Reusing existing envelopes

Kevin Janczyk

PROGRESS webinar 1, 07.05.2020

Reusing existing, single storey steel buildings

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Motivation for Sustainable Construction

- The building sector (worldwide) is responsible for

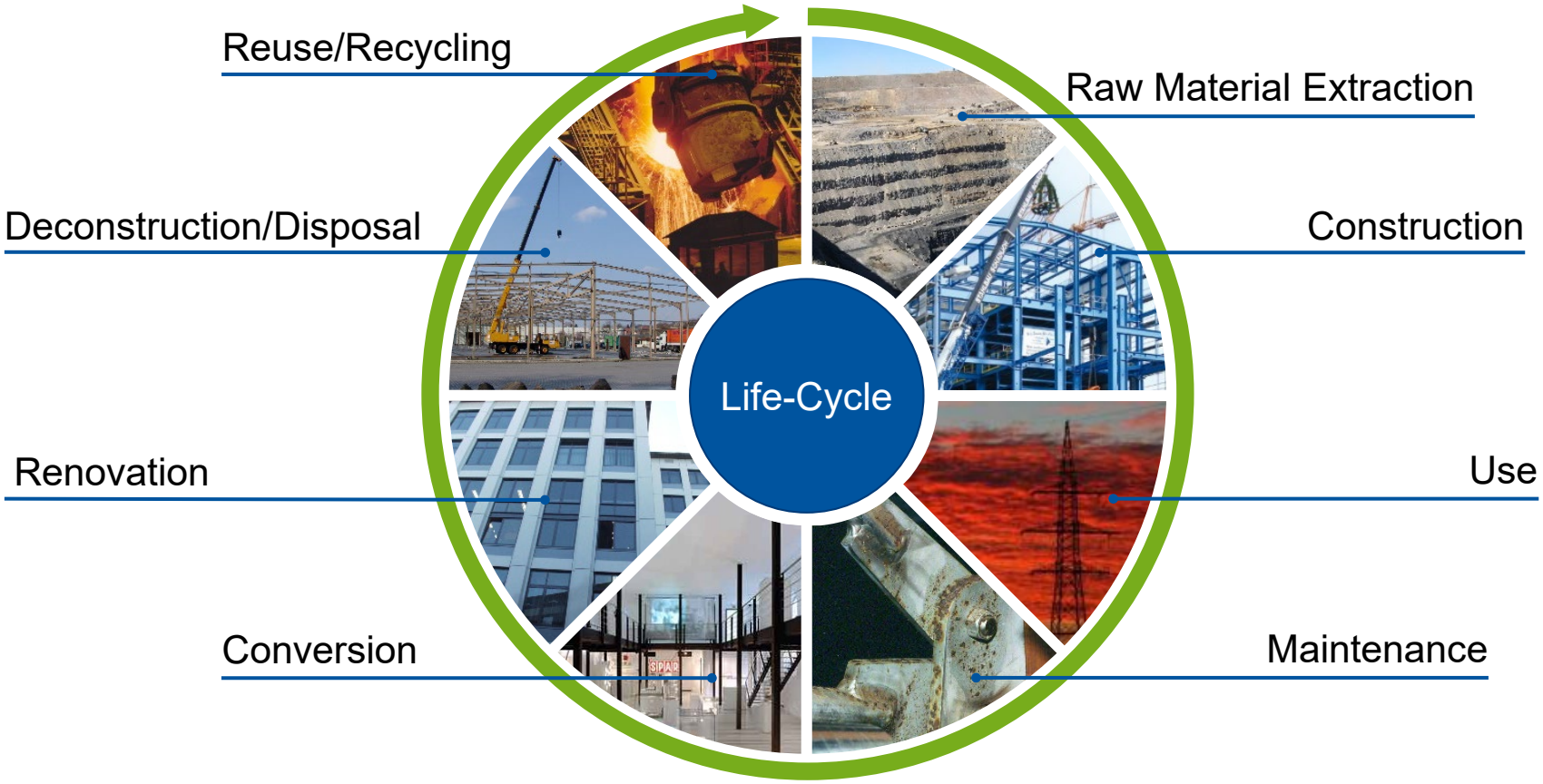
17%	25%	33%	30-40%	40-50%
of fresh water consumption	of timber use	of CO_2 emissions	of energy use	of raw material consumption





- Sustainable planning, construction and operation of the built environment
- Saving resources during construction and operation

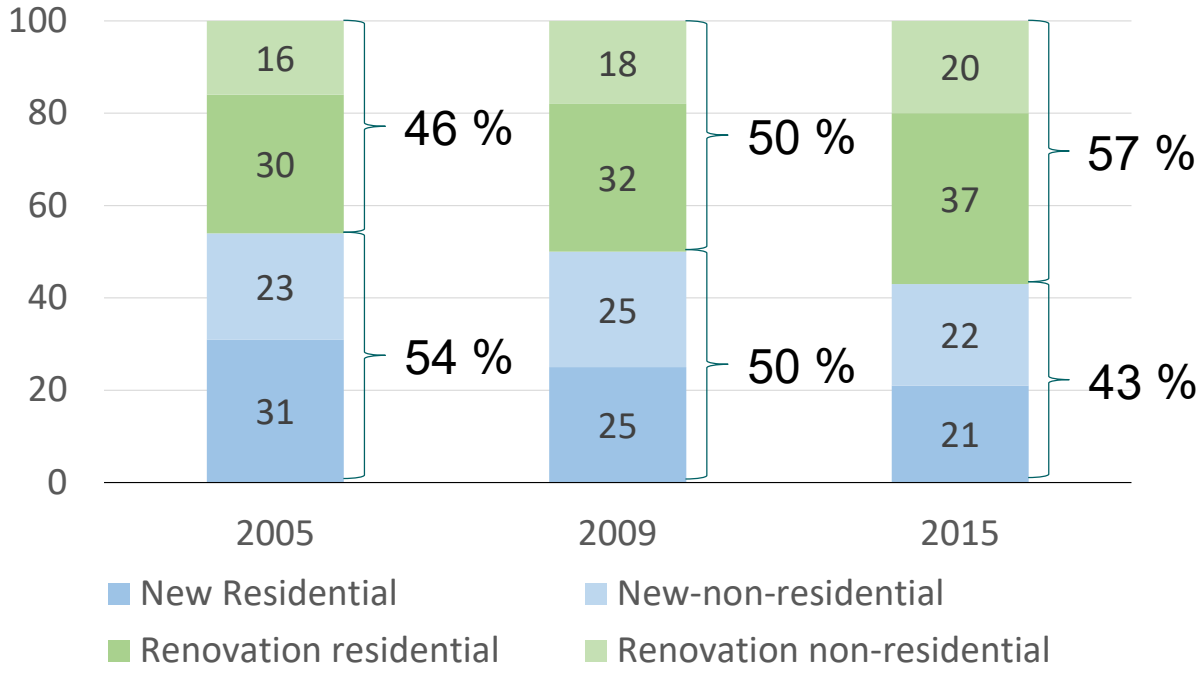
Sustainable Construction



European Building Stock Data

Renovation market

- The renovation market overtook the market for new buildings since 2010
- Market share per building segment in European countries:



OPENEXP (2016)

EU-RFCS Project „PROGRESS“

PROvisions for Greater REuse of Steel Structures

- Project duration 36 months (1.6.2017 - 31.5.2020)
- Focus on single-storey steel buildings
- Existing and future buildings
- Design from reused elements
- Design for improved reusability

Reuse case study buildings

- Seminar Building RWTH Aachen

Thermal Power Plant

Seminar Building

Reuse case study buildings

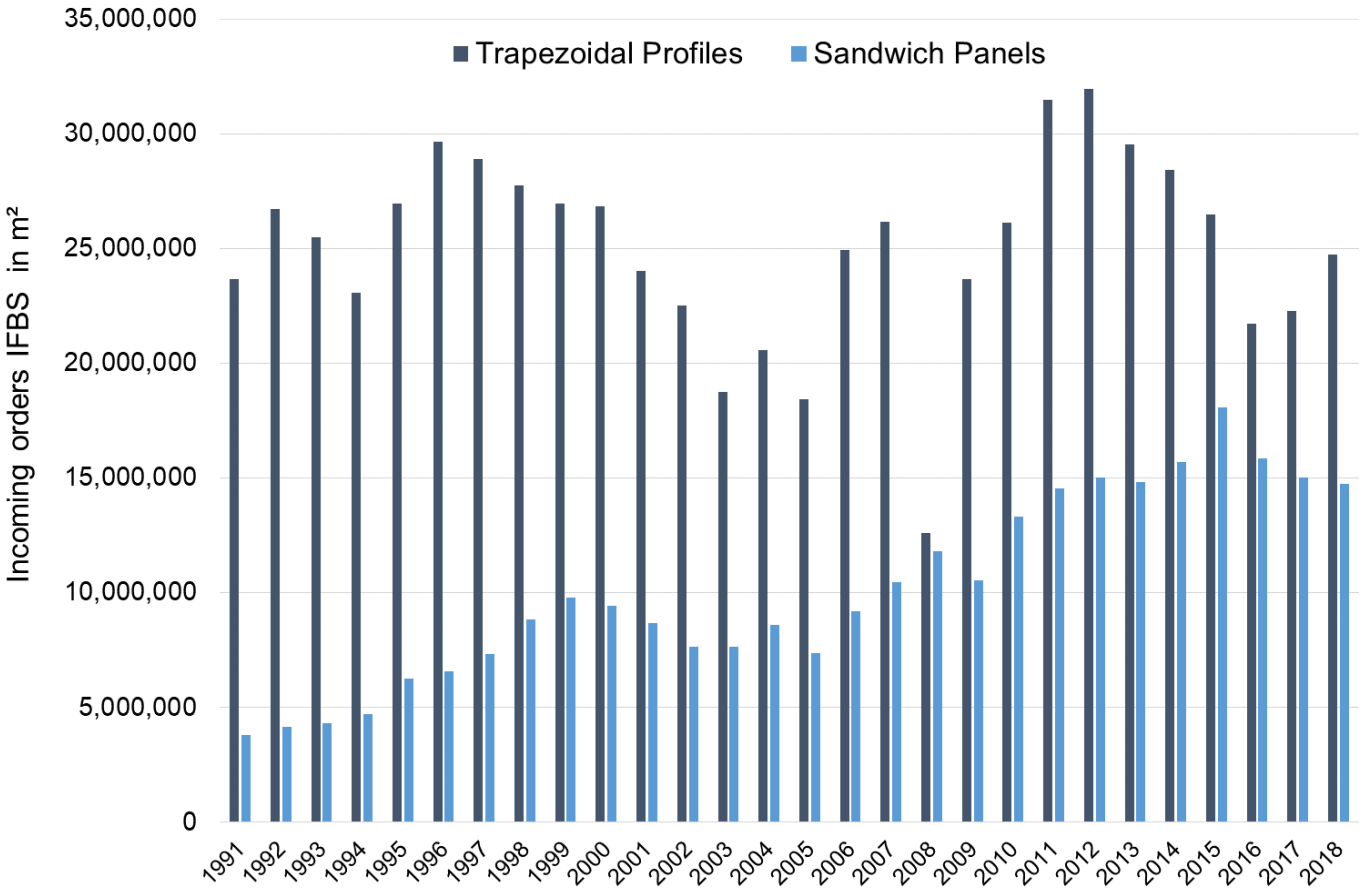
- Seminar Building RWTH Aachen

Reuse case study buildings

- Seminar Building RWTH Aachen

Reuse of steel cladding systems

Market Analysis Germany 1991 - 2018



TP 700 Mio m²

SP 300 Mio m²

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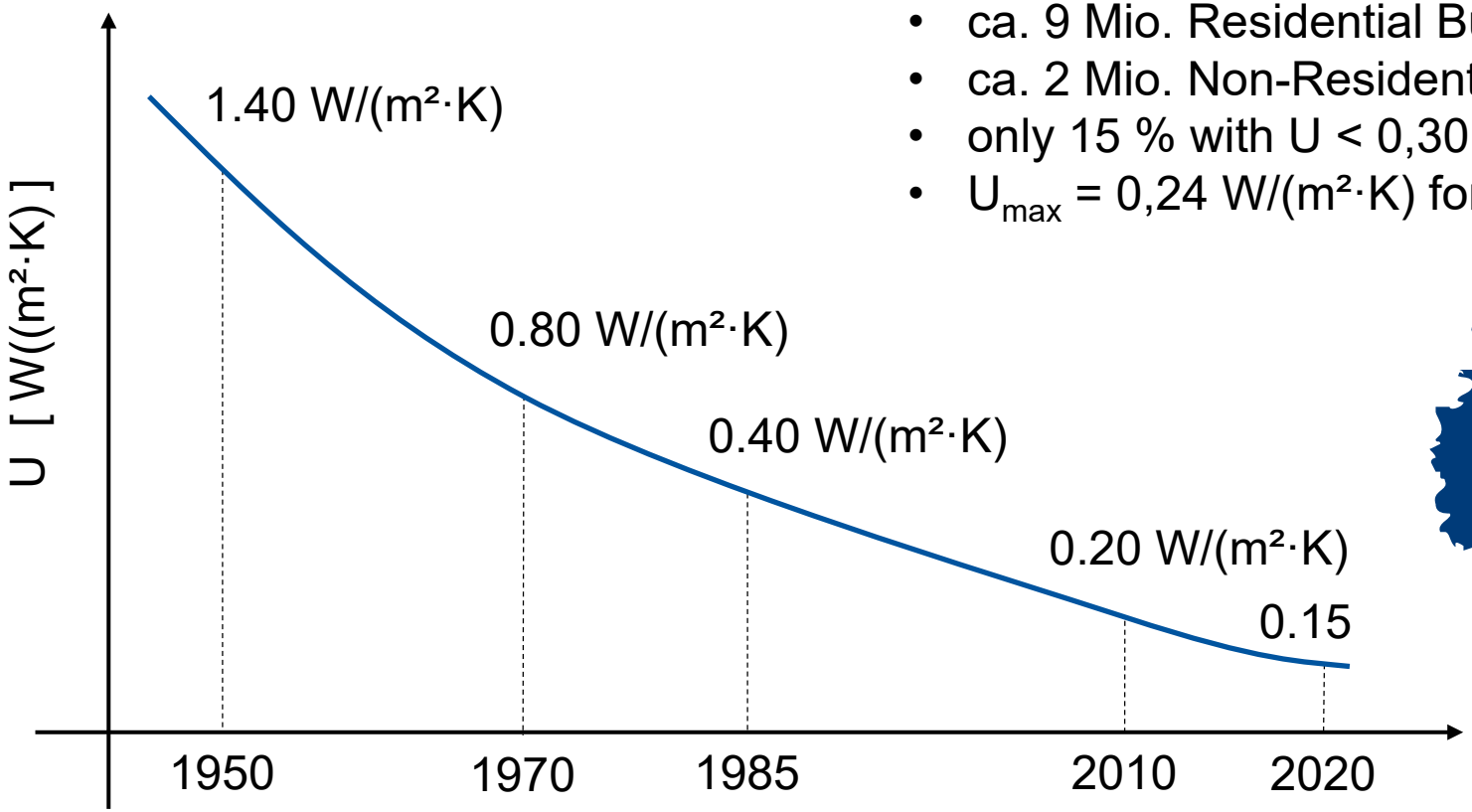
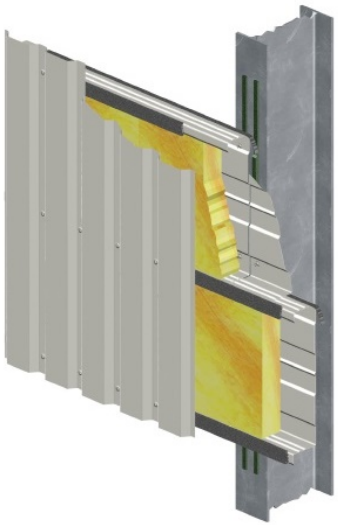
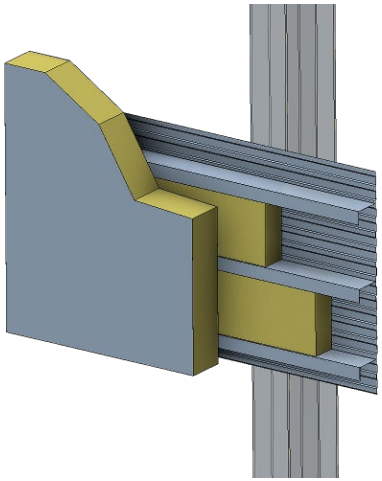
Energy Efficiency – Developing of requirements in Germany



- ca. 9 Mio. Residential Buildings
- ca. 2 Mio. Non-Residential Buildings
- only 15 % with U < 0,30 W/(m²·K)
- U_{max} = 0,24 W/(m²·K) for renovation

Reuse of steel cladding systems



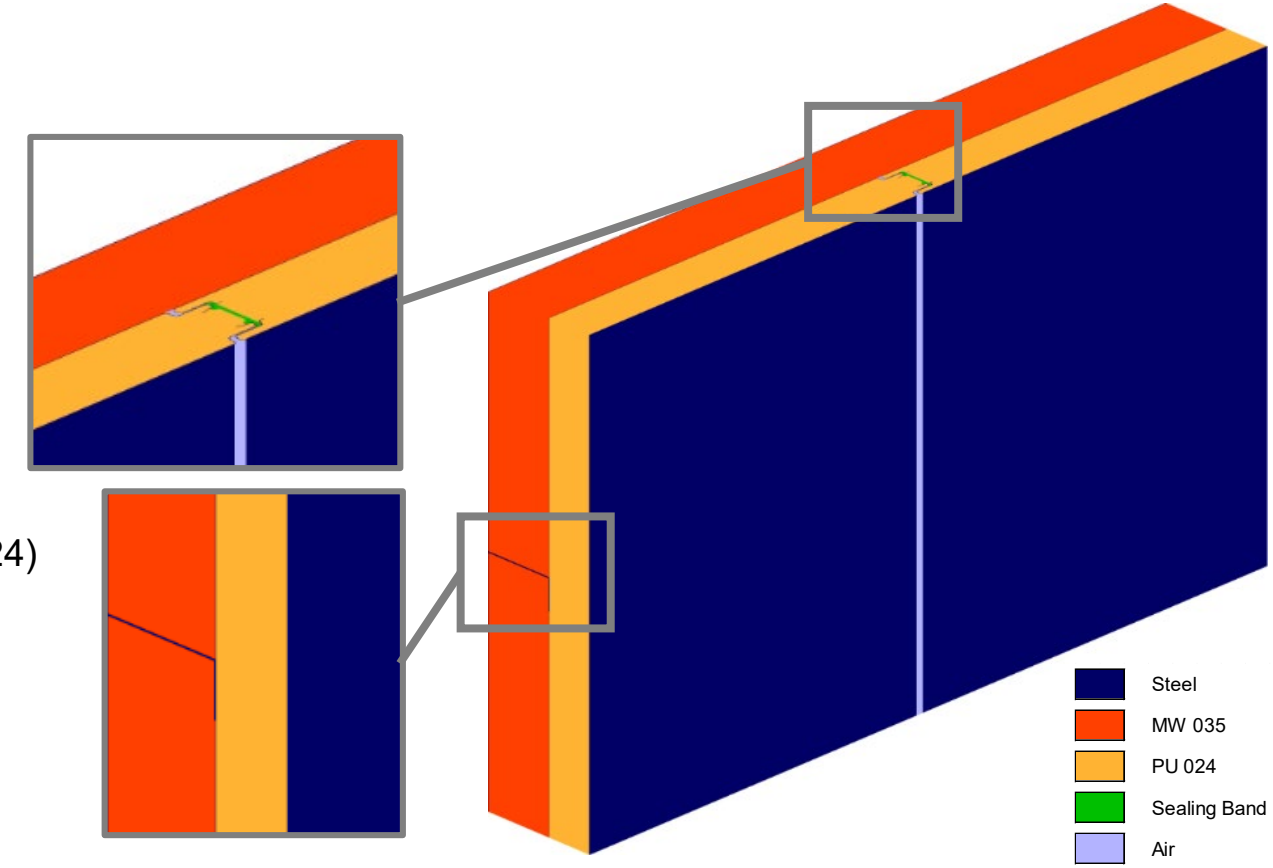


Reuse of steel cladding systems

Reuse of liner tray profiles and over-cladding with sandwich panels

Energetic aspects

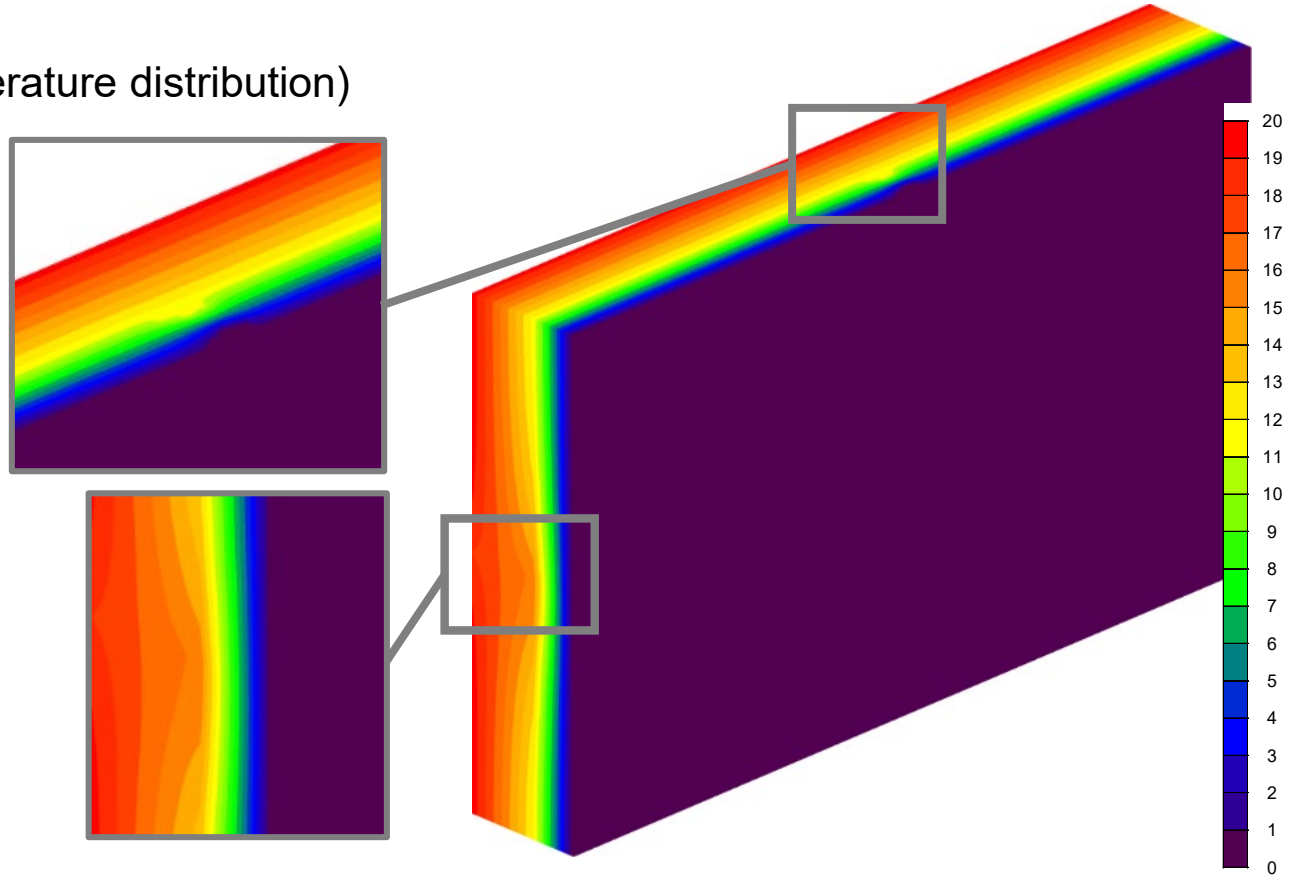
- Hybrid-Façade
  - FEM – Model
    - Existing Solution: Cassette Profile (100 mm ; MW 035)
    - Hybrid Solution: Existing Cassette (100 mm ; MW 035) plus Sandwich Panel (type I, 60 mm, PU 024)



Reuse of liner tray profiles and over-cladding with sandwich panels

Energetic aspects

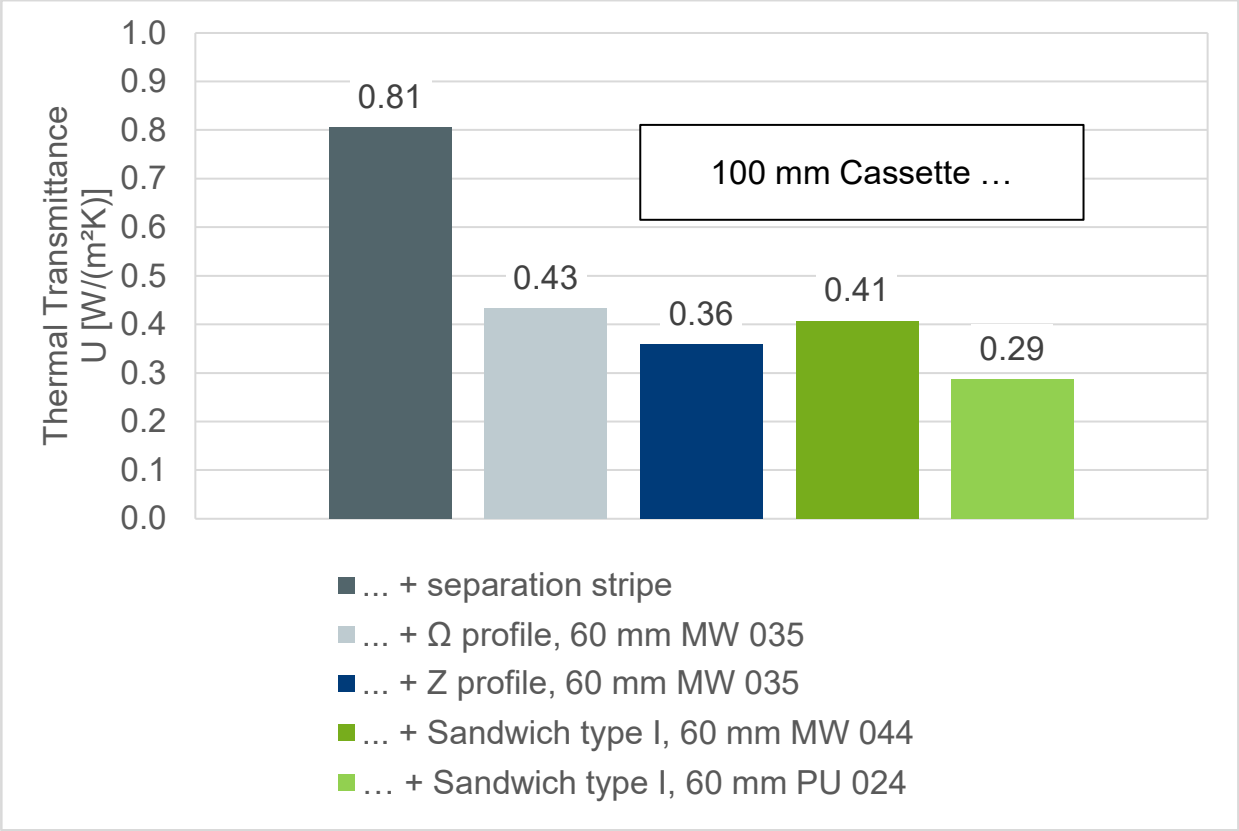
- Hybrid-Façade
  - FEM – Result (temperature distribution)
    - Existing Solution
      U = **0,81 W/(m²K)**
    - Hybrid Solution
      U = **0,29 W/(m²K)**



Reuse of liner tray profiles and over-cladding with sandwich panels

Energetic aspects

- Comparison of solutions



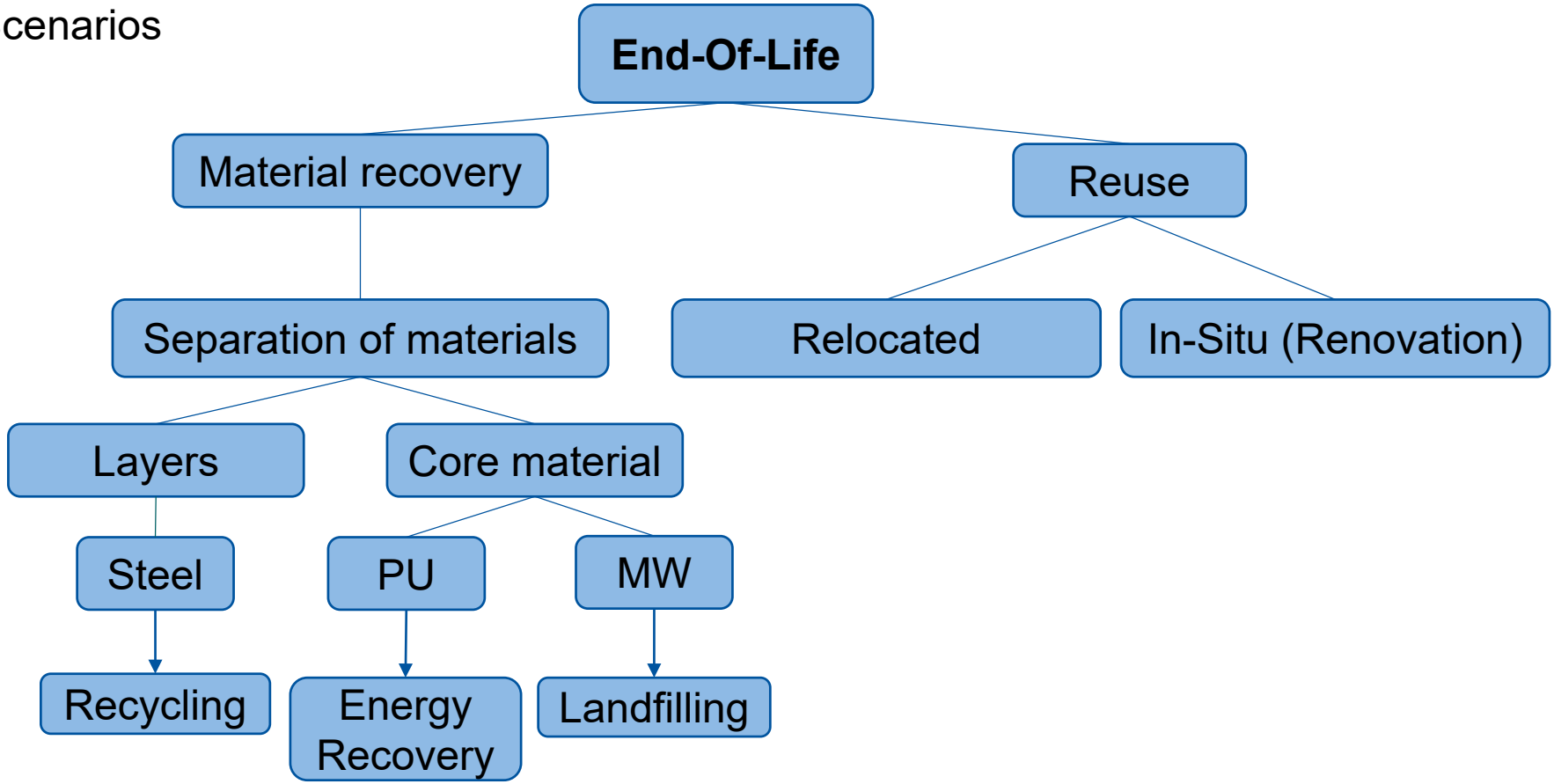
Reuse of Sandwich Panel Constructions

End-Of-Life of Sandwich Panels

- Separation of materials on construction site

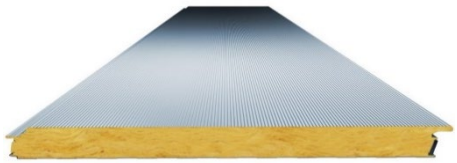
End-Of-Life of Sandwich Panels

- Scenarios



End-Of-Life of Sandwich Panels

- State-of-the art
  - End of Life scenarios according to Environmental Product Declarations



Double skin steel faced sandwich panels with a core made of polyurethane

End of life (C1-C4)

Name	Value	Unit
Collected separately waste type	13.3	kg
Recycling	8.3	kg
Energy recovery	4.3	kg
Landfilling	0	kg
Scrap content (not credited)	0.7	kg

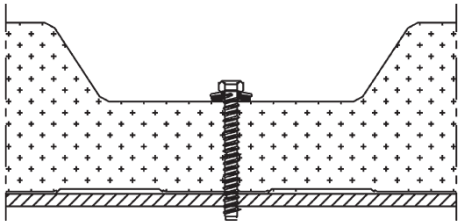
Double skin steel faced sandwich panels with a core made of mineral wool

End of life (C1-C4)

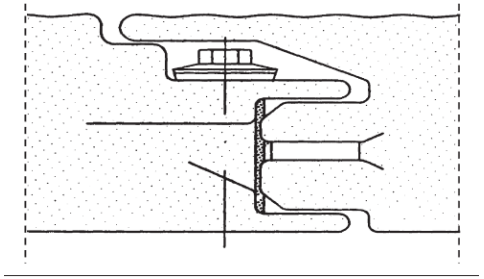
Name	Value	Unit
Collected separately waste type	20.2	kg
Recycling	8.1	kg
Energy recovery	0	kg
Landfilling	11.4	kg
Scrap content (not credited)	0.7	kg

Challenges for Reuse of Sandwich Panels

- Screw holes
  - “Push through mounted fastener” are usually used
  - Connection to the substructure is a direct or hidden fixation



direct fixation

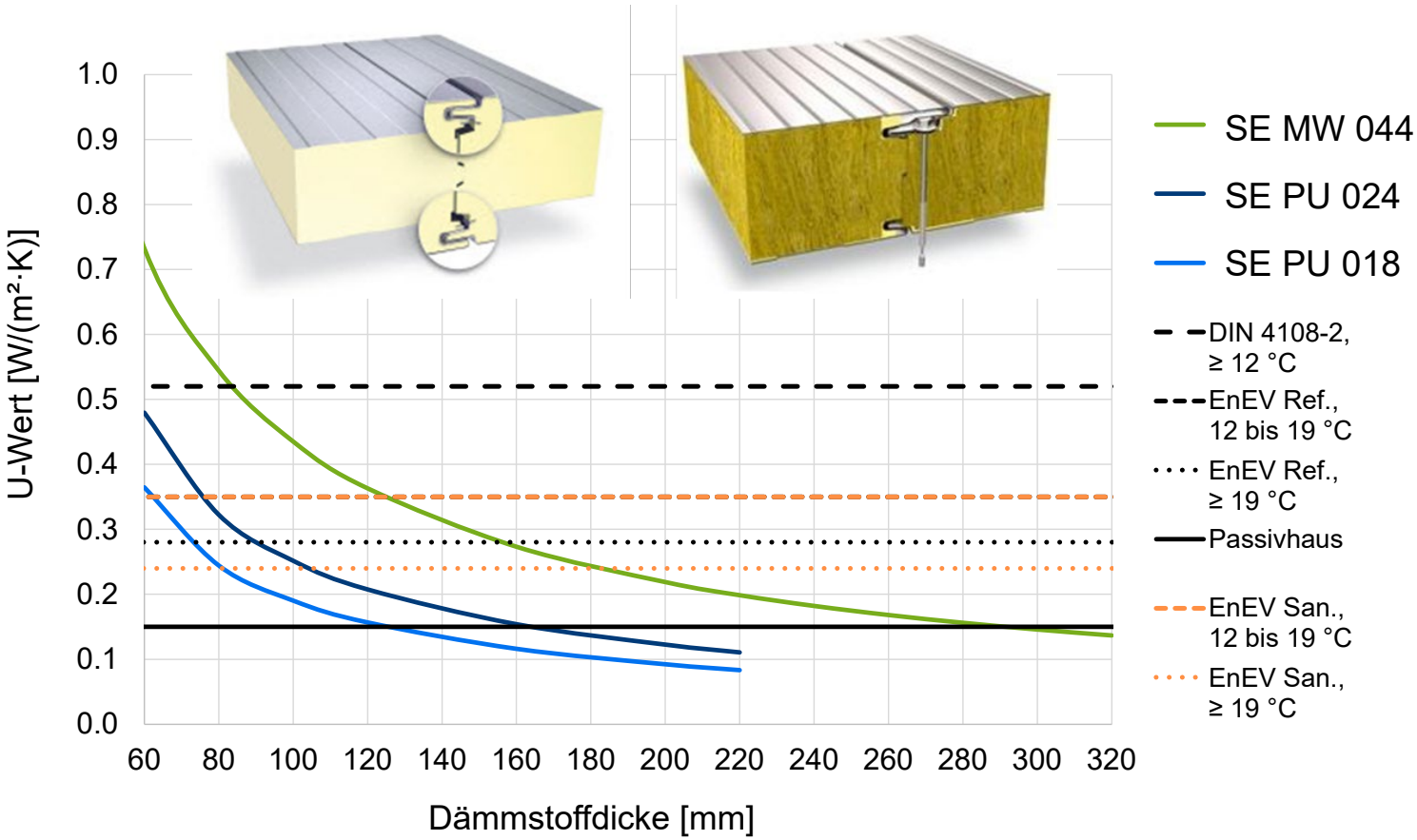


hidden fixation

- Outer layer is aesthetical not sufficient

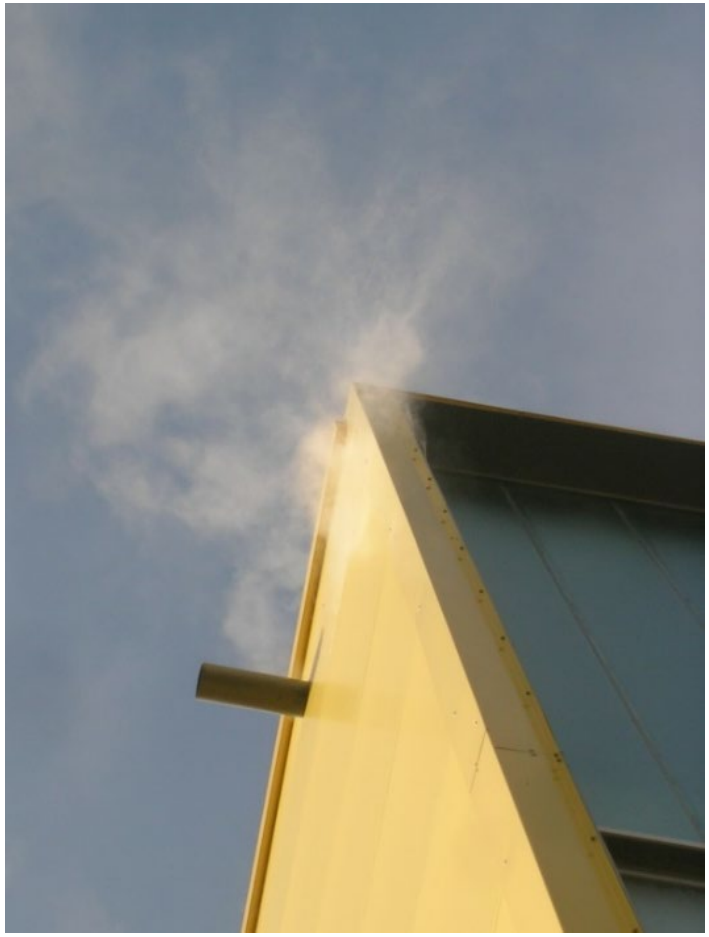
- Insufficient thermal performance and airtightness

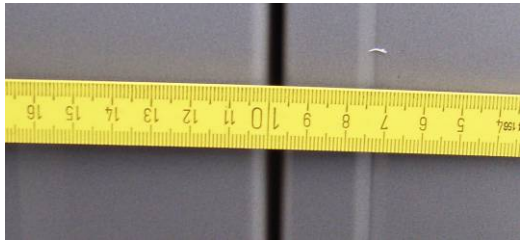
Thermal Performance – Requirements in Germany

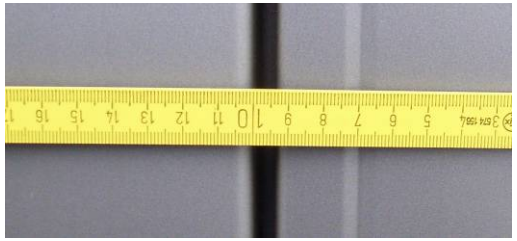


Reuse of Sandwich Panel Constructions

Airtightness

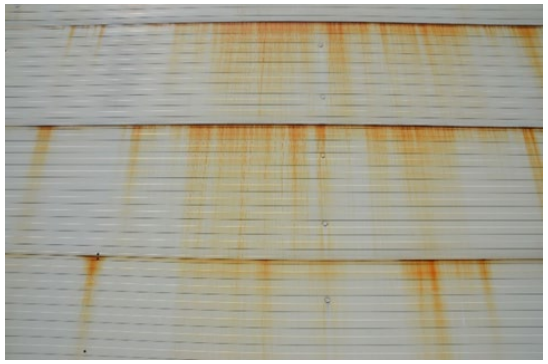






Reuse of Sandwich Panel Constructions

Over-cladding sandwich panel construction



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