

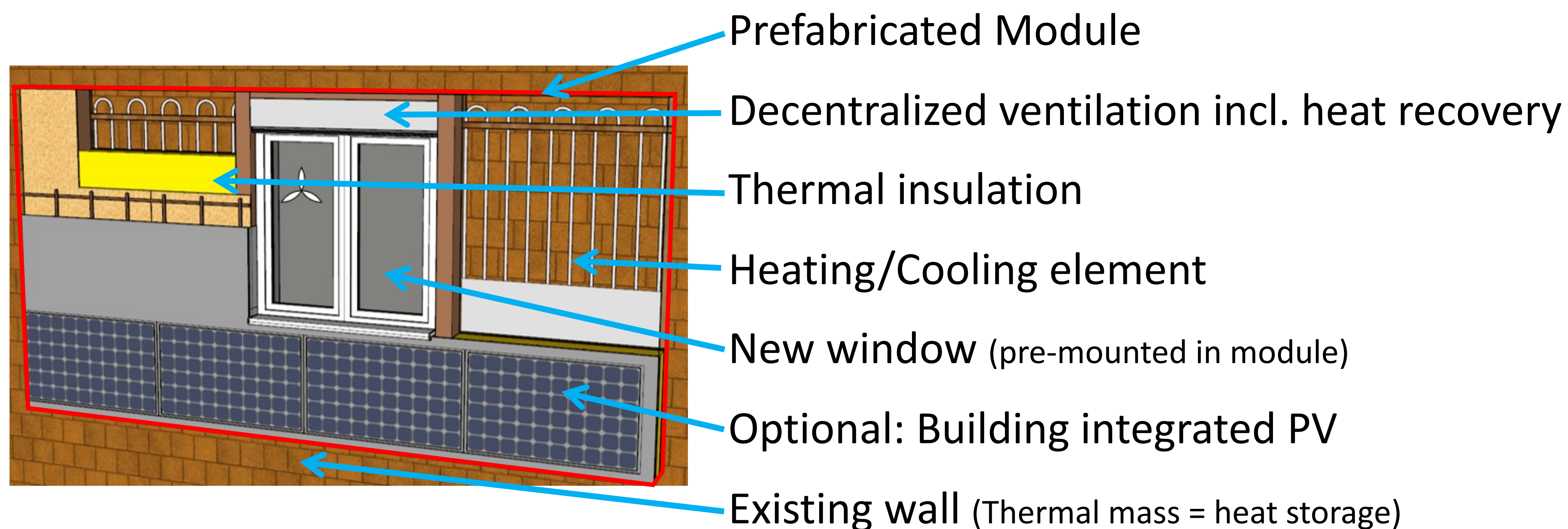


External wall heating system – Renovation of a MFH to nZEB standard

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Description

All in one: The **ProsumerSkin** is a prefabricated facade module that combines the shown tasks.



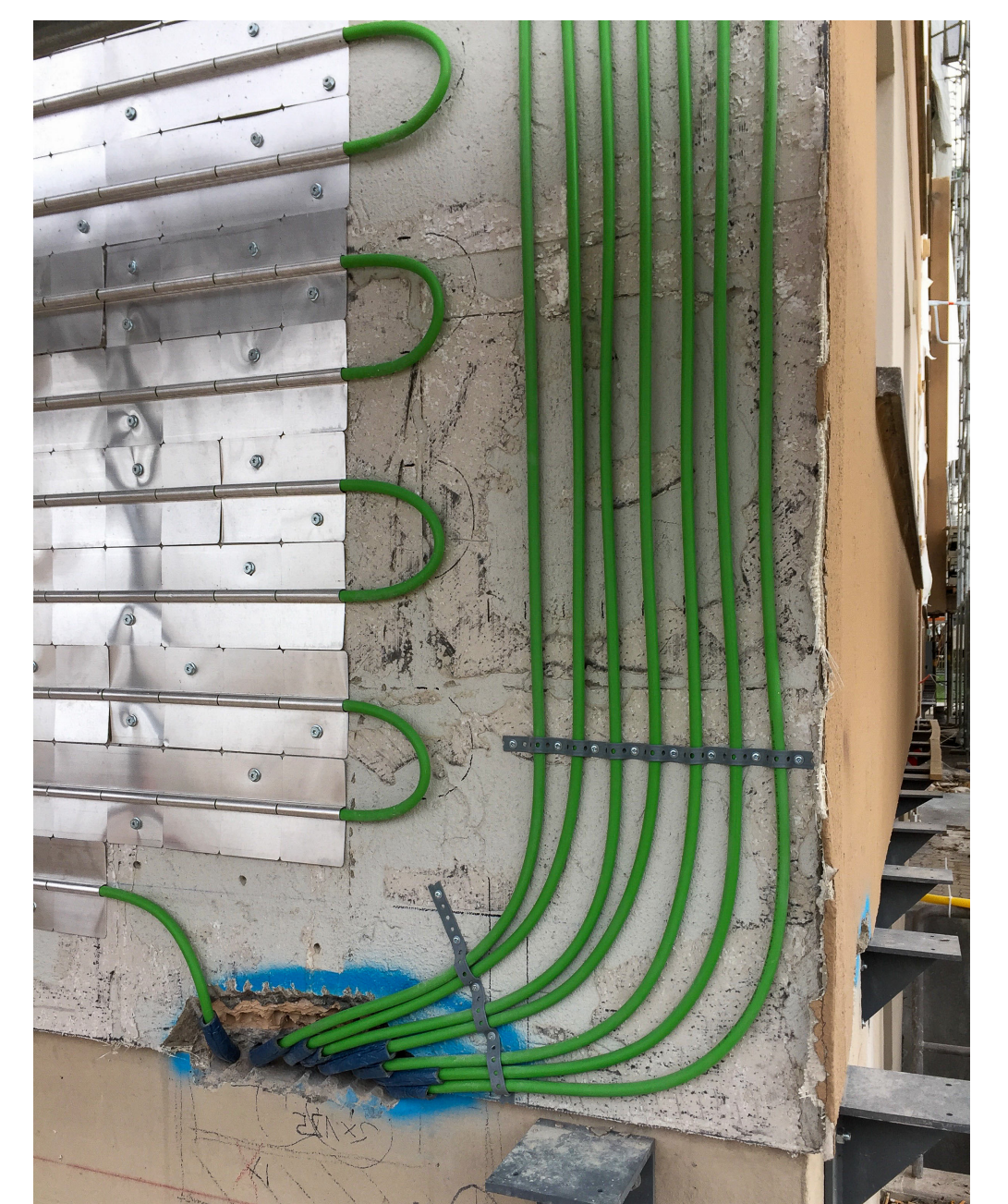
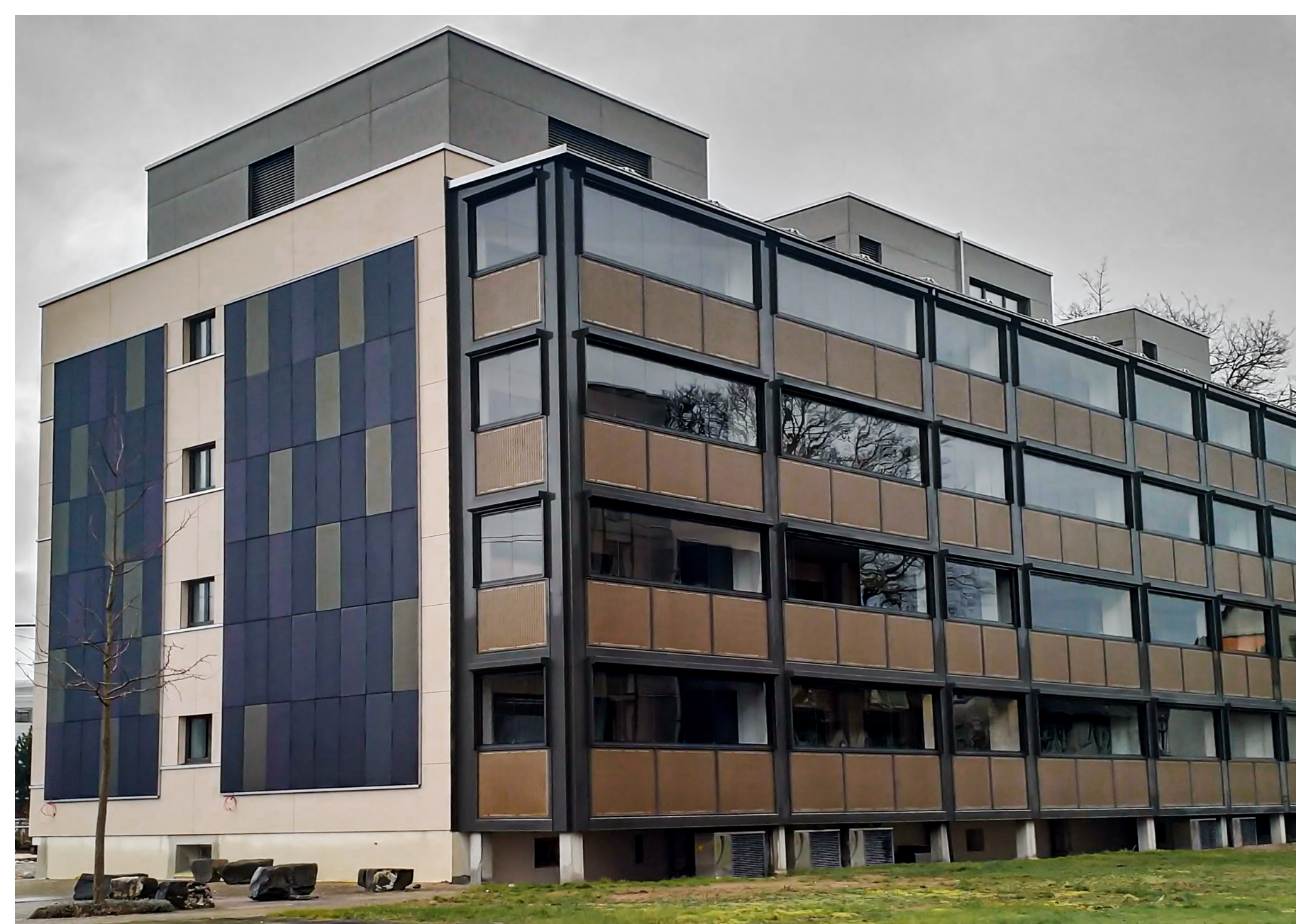
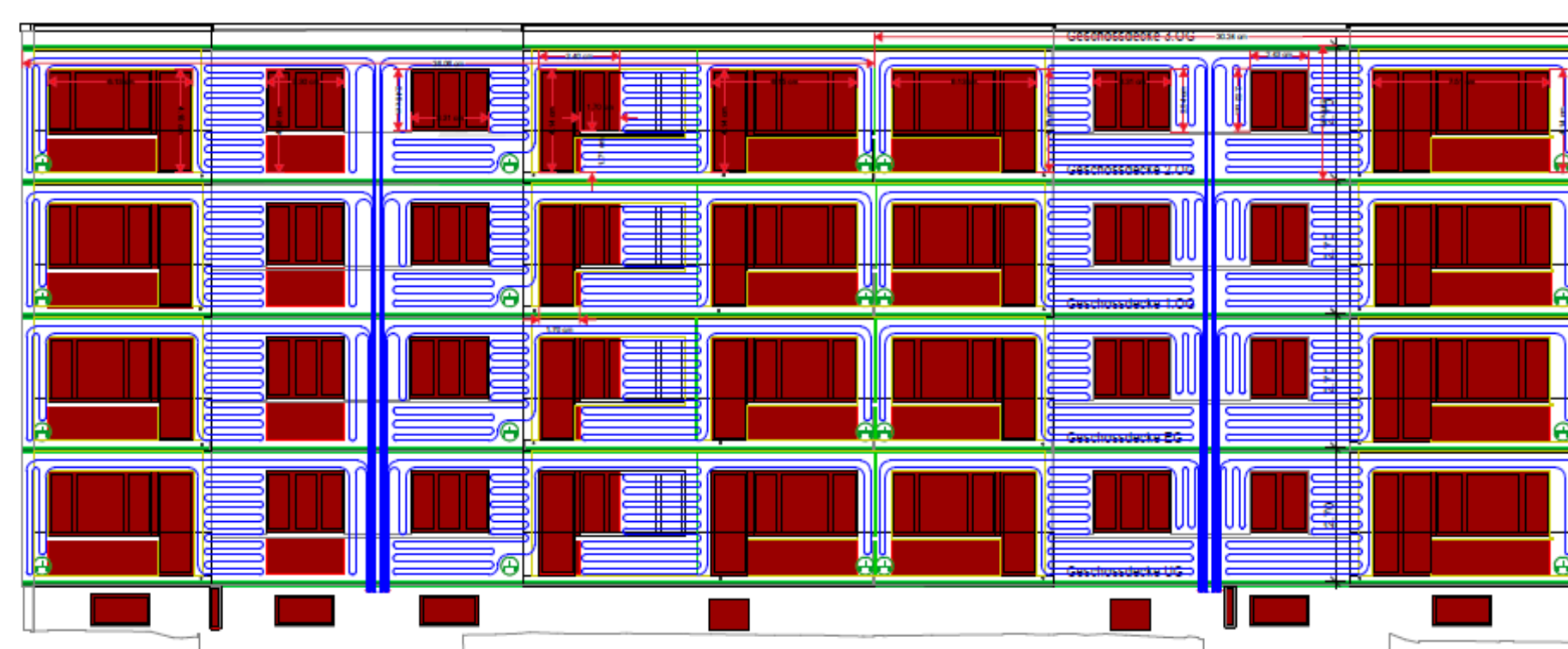
Requirements at the Building to be Renovated

- No insulation or easily removable, U-Value about 0.8 W/m²K or greater
- No floor heating system possible (e.g. tenants should stay during renovation)
- Sufficient and simple structured facade surface for external wall heating
- Large building with good statics for the mounted facade elements
- In case of PV: Low shading by objects around the building

Example: MFH in Berne

A pioneering example of an external wall heating system used in a renovation with prefabricated facade modules is a multi-family house in Bern.

- **Facts & Figures:**
 - 22 apartments
 - Built 1964; Renovated 2019/2020
 - 5 propane heat pumps (each 9 kW) / 392 PV Modules in total
- **Installation**
 - Three steps: Mounting of the wall heating; installation of the façade elements; integration of the PV modules
 - Future developments aim to combine these three steps into a single process (e.g. www.plural-renovation.eu)
- **Coexistence with old Radiators:**
 - Provides the advantage of heating rooms that have no external walls
 - Radiators run at the same temperature as the wall heating



Added-Value

- **Faster Renovations, Reduced Disruption and Greater Acceptance**
 - ProsumerSkin concept speeds up the renovation process with less workers needed. Especially important due to labor shortage.
 - Prefabrication and the integration of space heating and solar power generation minimise disruption to residents as they can continue to live in their homes during renovation, leading to greater acceptance.
- **Enhanced Energy Efficiency and Indoor Air Quality**
 - ProsumerSkin facades work with low flow temperatures and high thermal insulation. Switch from radiators to wall heating allows for efficient use of heat pumps.
 - The integration of ventilation systems improves indoor air quality (CO₂ + humidity). Heat recovery ensures efficient air exchange.
- **Energy Generating Facades**
 - The inclusion of PV modules in the facade maximises the energy generating area of a building. This contributes to energy self-sufficiency, reduced dependency on the grid, and potential cost savings in the long term.
- **Future-Proofing**
 - The incorporation of efficient heating, PV integration and ventilation systems, future-proofs the multi-family house against increasing energy costs and evolving environmental regulations.

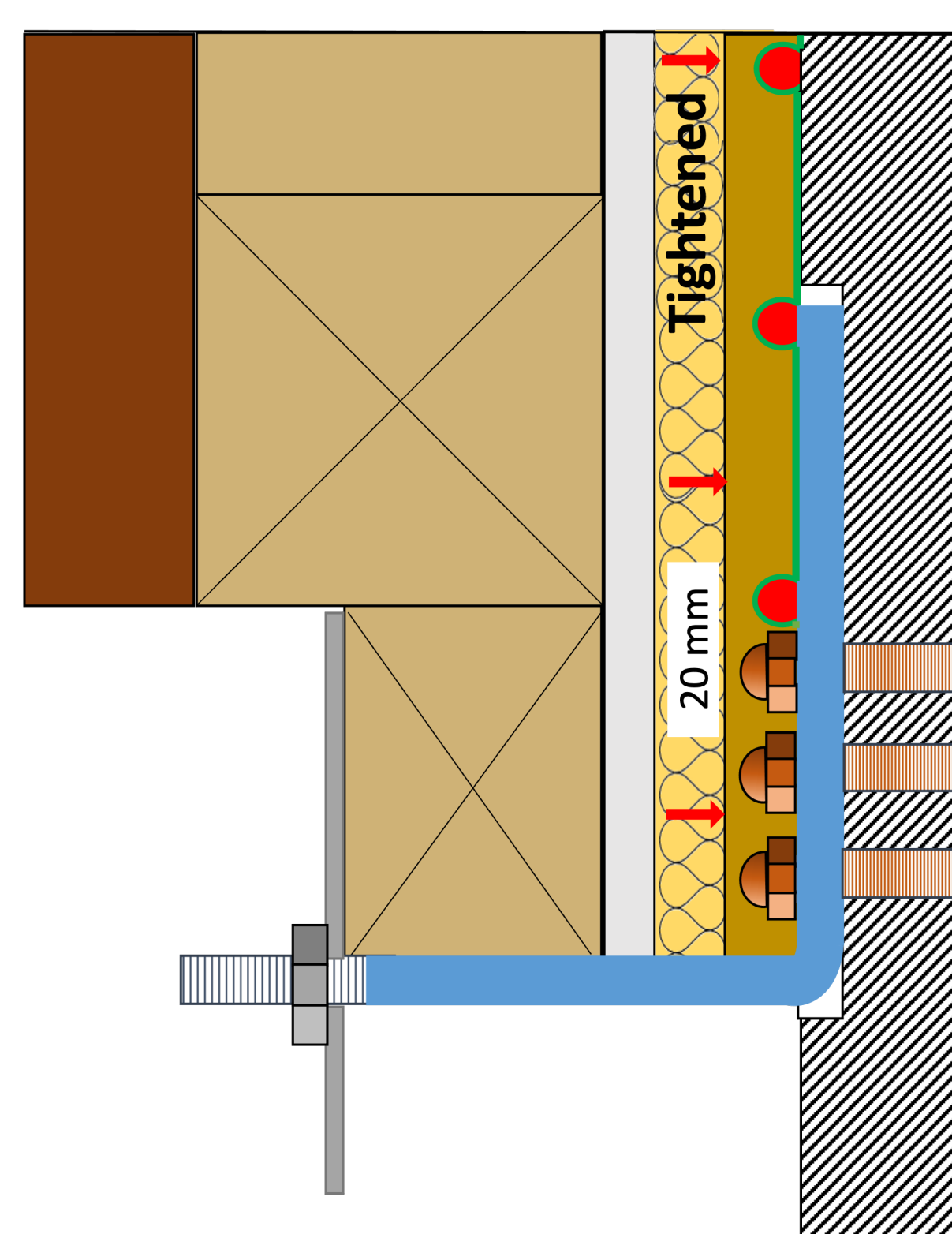
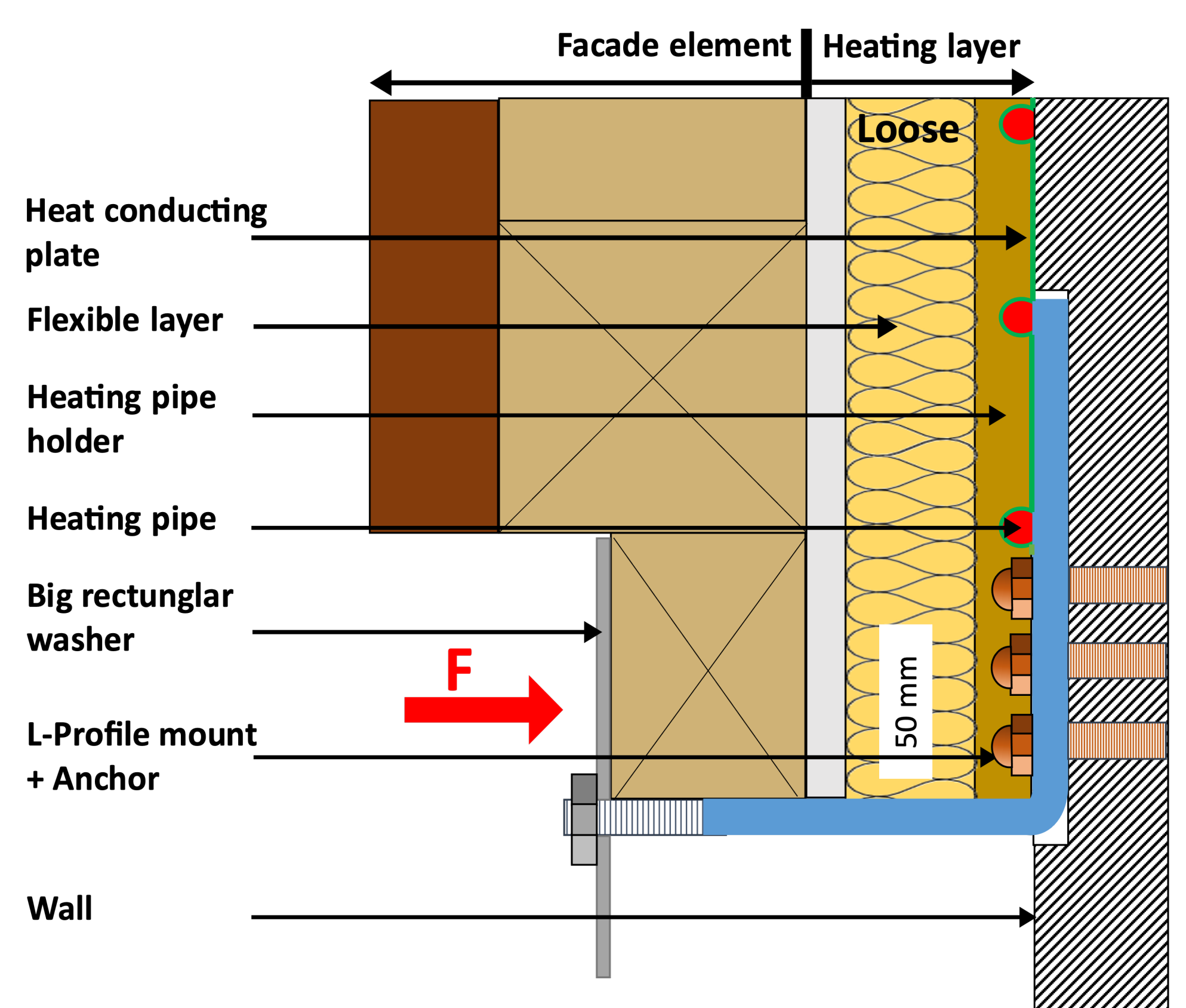
Challenges

Pre-fab Façade Renovation in general

- **Potential Assessment and Regulatory Boundaries:**
 - Identify the buildings where a prefabricated façade with a heating layer is suitable.
 - Regulatory clarification e.g. for fire protection in high-rise buildings, which affects the PV façade and the heating layer.
- **Prefabrication:**
 - Serial renovation is a new technology offered by very few companies worldwide. For a high-quality prefabrication accuracy is essential. Furthermore, it is necessary to handle physical building properties such as wind tightness and vapor diffusion.
- **Interface between Trades, Maintenance and Guarantees:**
 - HVAC-, PV-planners and architects have to work closely together during planning and production phase. -> Acceptance in the building industry?
 - New technologies make it difficult for existing craft businesses to take on maintenance work.

Heating Layer

- **Contact Wall/Heating Layer:**
 - The heating layer has to be flexible to adapt to uneven wall surfaces and has to be pressed firmly against the wall to guarantee maximum heat transfer.
- **Connection between Heating-layer and Façade Element:**
 - Flexible but stable connection between heating layer and façade element is challenging
- **Reaction Time of Heating Layer:**
 - High inertia of heating system. Changes of room temperature take effect with a delay of about half a day



Working principle of the compression of the flexible heating layer to ensure a close contact between heating system and wall

Left: Loose, i.e. small gaps between wall and heating layer possible

Right: Tightened, i.e. flexible layer pushes heating pipe holder against the wall