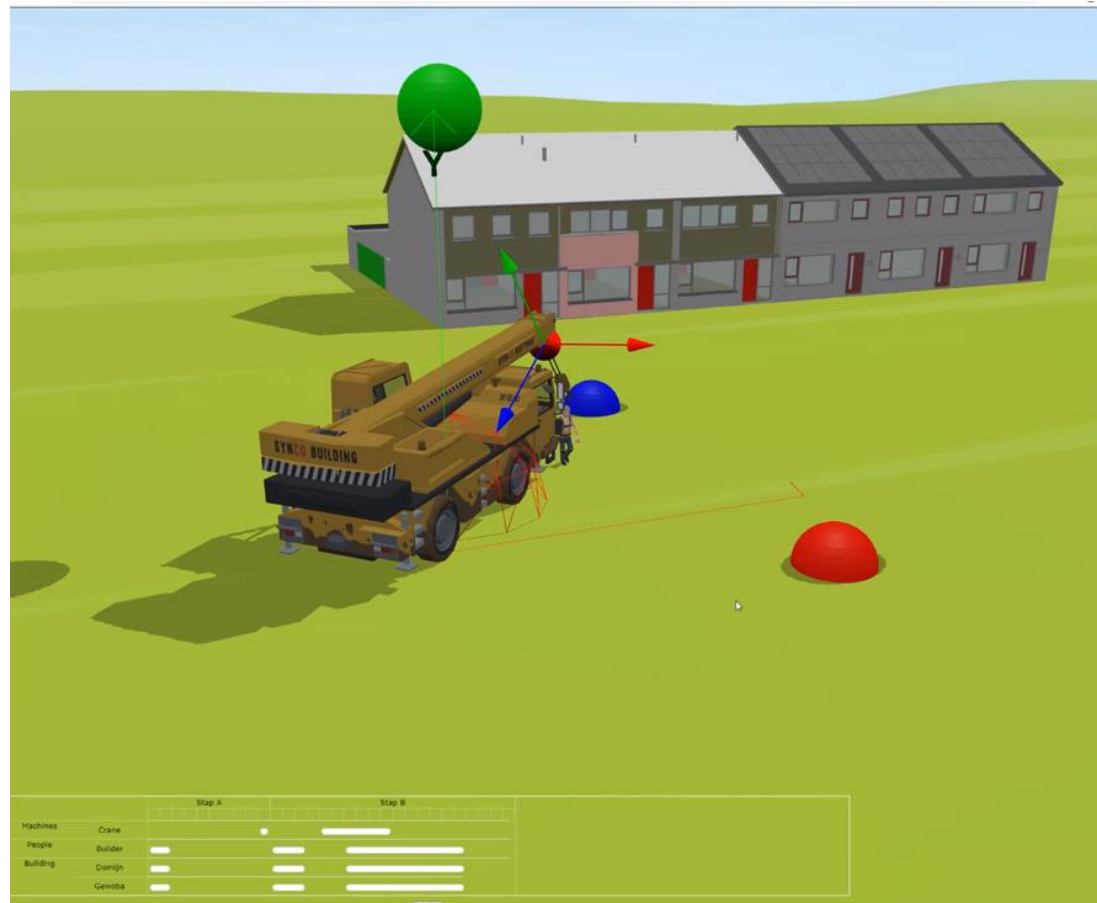


On-site mounting



- **Goal: Renovation ready within 3 days with 5 workers (terraced house)**
—> **1022 workers/year**
- **Tenants can stay at home**

Web based trainings tool – building site



Examples of renovations

Examples of renovations



Showcase renovation

Terraced houses from Domijn in Enschede / NL

- Net Zero renovation
- 3 different types of installations
- New developments
- 2 houses with tenants 1 showcase house



Virtual showcases

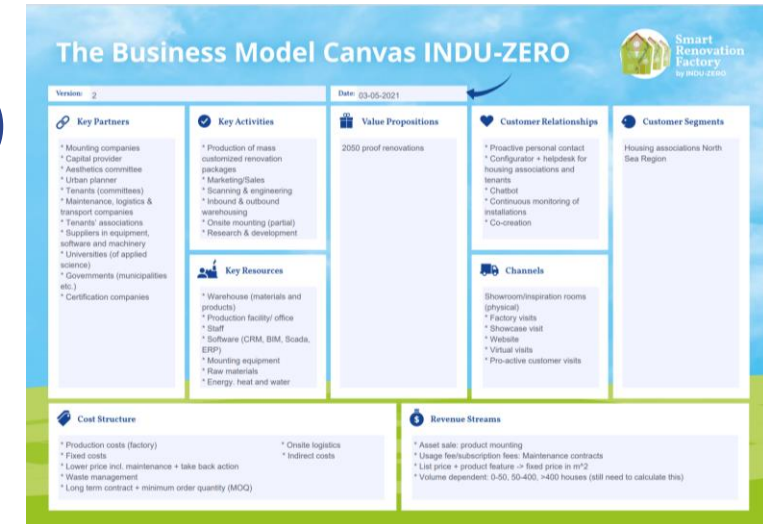
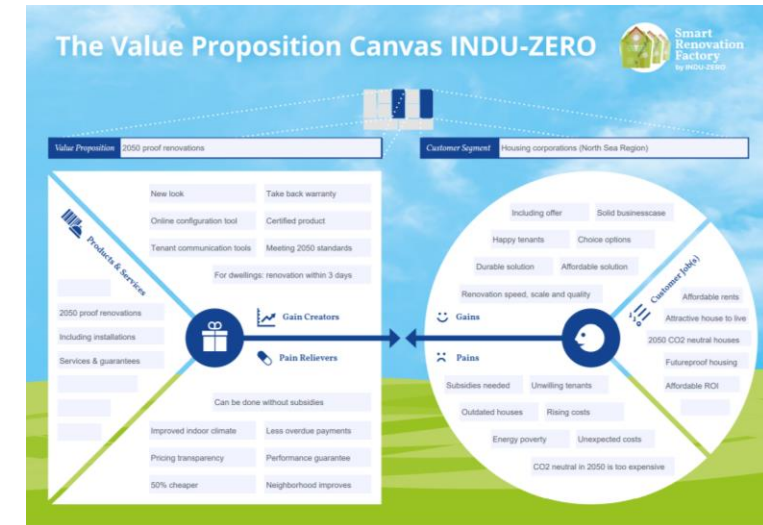
- 2 type of buildings
- In 4 regions (Benelux, D, Scandinavia and the UK)



Business case

Business Case von der Fabrik

- Business Model Canvas
- Value propositions
- Customer and market research (NL/D)
- Product / Service recommendation
- Break-even-calculation
- Total cost of ownership calculation



Take home message

Take home message

Industrial Net Zero renovations for half the current price!

- <https://northsearegion.eu/indu-zero/>
- **End event – 7 October 2021**
- **INDU-ZERO newsletter**
- **Webinars / Video's – Next external webinar 25 May 2021**
- **Reports**



Ulla-Britt Krämer

Questions?