Positive Energy Building Upgrade Plan Intro

The **Alken** case, with its focus on the Eduard Dompas project, consists of 14 newly-built multi-family apartments for social housing. The buildings are heated by a central heating system that combines a gas-fired boiler with heat interface units in each apartment.

In the municipality of Alken, 3.5% of the buildings are used for social housing, which is significantly lower compared to the national average of 6,5%.

The social housing company WIL (Wonen In Limburg) is the building owner and is responsible for managing the site. This includes technical operations, user administration, social services and support for their tenants.

While the Flemish Society for Social Housing provides guidelines for new construction and renovation projects, support on technical aspects such as renewable energy technologies and PEB concepts is not included. As a result, the social housing company is responsible for knowledge and capacity-building in these areas. Therefore, WIL considers the PEB concept as a good practice example of how to use energy technology optimally.

WIL emphasises the importance of incorporating PEB replication in renovation projects. The number of prospective tenants has been steadily increasing in recent years, and there simply are not enough dwellings available to meet the demand. While in some cases, it may be more effective to demolish and rebuild, renovation is often chosen instead due to the shorter lead time.

An important driver for rebuilding older dwellings is the trend to build more compact. Older dwellings are often large in terms of available floor surface compared to modern standards. More dwellings can be created on existing building plots, which in terms of energy efficiency, is also the preferred option. This highlights the tension between the growing demand for social housing and the need for energy efficiency. Here, the replication plans intend to support building owners in their decision-making.

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1 Baseline assessment of the implementation environment

1.1 Building description

Project Eduard Dompas includes 4 detached buildings constructed between 2017 – 2018 on a common building plot in

the municipality of Alken. The buildings have a communal basement offering storage space and car parking. Additionally, the HVAC installation is installed underground. The floor surface area of the apartments varies between 72m² and 122m². The total annual heat load projected by the EPBD calculation method is 67MWh while the measured heat demand in 2021 was +/- 68MWh.

Initially, a central heat pump installation was planned as the main heat source, however, due to budget restrictions, this plan was abandoned, and a gas-fired boiler was installed. Fortunately, in the context of the PEB replication plans, the heating system architecture allows for a relatively straightforward retrofit and heat source conversion.

The flat roofs of the buildings are ideal for installing PV panels or solar thermal systems. With 640m² of available roof space—well above the 160m² minimum required—a PV installation sufficient to meet the PEB target can be accommodated.

Figure 1 View on project Eduard Dompas (image courtesy: Cordium - WIL)

1.2 Regulatory aspects and public support schemes

Local regulatory aspects

The municipality of Alken evaluated the building permit for the project according to a diverse set of criteria including functionality and adaptability to the environment, water, mobility, the use of land and open space, construction density, visual characteristics, health and safety. There are no further legal or regulatory aspects to consider when converting the building to PEB, however, there is a reporting obligation for PV installations to the DSO. More technical requirements on the installation of large PV systems can be found in the Kuringen replication plan or on the DSO website (www.fluvius.be). There is no permit required for the installation of geothermal probes if the depth criterion is respected on the project location. For this location, a depth of 100m is sufficient for the technology considered in the replication plans – well within the 150m depth criterion.

National and regional law

In Belgium, and more specifically in Flanders, only fire resistance and energy performance are regulated. The clearest is the national legislation for fire safety, which is arranged in terms of risk classes related to fire-fighting equipment. The general objectives of the legislation determines the minimum conditions to be met by the design, construction and layout of buildings. Fire behaviour in case of fire of a construction element is assessed according to its resistance to fire but also to the fire reaction of its constituent materials.

In Belgium, no sustainability regulations apply to existing buildings and to renovation of existing buildings.

Contracts for the delivery of work, including the delivery of building works, are made together with the rules of general contract law primarily governed by Articles 1787 and the subsequent articles of the Belgian Civil Code.

The applicable energy performance requirements are set for primary energy consumption, insulation level, ventilation rate, overheating, technical installation, etc. These requirements are different for new or renovated buildings and units depending on the function (residential, office, educational, other non-residential). The requirements are updated on a regular basis according to the EPBD.

EU level

At the EU level, new constructions must ensure the building meets high energy performance standards, in accordance with the EPBD. The directive also mandates optimising health, indoor air quality, and comfort levels in building energy calculations, and highlights the IEQ impacts on health, productivity, and overall well-being of building occupants.

1.3 Social Dimension

Converting buildings to Positive Energy Buildings involves more than upgrading the technical infrastructure. Social aspects should also be considered to improve the well-being of residents and the local community. In the three Belgian replication plans, the targeted buildings house socially vulnerable populations. Rather than focusing solely on one specific demographic, a diverse range of socially vulnerable groups in considered, ensuring inclusivity, and addressing various social challenges. In this context, the following wishes or requirements - relevant for the development of PEBs - were identified amongst social tenants: (REF: https://www.hogent.be/sites/hogent/assets/File/24-01-15_WISHES_ONLINE.pdf).

- Proper insulation levels of the dwellings both in relation to thermal and acoustic comfort
- The facilities of the dwelling should match with the user target group
- Operational costs should be calculated and communicated in a transparent way
- Sufficient storage space and visual comfort

The buildings considered within the replication plans and the Excess demosite are designed to comply with these user wishes and preferences. The central basements at the different sites both offer sufficient storage space and host the technical building installations. This delivers additional space in the dwellings and improves visual comfort. The buildings have proper insulation levels and the advanced monitoring infrastructure facilitates a transparent operational cost calculation. In addition, the PEB technology packages will result in lower overall heating costs for tenants in the longer term.

Another important aspect related to the social dimension is creating user awareness on energy consumption and targeting energy poverty. WIL observes major differences in energy consumption between similar or identical dwellings. Therefore, the tenants should be advised on the rational use of energy. This role is picked up by the social services within WIL.

2 Technical information / design specifications

2.1 Key technologies installed

- Gas-fired boiler (80 kWth) in combination with heat interface units in each apartment for space heating and domestic hot water production
- Individual ventilation units without heat recovery (type C)
- Underfloor heating in the apartments

2.2 Energy balance

The specific energy demand of the buildings is compared to the energy demand of the Excess demo project in Figure 2. The buildings in the Alken case are constructed more recently but have a slightly higher specific heat demand. Measurements indicate that the actual heat demand corresponds with the heat demand projected by the EPBD evaluation method.

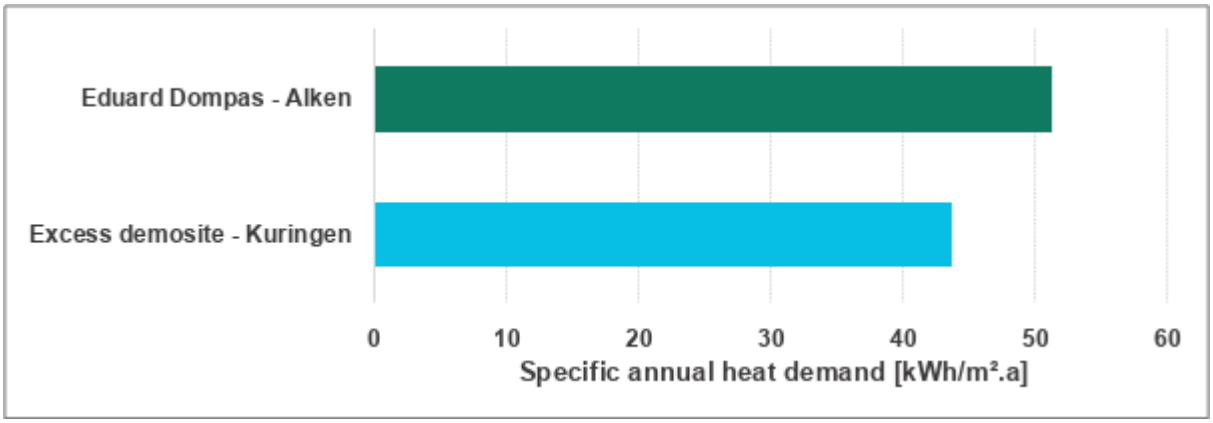


Figure 2: Specific heat demand for space heating according to EPB calculation method

2.3 PEB evaluation

The Alken replication case study is a relatively small site with only 14 dwellings. It is integrated in a residential neighbourhood consisting of primarily detached houses without high-rise buildings. Therefore, the available roof surface area for the installation of PV is quite large in relation to the energy demand of the buildings. Different technology packages are considered with PV, district heating, central air-source heat pump and central geothermal heat pump:

- Collective geothermal heat pump + District heating network + PV_{min} **(HPgeo_DHN_PV_min)**
- Collective geothermal heat pump + District heating network + PV_{max} **(HPgeo_DHN_PV_max)**
- Collective air source heat pump + District heating network + PV_{min} **(HPair_DHN_PV_min)**
- Collective air source heat pump + District heating network + PV_{max} **(HPair_DHN_PV_max)**

Individual heating systems are not considered due to the availability of a heating network and heat interface units. There are no technical changes required inside the dwellings, making the retrofitting of PEB technologies relatively simple and straightforward.

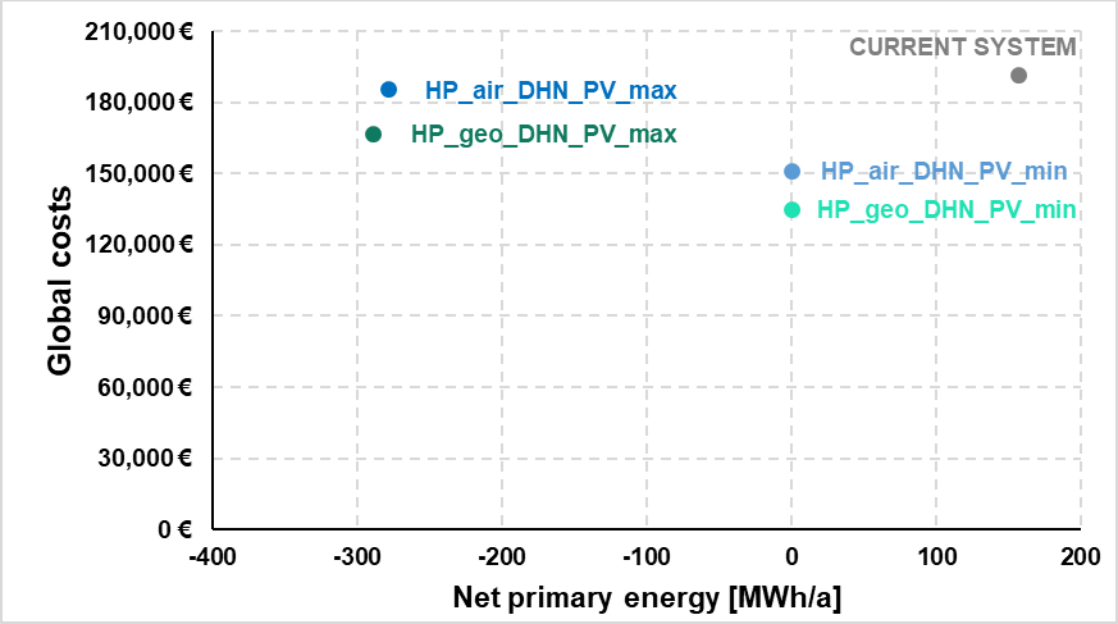


Figure 3 Global costs of PEB technology packages for project Eduard Dompas in Alken

Based on the results of the techno-economic analysis, the buildings are very suitable for the conversion to PEB given the following observations:

- Well-insulated and energy-efficient building envelope
- Large roof surface available (ideal orientation and no shading) for the installation of PV
- The heating concept (centralised with the heating network) allows retrofitting solutions without moving the tenants. This is a major advantage since deep renovation programs often require the tenants to move to a different location temporarily.

As Figure 3 shows, the cost-optimal solution is to install the minimal PV installation in combination with a geothermal heat pump. Global costs increase when scaling up the size of the PV installation, although the global costs are still smaller compared to the current system. Over a 20-year period, the global costs can be reduced by up to 60k€ for the minimum PV package with geothermal heat pump. It should be stated that the injection tariff for excess PV energy influences the results, where low injection tariffs increase the global costs of larger PV installations for negative net primary energy concepts.

3 Business model details & possible financing arrangements

The social housing company can rely on the Flemish climate fund or apply for specific subsidy schemes to implement energy efficiency schemes in social housing infrastructure. These schemes can be used for large and smaller renovation projects (e.g., heating system replacement and building envelope thermal performance improvement). In July 2023, a total resource volume of 70 M€ was available within the climate fund.

Under the incentive of the Energy Performance of Buildings Directive, heat pumps are also becoming more widespread for new building projects, such as the replication case in Kuringen. The social housing company invests in energy-efficient technology, and the users benefit from the savings on their energy consumption. The social housing company receives a reduction in the real estate tax for energy-efficient dwellings. WIL also recovers part of the additional investment for centralised sustainable heating systems via the heat tariff.

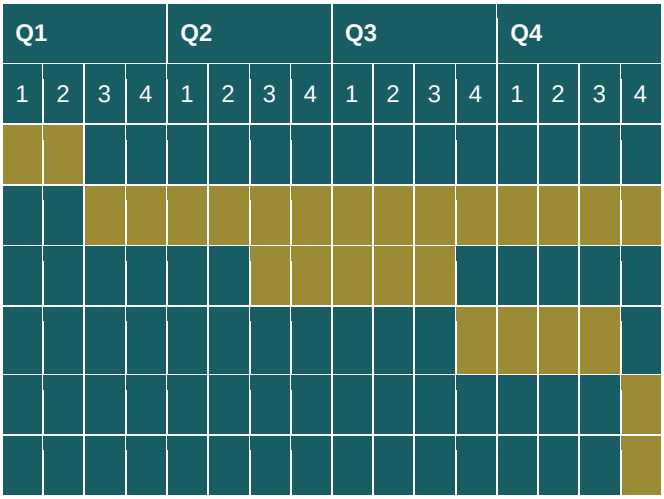
Photovoltaic panels are also applied more frequently in social houses. The Aster project (supported by the European Commission and the European Investment Bank) is accelerated using an appropriate split-incentive financing model. The social housing company invests in PV panels while the tenants purchase PV energy from the social housing company at a reduced tariff. Excess electricity is sold to the market. This model can also be applied to other energy-efficient technologies.

4 Possible PEB upgrade timeline

A high-level upgrade timeline is included in the replication plans. This timeline includes experiences from the demo partners gained during the roll-out of the PEB concepts during the Excess project. No permits are required for the installation of the technology packages considered. The installation of the roof PV installation is very straightforward and will only cause minimal disruptions in the heating system operations during the installation phase. The energy management system can be applied without hardware modifications to the existing building management control system. The total duration of the project is estimated to be approximately one year.

PEB Upgrade Activities in M01 to M06

- Activity A – Concept definition
- Activity B – Project planning
- Activity C – Project procurement
- Activity D – Installation process
- Activity E – Commissioning
- Activity F – System monitoring



5 Local Government Recommendations

Local governments play a crucial role in promoting affordable housing, with social housing being a key element. In Flanders, each municipality has been given a binding target that specifies the minimum number of social housing units to be provided within their area by 2025. To accelerate the energy efficiency of these dwellings, local governments could support PEB retrofits in various ways:

First, local governments should establish support mechanisms to facilitate the access of energy efficiency to the market via energy communities.

To encourage the building of PEBs, local planning should enable higher-density and more compact buildings while energy efficiency goals can be incorporated in local zoning plans.

Additionally, complementing regional and national grant or subsidy schemes, local governments could entertain the establishment of a special fund for PEB support and/or act as a guarantor for banks to offer low-interest loans for PEB projects.

For privately owned homes, local governments could create a fund to help low-income households and those vulnerable to energy poverty carry out energy renovations. When feasible, more flexible requirements should be introduced regarding energy performance systems in buildings.

Finally, local governments should enhance technical advisory services (One-Stop Shops) to guide building owners through decision-making processes, helping them identify appropriate measures, subsidies, or grants to enhance their building's energy performance.