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Arbeitsbereich für
Energieeffizientes Bauen

outPHit

Serial Renovation of an University Building

Bruno-Sander-Haus – outPHit observer project

Point cadrage : conférence Rénovation 29/3

Assoz. Prof. Dr.-Ing. Rainer Pfluger
University of Innsbruck
Unit: Energy Efficient Building

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 957175. The presented contents are the author's sole responsibility and do not necessarily reflect the views of the European Union. Neither the EASME nor the European Commission are responsible for any use that may be made of the information contained therein.

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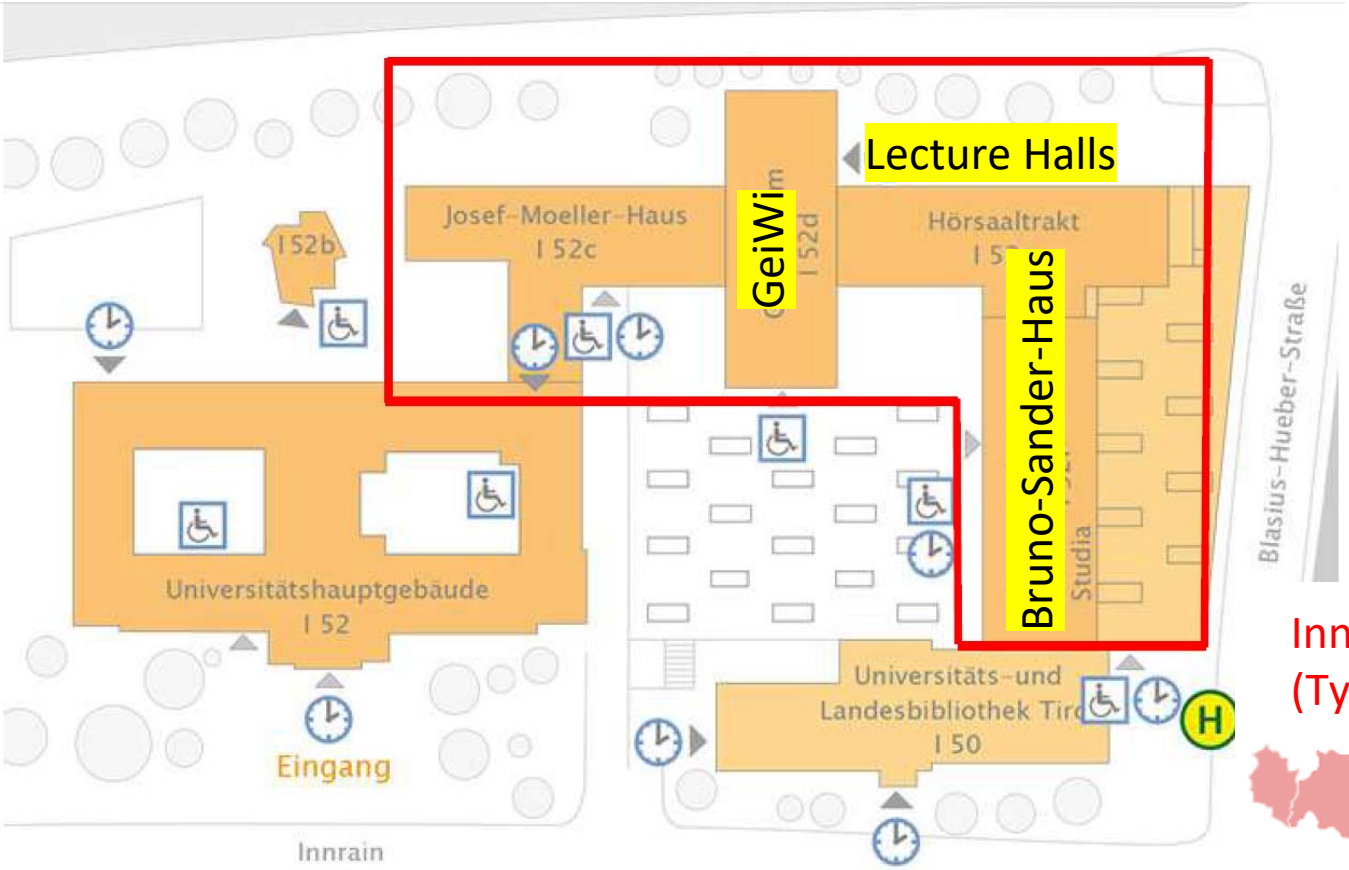
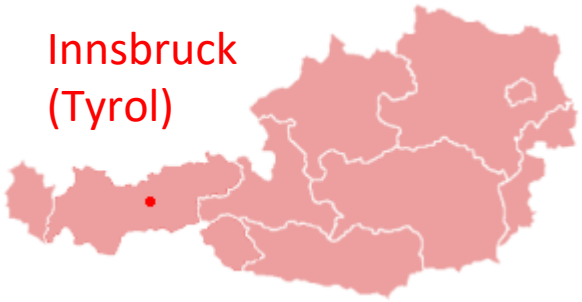
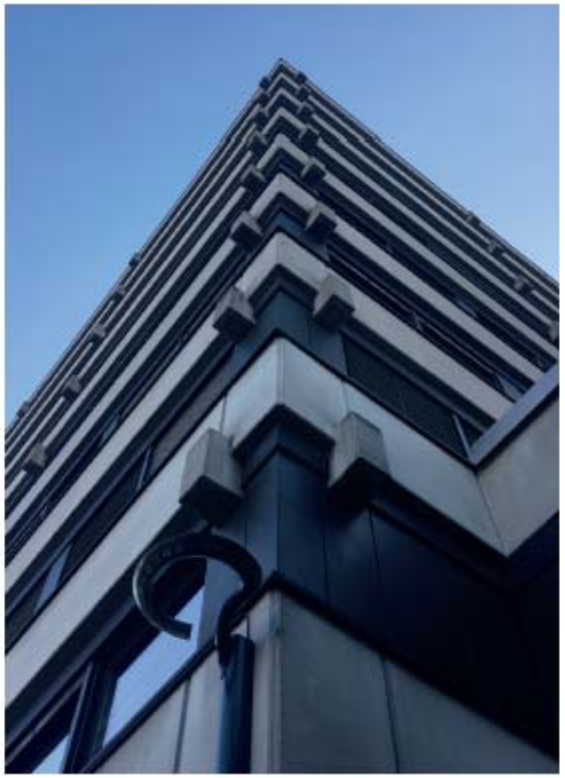
Site Plan (University of Innsbruck, Austria)

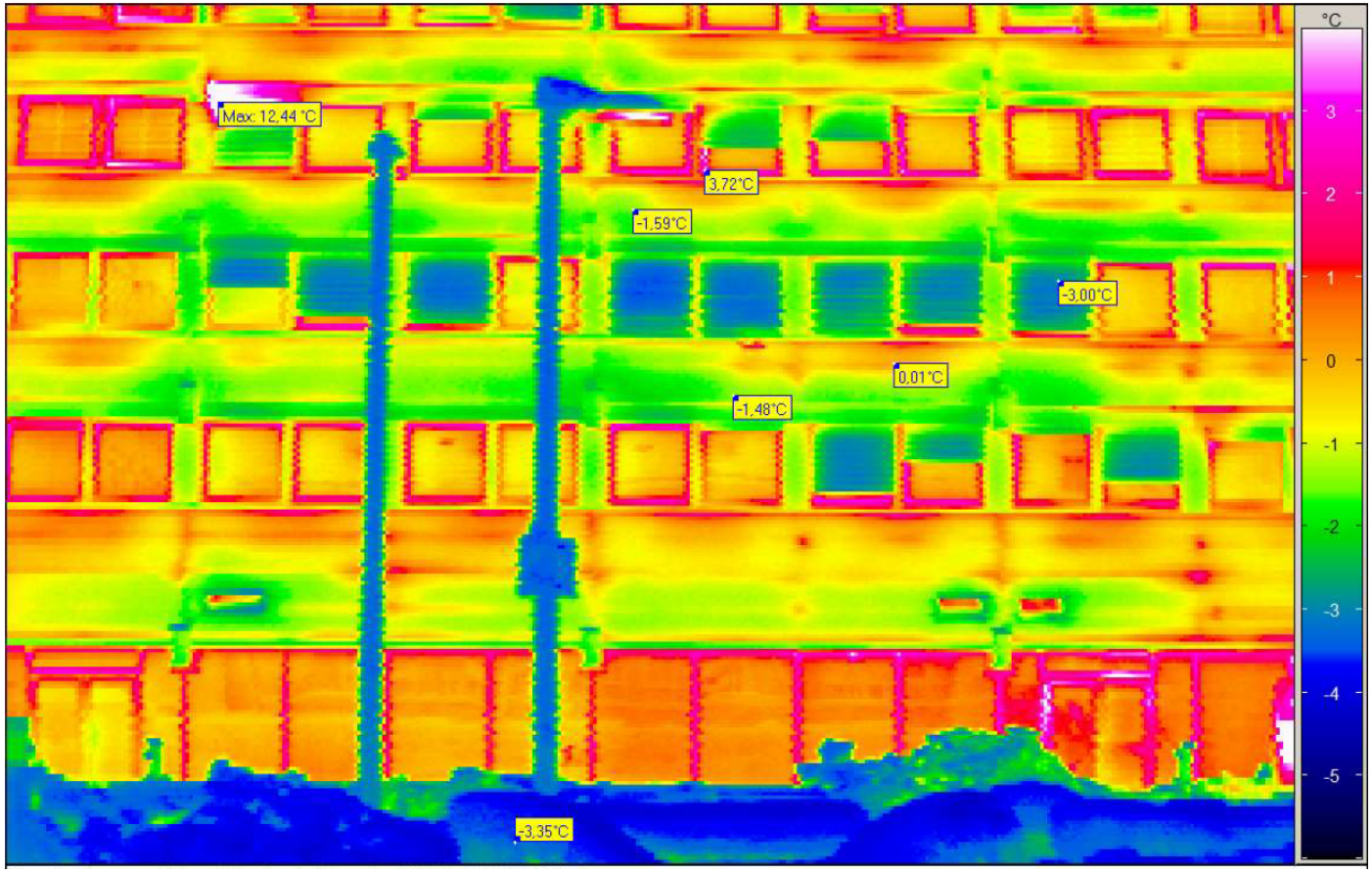




Existing Building

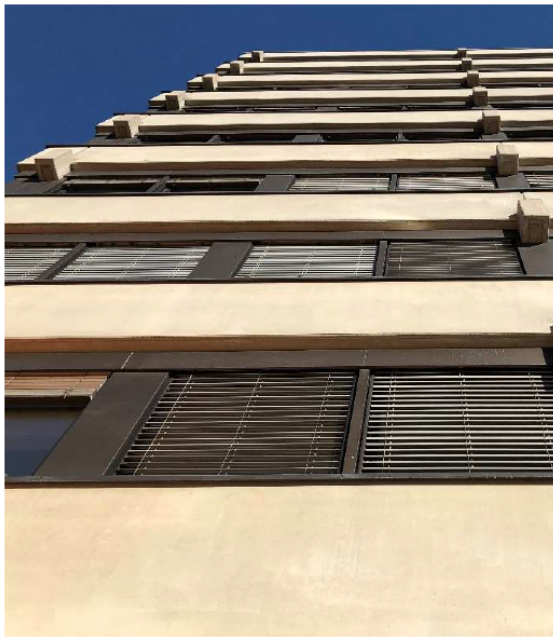


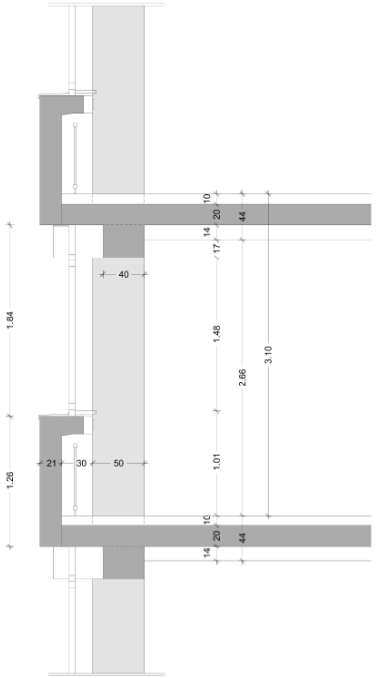
IR-Thermography (Thermal Bridges!)

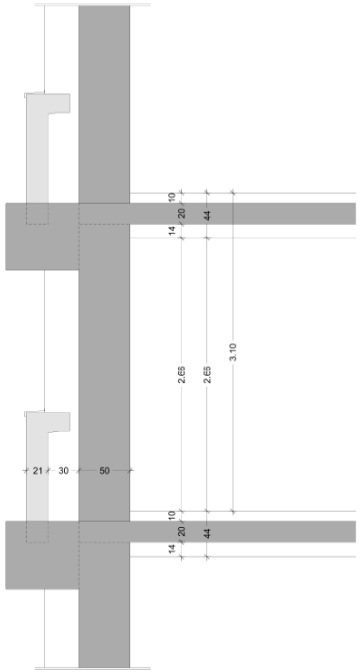


Source:
AB Timber Construction
Anton Kraler

Existing facade construction







Source: Master Thesis Manuel Dragaschnig, BSc

The challenges and how to solve

- **Construction year:** 1980
- **Poor insulation:** External insulation+new windows
- **Thermal bridges:** External insulation
- **Low airtightness:** Airtightness layer
- **Bad air quality:** HRV Ventilation system
- **Overheating in summer:** External shading

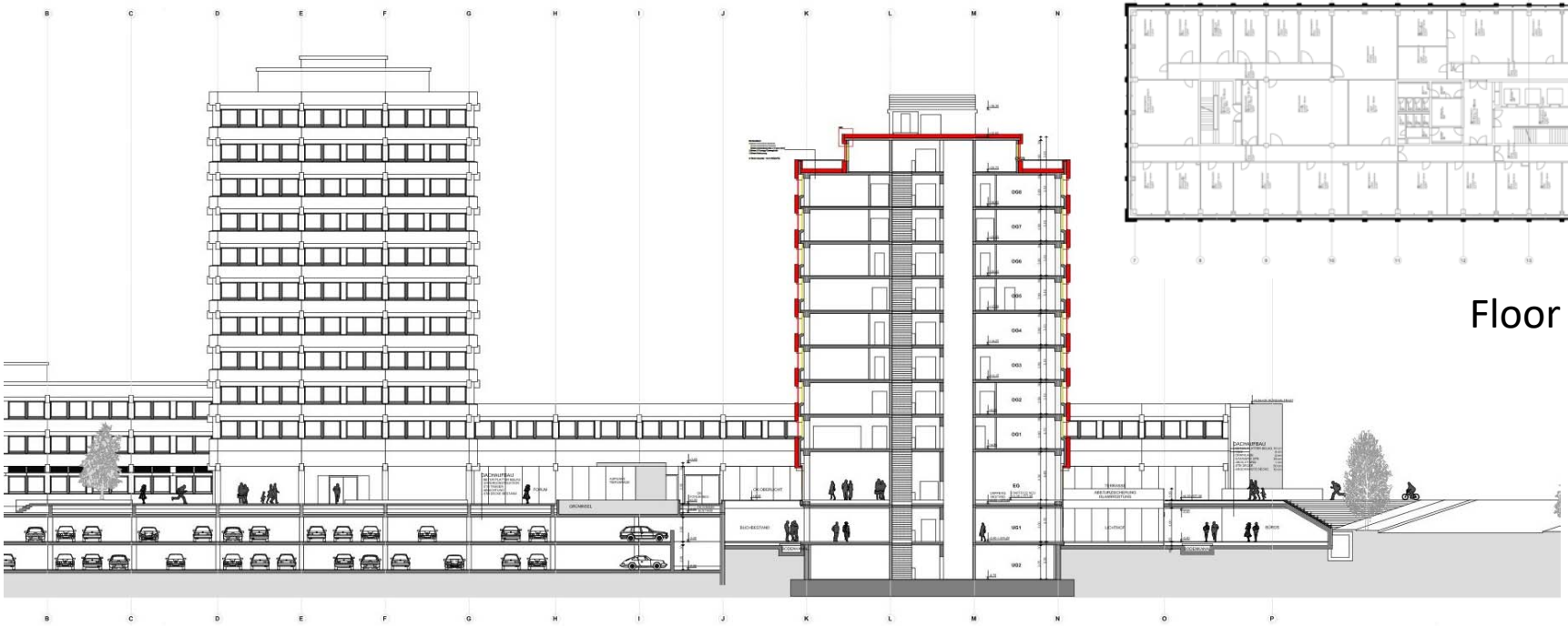
- **Refurbishment during operation of the building (University):** Prefabricated elements!

Solution: outPHit

before 156 kWh/m²a after: 22,4 kWh/m²a < 25 kWh/m²a
(Passive house standard for refurbishing: EnerPHit)

Bruno-Sander-Haus,
Source: UIBK

Cross section (10 storey building) offices, seminar rooms, labs



Floor plan

Airthightness and thermal insulation

Mounting variants of prefabricated facades depending on static requirements and geometry

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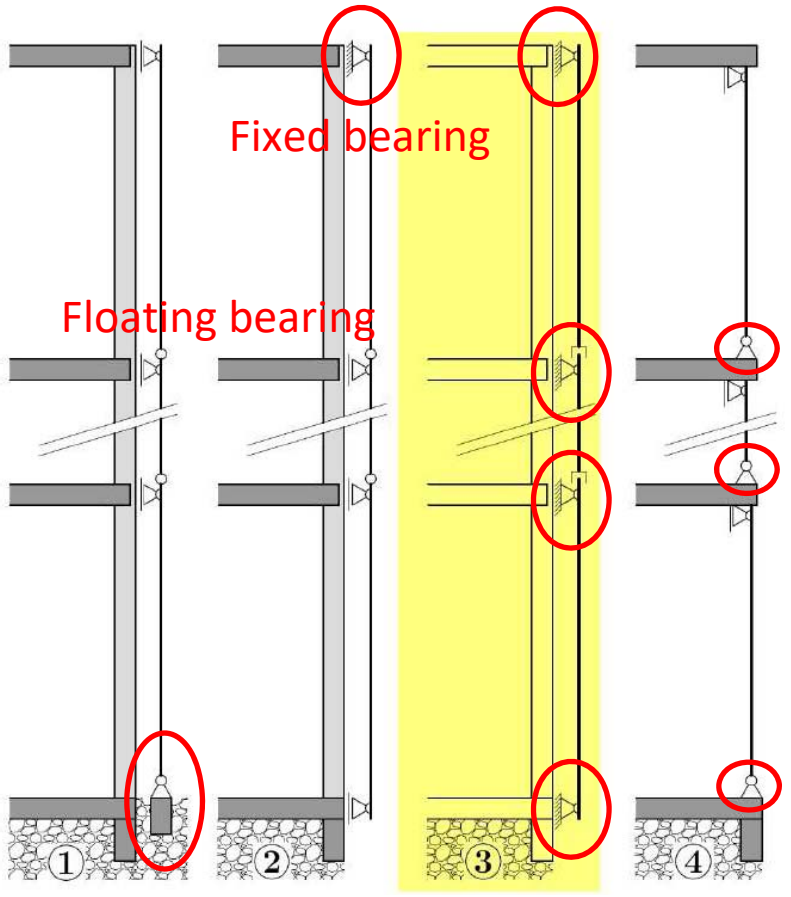
1. Load down poor static
Foundation necessary
Modules not replaceable

2. Suspended fixed bearing
at the top: Tensile forces

3. Curtained (preferable)
Modules replaceable

4. Put on
Remoove old facade
Modules replaceable

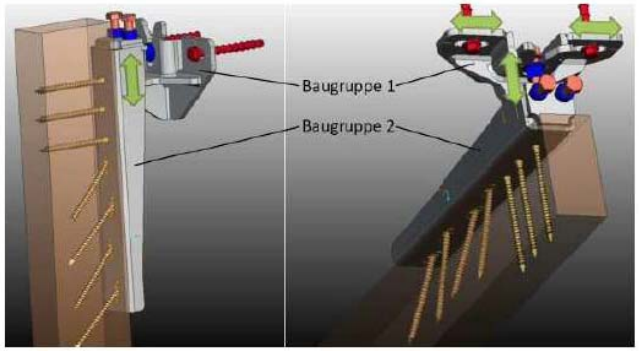


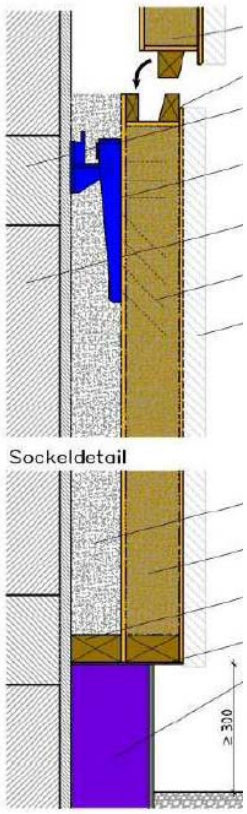
Source: C. Le Levé, dissertation, UIBK 2020

Assembly of Curtained prefab. Elements

Facade Connector developed by UIBK

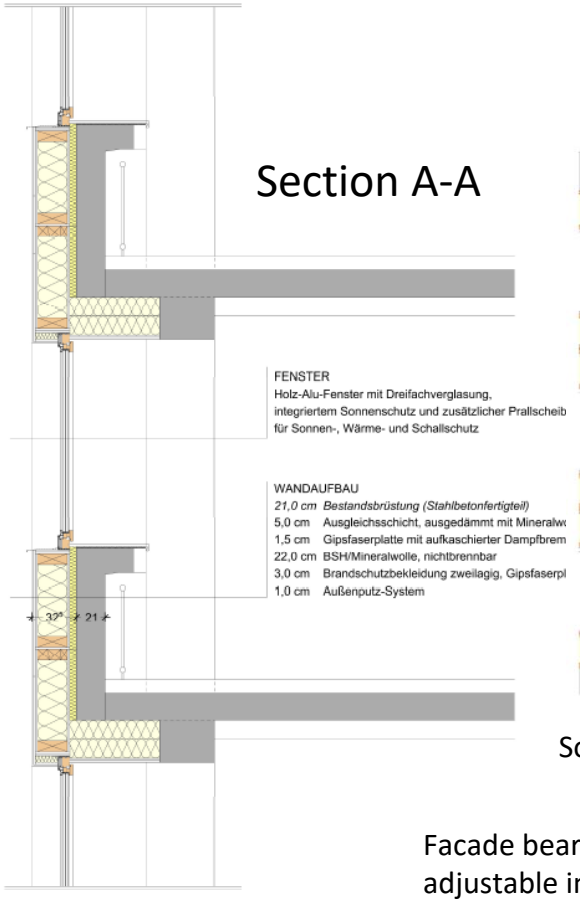
Sherpa Efco for timber frame construction

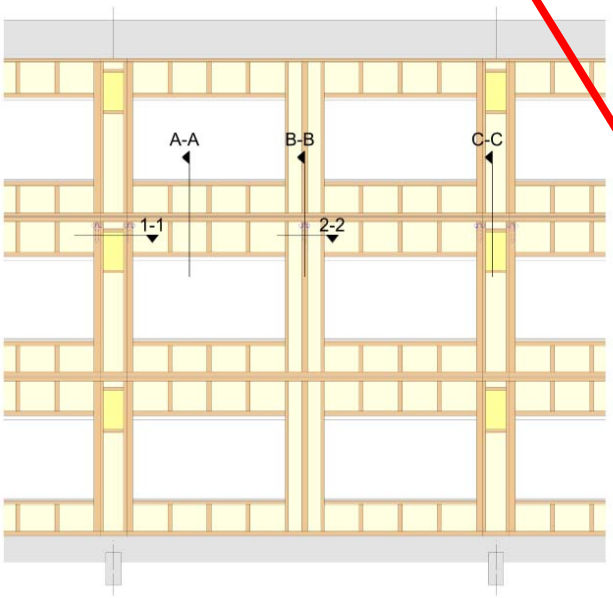




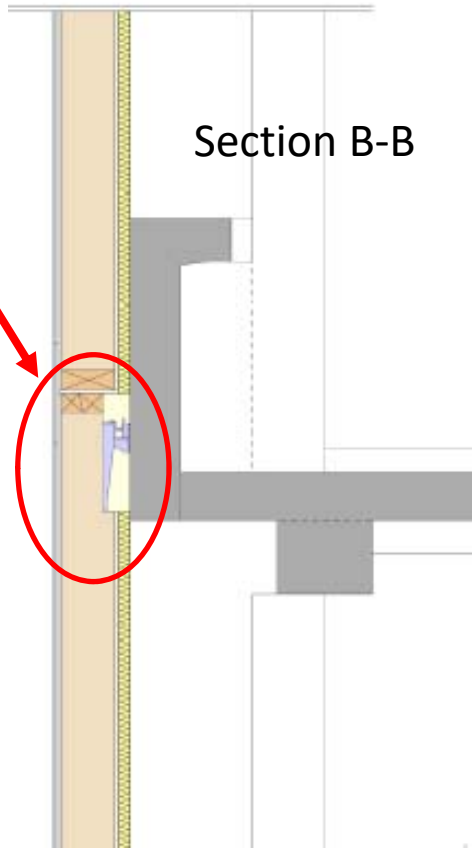
Source: C. Le Levé, dissertation, UIBK 2020

Facade bearing





Source: Master Thesis Manuel Dragaschnig, BSc



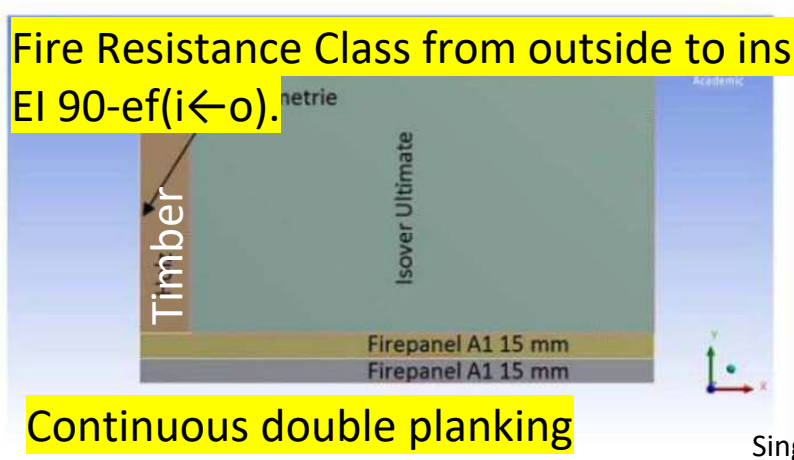
Facade bearing mounted at the concrete elements,
adjustable in three dimensions compensate for tolerances

Prefab. timber elements in a high-rise building: How to solve fire safety?

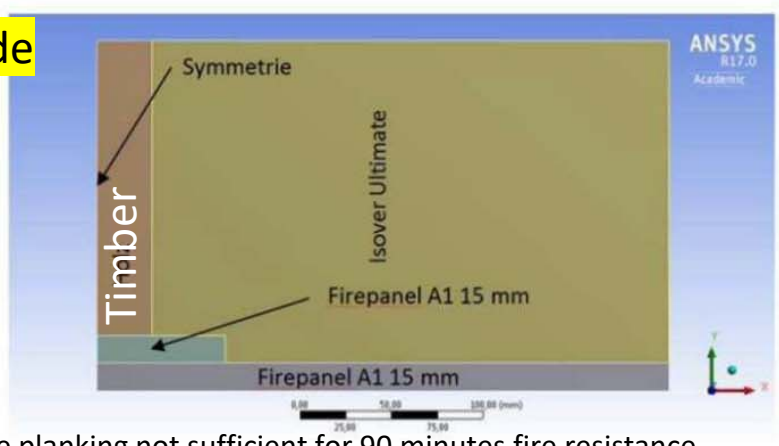
In principle, the use of combustible materials, including wood, are not covered by the applicable legislation. However, the OIB guideline 2 "Fire protection" allows a deviation, provided that it can be demonstrated that the same level of protection is maintained!

Research of Univeristy of Innsbruck (Unit Timber Construction):
Simulation and fire tests about **encapsulation of timber elements**

Fire Resistance Class from outside to inside
EI 90-ef(i←o).



Continuous double planking



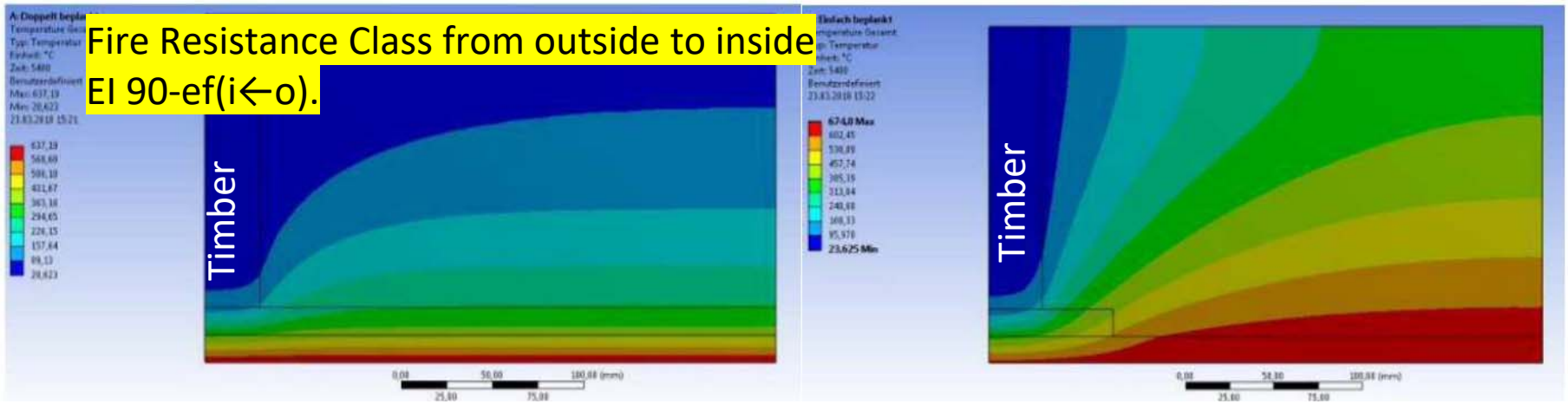
Single planking not sufficient for 90 minutes fire resistance

Prefab. timber elements in a high-rise building: How to solve fire safety?

outPHit

Continuous double planking

Temperature distribution within the construction calulated by dynamic simulation after 90 minutes expose to fire from the outside.

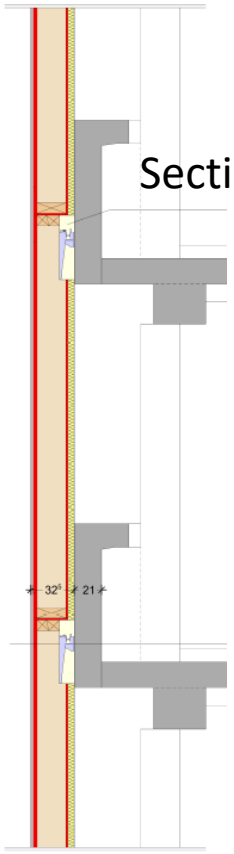


Fire safety by double-layer gypsum fiber board

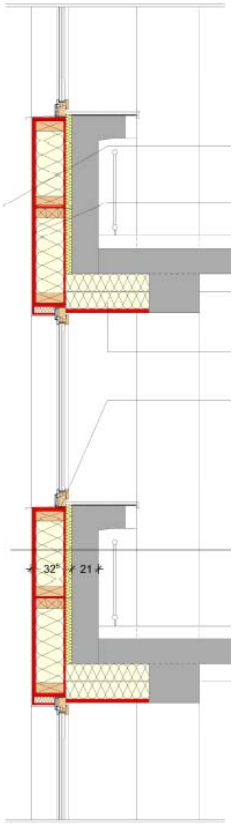
Encapsulation

Encaplusation by double-layer gypsum fiber board from outside, fire from inside by concrete elements of the existing building

Section A-A

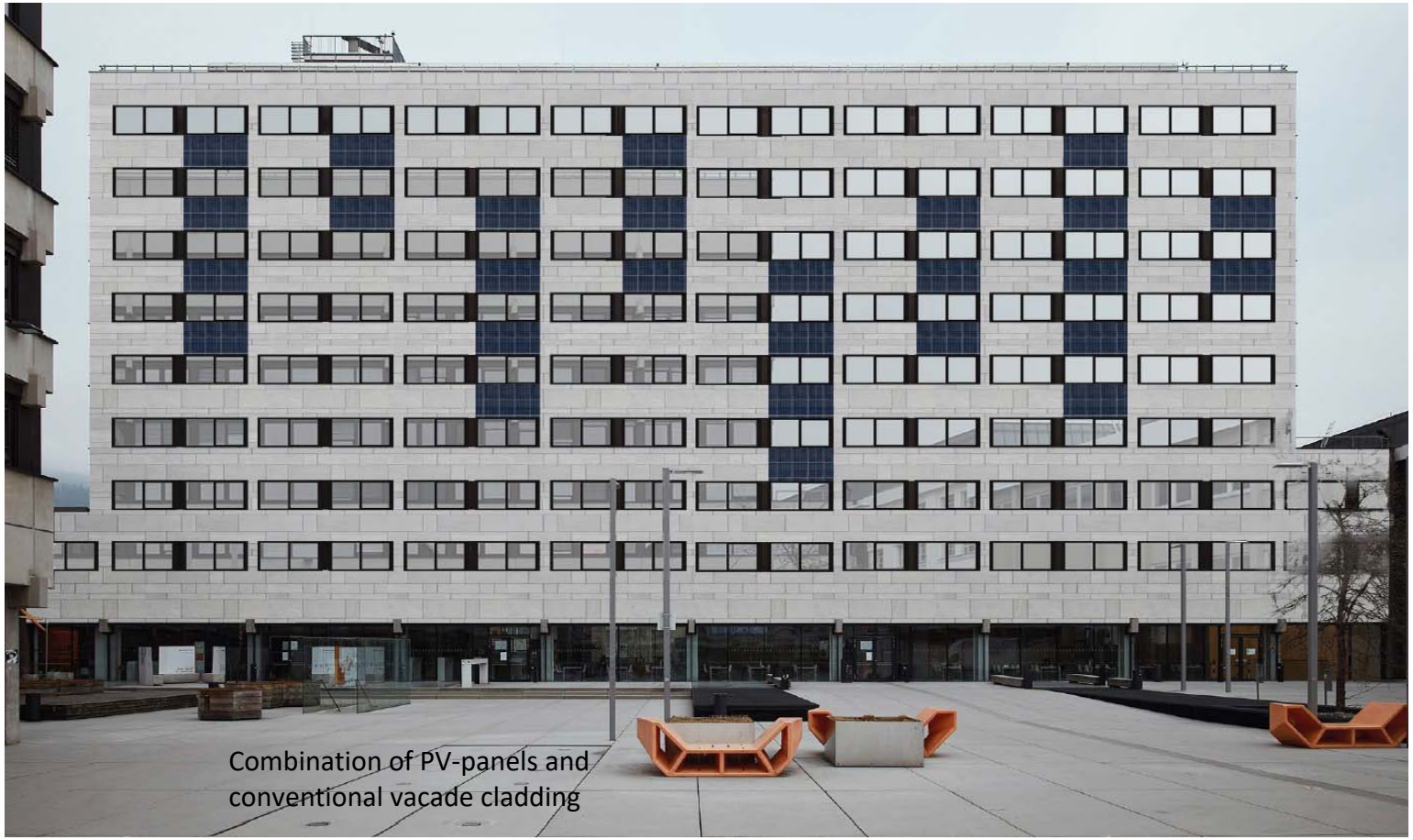


Section B-B



Source: Master Thesis Manuel Dragaschnig, BSc

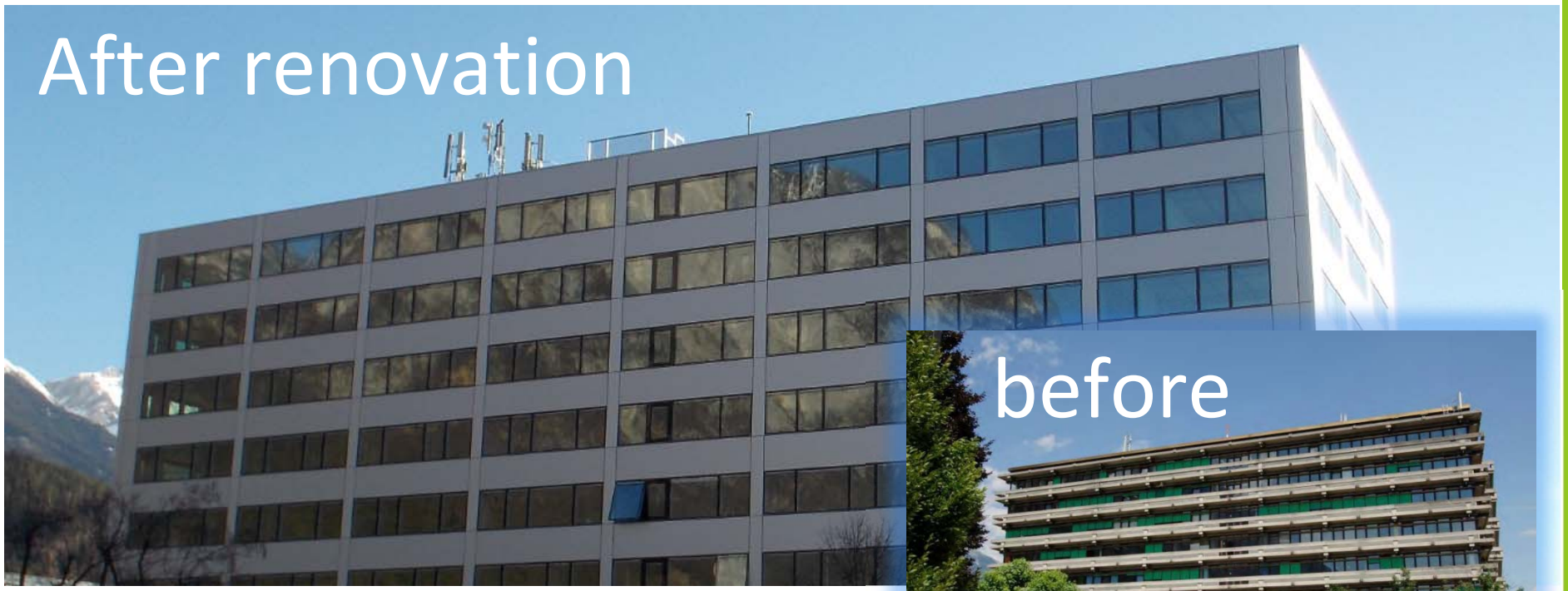
Architectural design (Student Theses)



Combination of PV-panels and conventional vacade cladding

Source: Julian Höck

EnerPHit-renovation of University Building in 2014 (Faculty of technical sciences)



Energy reduction by a factor of 9

Specific heat demand before renovation: >180 kWh/m²a

After EnerPHit-renovation: < 20 kWh/m²a

Architectural design (Student Theses)

Rendering of facade design similar to the EnerPHit-Building of the Faculty of Technical Sciences

Source: Sven Stiefel

Architectural design (Student Theses)

Source: Isabelle Limberger

Prefabricated elements with transparent/opaque parts

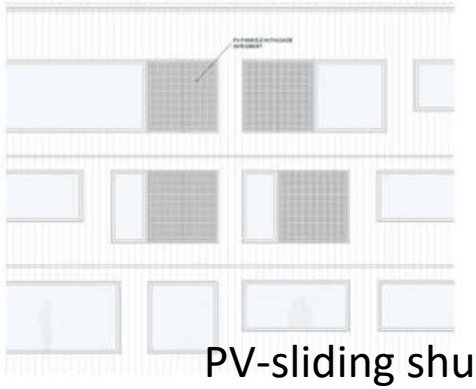
Source: Clemens Berresheim

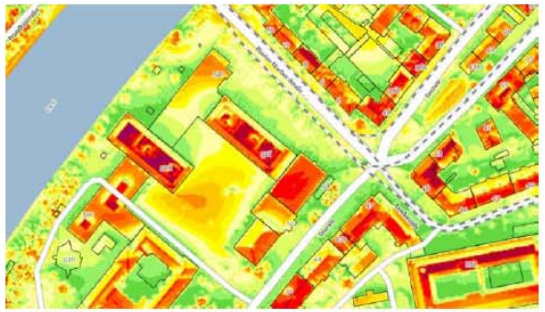
Architectural design (Student Theses)

Facace integrated PV-panel

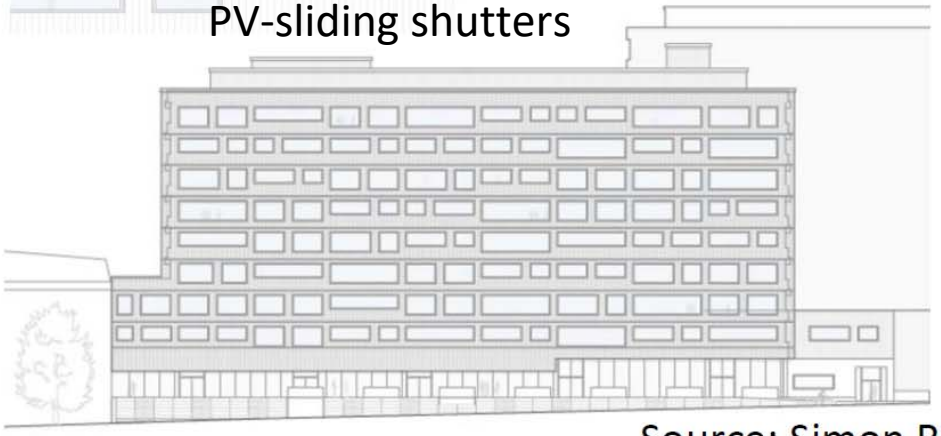
Source: Esra Agcakoc

3-Dimensional Facade structure
and Buidling integrated PV BIPV



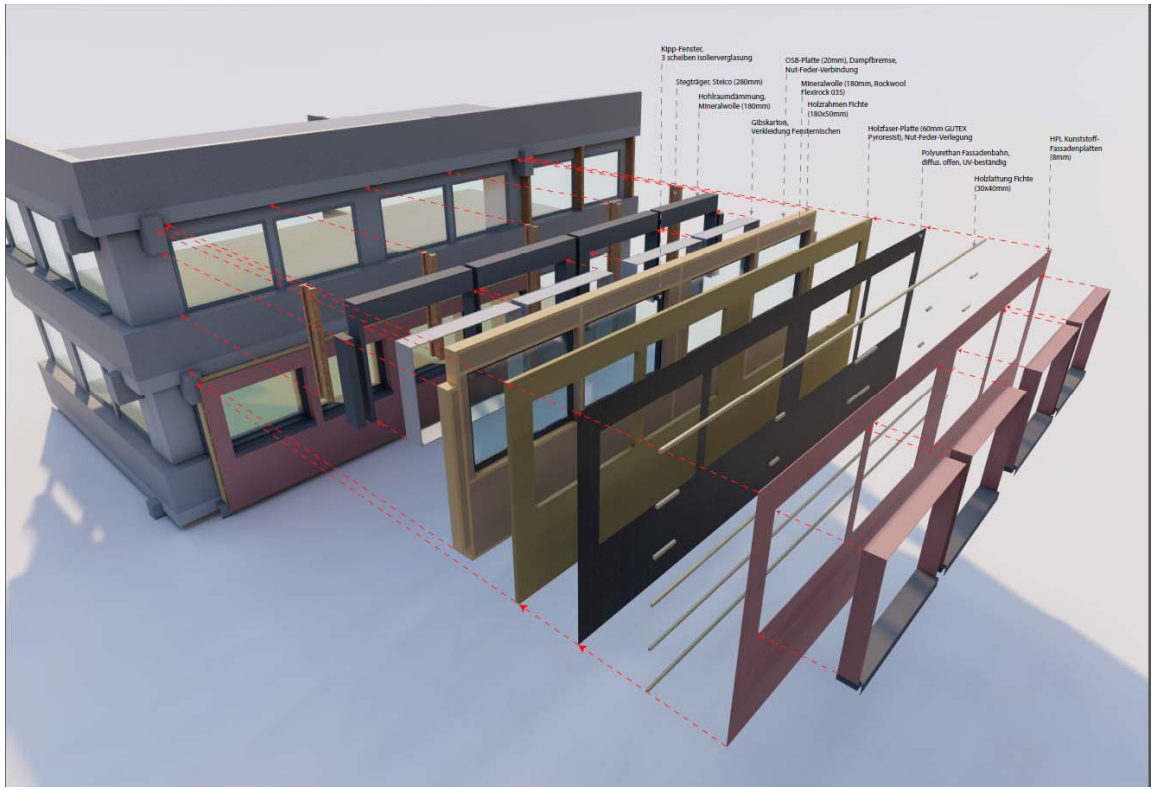


PV-sliding shutters

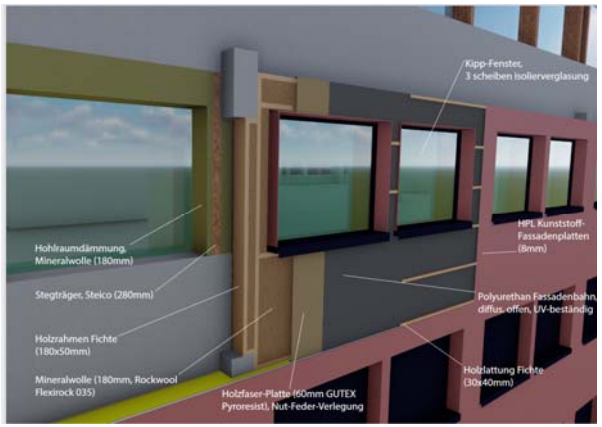


Source: Simon Rudiger

Architectural design (Student Theses)



Source: Elias Spitaler, UIBK



Prefabricated Elements

Exploded drawing of prefabricated elements,
Different layer, statics and windows included

Summary

outPHit Observer Project Bruno-Sander-Haus
High energy efficiency: EnerPHit-Standard < 25 kWh/m²a
Prefabrication with timber elements:

- **Refurbishing during ongoing operation of the building**
- **High quality, low cost**
- **Fire protection by encapsulated timber**
- **Roof and facade integrated PV**

Find out more?

Visit us on **outphit.eu**

Any questions?

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OutPHit-Projektteam