



P2P LEARNING PAPER

Municipalities Setting the Standard for Good Practices in Sustainable Building Renovation

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1. Introduction

At the outset of the *Sustainable Building Renovation – Forming the Future* (SURF) project, implemented by Deutsche Umwelthilfe (DUH), Ae3R, and Energiaklub, a Peer-to-Peer (P2P) learning programme was developed to facilitate knowledge exchange among municipal professionals and local decision-makers in Germany, Romania, and Hungary. The P2P learning programme consisted of three transnational workshops - two held online and one in person, which included a site visit in Germany. The initiative was designed for forerunner municipalities from Germany to share their expertise, successful experiences, and good practices related to sustainable building renovation projects with municipalities from Romania and Hungary. The transnational workshops aimed to foster the exchange of ideas and insights among participating municipalities, identify synergies, and promote collaboration. Ultimately, the programme sought to enhance their capacity to plan, finance, and implement sustainable building renovation projects.

A total of 19 municipalities participated in the programme: three from Germany - Halle (Saale), Crailsheim, and Steyerberg; six from Hungary - Ajka, Alsómosolád, Budaörs, Pilisborosjenő, Szászvár, and Szeged; and ten from Romania - Ploiești, Mizil, Lipoșești, Măgurele, Florești, Bănești, Vălenii de Munte, Tinosu, Târgșoru Vechi, and Gura Vadului.

This P2P learning paper aims to share two examples of good practice from German municipalities with a broader audience of municipal professionals and local decision-makers. We believe that by fostering knowledge sharing and collaboration with other local stakeholders, municipal decision-makers and professionals can drive a bottom-up shift toward sustainable building renovations and contribute to achieving the EU's 2050 climate neutrality goal for the building sector.

Section 2 of this paper delves into Luckenwalde's extensive experience in energy-efficient district renovation, with a particular focus on one district where the municipality successfully combined energy renovation with the integration of district heating. *Section 3* explores Krefeld's approach to embedding sustainability into both local renovation and new construction projects, drawing on the "Planning Instructions for Municipal Properties" adopted in 2021. Finally, *Section 4* highlights key takeaways from both municipalities and provides recommendations for sustainable renovation and building practices.

2. Combining Energy-Efficient Renovation and District Heating in Luckenwalde

Luckenwalde, a town located south of Berlin with around 20,000 residents,¹ successfully combines urban planning with the goals of enhancing quality of life and reducing greenhouse gas (GHG) emissions. In collaboration with two neighbouring towns, Luckenwalde has

¹ Luckenwalde official website: <https://www.luckenwalde.de/Stadt/Statistik/Bev%C3%B6lkerung/>

developed a climate action plan based on current energy consumption and GHG emissions. One of the key climate protection objectives is to provide affordable and climate-friendly heating systems for the local buildings. This involves improving the energy efficiency of residential buildings and ensuring a sustainable heat supply through increased use of renewable energy.

Luckenwalde has carried out multiple district renovations, where energy-efficient strategies have been developed and implemented. The *Dahmer Straße district* (district around Dahmer Straße), highlighted in this paper, is particularly notable for integrating district heating into the buildings as part of the urban redevelopment process. The framework for the urban and energy-related redevelopment of this district is shaped by the goals of the Integrated Urban Development Concept, the housing and urban redevelopment plan of the town, and both national and local climate action targets. Additionally, as the town faces an aging population, the development of barrier-free or low-barrier housing is becoming increasingly important to ensure the long-term usability, marketability, and suitability of residential buildings.

The Pre-Renovation Status of the Buildings

Luckenwalde faces the dual challenge of revitalising aging buildings and addressing a significant number of vacant flats. Since the 1990s, many residents have relocated to newly constructed multi-apartment buildings or single-family houses on the town's outskirts. As a result, the district around Dahmer Straße, in the town centre, currently has 275 vacant flats - many of which have not been renovated to meet energy efficiency standards. The goal of redeveloping this area is to reverse the trend of suburban sprawl, where the outskirts thrive while central residential buildings fall into neglect.



Source: *complan Kommunalberatung* (2013)

In terms of urban structure, the district has very few commercial buildings, and approximately 300 buildings in the area are predominantly residential. The most common building types are pre-Gründerzeit (37%) and Gründerzeit buildings in serial construction (34%). A smaller proportion includes Gründerzeit buildings in representative construction (3%), villas (3%), and buildings from the interwar period (7%).



Source: *Source: complan Kommunalberatung* (2013)

Prior to renovation, the energy consumption of these buildings was significantly high, as shown in Table 1 below:

Building Type	Average Energy Consumption
Pre-Gründerzeit	188 kWh/m ²
Gründerzeit	148-173 kWh/m ²
Interwar Period	205 kWh/m ²

Table 1. Pre-renovation average energy consumption of various building types in Luckenwalde

Success through Collaboration

From the very beginning, the administration of Luckenwalde successfully collaborated with the municipal utility company and the property owners' associations. Planning and engineering firms were brought on board to address the technical requirements. All stakeholders participated in the project through a steering committee, which monitored progress and negotiated strategic agreements. The following steps were carried out based on KfW² guidelines for developing energy-efficient district concepts:³ The Urban Planning Office evaluated data provided by the Luckenwalde municipal utility company, covering infrastructure, energy consumption, and building details. They analysed the usage patterns and conditions of the buildings, including a detailed examination of selected reference buildings through energy balances and proposals for energy optimisation. The office then created an energy and CO₂ balance for the selected district, assessing potential savings and outlining development goals.

Harnessing Energy Upgrades for District Heating Integration

The evaluation of consumption data from the Luckenwalde municipal utility company for the Dahmer Straße district revealed the following: 72% of the buildings are heated with gas, 4% use district heating, and 8% rely on other forms of heat generation. Additionally, 16% of the buildings are vacant and currently do not consume any energy. Natural gas is the dominant source of heat generation in the area, representing the largest share of both final energy demand and primary energy consumption, making it the primary emitter of CO₂. Gas is mainly used for heating in private households, while district heating is primarily used in public buildings and, to a limited extent, in private households and commercial properties. Renewable energy sources have not yet been integrated into the district's heating systems.

² KfW is a leading promotional bank founded in 1948, with a mission to improve economic, social, and environmental conditions globally, on behalf of the Federal Republic of Germany and its federal states. KfW official website: <https://www.kfw.de/kfw.de-2.html>

³ KfW and BBSR (2020): Energy-Efficient Urban Redevelopment. A Funding Programme for Climate Protection at the Neighbourhood Level. Available [here](#).

Based on an analysis of heat densities, the planning office conducted preliminary planning for



Source: Source: *complan Kommunalberatung* (2013)

a potential district heating network. The objective was to prioritise road sections with the highest heat densities. The proposed new network would cover a total length of approximately 2,700 meters, with an additional 1,400 meters of house connection pipes to serve around 140 future connections. The total connected load for the properties to be linked to this network is around 6 MW, with a projected heat demand of 7,300 MWh/year. The

district heating pricing model incorporates the costs associated with connecting new households.

Environmental Impact: Supplying the district with district heating would reduce CO₂ emissions by 929 tonnes per year compared to heat generation using gas condensing boilers, achieving a 50% reduction in CO₂ emissions. The district heating system would provide 7,265 MWh/year, compared to the 8,920 MWh/year used by gas-based systems.



Source: Source: *complan Kommunalberatung* (2013)

Engaging Property Owners

The current urban redevelopment concept includes a housing strategy that features a structural analysis of ownership patterns for unrenovated residential buildings in the city centre. Based on this analysis, targeted strategies are developed for different groups of property owners. Another key aspect of the housing strategy is the provision of tailored advice and support for private property owners, aimed at encouraging renovation efforts or facilitating sales to potential investors. The property owners' association Haus & Grund played a crucial role as a local project partner and was actively involved in the project's steering committee.

Involving property owners in the concept development process was crucial, as the diverse building stock in the Dahmer Strasse district reflects a heterogeneous ownership structure. To address this, Luckenwalde established a One-Stop Shop for owners, although it was not initially referred to as such by the planning office. The district's renovation office assumed the typical functions of a One-Stop Shop: organising public information events, distributing a questionnaire to all building owners in the district, and offering guidance on energy-efficient

renovations and property value enhancement. Ensuring continuity and employing innovative outreach methods were key to engaging owners who had not yet been reached.

Renovation Outcomes

By the end of the project, a total of 139 flats will have undergone energy-efficient renovation. The original goal was to renovate 27 properties by 2030, which represents over half of the vacant and unrenovated buildings in the district. The objective of these renovations is to reduce the final energy demand by an average of 30% compared to the average energy



Source: *Source: complan Kommunalberatung (2013)*

consumption of already renovated buildings. This translates into an estimated saving of approximately 86,600 kWh per year and 71.3 tonnes of CO₂ per year for each building.

In the context of widespread demolitions of vacant residential buildings in former GDR towns, preserving the existing building stock is of particular significance. Demolishing older buildings and constructing new ones leads to increased resource consumption and elevated GHG emissions, primarily due to the energy-intensive processes involved in the extraction of natural resources and the production of construction materials⁴.

Of the 139 renovated residential units, 50 are fully wheelchair-accessible with barrier-free access to all flats, 29 are barrier-free, and 52 are low-barrier. Additionally, cost-effective measures, such as improving the hydraulic efficiency of the heating systems, were implemented during the project. The urban planning office also carried out further measures, which are out of the scope of this paper.

During the initial planning phase in 2012/2013, the analysis of the general conditions led to decisions that would likely be reassessed today. One such decision was the exclusion of heat pumps, as the prevailing view at the time was that heat pumps were better suited for new buildings rather than renovations.

Financing the Project

Luckenwalde successfully leveraged a combination of national and regional funding programmes to finance the project. The primary funding source was the KfW Programme 432, "Energy-Efficient Urban Redevelopment," managed by KfW, Germany's state-owned development bank. This national programme is specifically designed to support the

⁴ For more information on embodied carbon, please refer to the Factsheet on Climate-Friendly Building Materials and the Checklist for Sustainable Building Renovations, available on the [SURF project website](#).

renovation of entire districts and plays a pivotal role in helping the German federal government achieve its climate protection goals.

The “Energy-Efficient Urban Redevelopment” programme was launched in 2011 and aimed to enhance energy efficiency in buildings and infrastructure at the district level, both urban and rural. The programme connected energy-efficient renovations, efficient energy supply systems, and the expansion of renewable energy with local demographic, economic, and housing challenges. Its unique focus on district-level processes allowed professional requirements to align closely with the interests of local stakeholders. Despite the success in promoting energy-efficient renovations at the municipal district level, the German federal government has recently discontinued funding for this kind of initiatives.

Luckenwalde’s Blueprint for Success

The Luckenwalde case study highlights sustainable urban redevelopment and demonstrates how innovative approaches can effectively transform a city's building stock while advancing climate goals. Through a blend of strategic planning, strong stakeholder collaboration, and forward-thinking solutions, the town has addressed key challenges in energy-efficient renovations, resource consumption, and urban revitalization. Below are some of the key practices that have contributed to Luckenwalde’s success:

- Combining district heating and energy-efficiency: Luckenwalde integrated the expansion of its district heating network with energy-efficient renovations, a success achieved through close cooperation among local stakeholders.
- One-Stop Shop for property owners: Luckenwalde introduced a One-Stop Shop model that enabled efficient engagement with property owners. This approach offered customised advice, making the building renovation process more straightforward for owners.
- Tackling the "Donut Town" phenomenon: The urban planning office in Luckenwalde developed solutions to address the challenges of "donut towns," where town centres, filled with ageing, unrenovated buildings, decline while new developments on the outskirts drive up greenhouse gas emissions and resource consumption. By revitalising the town centre and renovating the existing building stock, Luckenwalde mitigated these issues and promoted sustainable urban growth.

3. Krefeld's Approach to Sustainable Building Practices

Krefeld, a city in North Rhine-Westphalia with a population of around 230,000⁵, is dedicated to integrating sustainability into its public procurement for construction projects, which is

⁵ Krefeld official website: <https://www.krefeld.de/de/buergerservice/allgemeine-daten/>

crucial to get long-term benefits and decrease external costs.⁶ The focus is on energy-efficient buildings, pollutant-free materials, and healthy indoor environments. The process began with the creation of construction standards based on the outcomes of a workshop held at Venlo Town Hall (the Netherlands), followed by a decision by Krefeld's politicians in September 2020 to implement these standards. These efforts ensure that sustainability is not just an ideal, but a mandatory part of the city's construction practices.

The standards are based on the Assessment System for Sustainable Building (BNB - Bewertungssystem Nachhaltiges Bauen)⁷ and are binding for large-scale municipal projects, with compliance ensured through inclusion in tender documents and contracts. Before planning services are tendered, target agreements are set by an internal project team, and adherence to these standards is a key aspect of the procurement process. Traditional sustainability certifications like DGNB (Deutsche Gesellschaft für Nachhaltiges Bauen)⁸ or BNB are applied only to particularly large projects.

Key focal points of the sustainability standards include reducing global warming potential through life cycle assessments, material specifications that avoid undesirable substances, and minimising energy consumption with a focus on renewable energy sources. Furthermore, the standards aim to increase user comfort by ensuring thermal comfort, good indoor air quality, acoustics, and visual comfort. Recyclability is emphasised, with products designed for easy dismantling and reuse, using Cradle to Cradle (C2C) certified materials.

Despite strong political commitment, the implementation faces several challenges, including a lack of capacity among planners to conduct life cycle assessments (LCA) or life cycle costing (LCC). Furthermore, Krefeld has found that awarding contracts to individual planning offices can be inefficient due to the high coordination efforts involved, which has led to the decision to invite tenders from general planning teams, though this contradicts typical award guidelines and requires project-specific justification. Additionally, there is a shortage of experience in sustainable building design, which limits the pool of qualified bidders.

Currently, the standards do not extend to the maintenance phase of buildings, and work is needed to develop easy-to-implement measures, such as component catalogues for standard components and specifications. Once political approval is granted, the sustainability standards are mandatory for major projects, but smaller maintenance tasks still face a backlog. Adjustments can be made during the project phase, but these changes must be properly justified.

⁶ For more information on green public procurement, please refer to the Green Procurement Guidelines for Buildings, available on the [SURF project website](#).

⁷ BBSR (2023): Assessment System for Sustainable Building. Available at: <https://www.bnb-nachhaltigesbauen.de/en/>

⁸ DGNB: <https://www.dgnb.de/de>

Good Practice Examples in Krefeld

Two good-practice examples highlight the successful application of these standards in Krefeld. The *Weidenröschenweg daycare centre*, completed in August 2023, was planned by Central



Source: City of Krefeld

Facility Management up to the second planning phase (LPH 2) and fully integrated sustainable construction standards. The project features energy-efficient elements such as timber-frame construction, passive house standards for the building envelope, photovoltaic systems with a green roof, heat pumps with underfloor heating and cooling, and a ventilation system with heat recovery. Sustainable materials were carefully selected, including Cradle to Cradle certified

flooring and components designed for easy reuse.

Similarly, the *Ritterstraße daycare centre*, currently under construction, follows the same sustainability principles. Located in the city centre, the project involves land consolidation rather than greenfield development, promoting brownfield regeneration and soil remediation. The design includes photovoltaic systems, district heating, underfloor heating, and a heat recovery ventilation system. Climate friendly materials, such as wood fibre insulation and rubber flooring, were chosen, and the building's outer shell meets passive house standards. A hybrid construction approach that combines reinforced concrete for



Source: nvg Architekten, Krefeld

the floor slabs and ceilings with wood for the exterior walls offers both sustainability and structural integrity.

Key Insights from Krefeld's Sustainable Construction Practice

In terms of project realisation, Krefeld has learned that the successful implementation of sustainability goals is strongly influenced by the conviction of the planner, with varying outcomes in quality and price. Many offices lack the necessary expertise in sustainable building practices, leading to a limited number of bidders for contracts. Close cooperation between all planners is crucial to ensure that everyone works toward the same sustainability objectives, and willingness to innovate may require additional effort from all involved.

During execution, deviations from standard tendering procedures can reduce the number of bids received, making price comparisons more difficult. Additionally, the availability of skilled craftsmen can be an issue, and experience with general contractors and planners has been positive, provided there is consistent construction supervision and quality control. This includes rigorous post-construction inspections and other quality assurance measures.

For successful utilisation, users must be properly educated on the building's technical and structural features. A healthy building can only remain healthy if the furniture, fixtures, and other components installed are free of harmful substances. The Weidenröschenweg daycare centre, which opened in October 2023, has been well-received by users, with high satisfaction regarding its functionality. However, long-term user comfort and sustainability impacts will only become clear after extended use.

Krefeld's experience with these projects has led to several conclusions. First, it is important to analyse experiences from completed projects to continuously improve and update sustainability standards. Additionally, further training and education for employees involved in these projects is essential to maintain a high level of expertise. The exchange of knowledge within municipal networks and through public relations efforts is also crucial, not only to inform the public but to inspire other municipalities to adopt similar sustainable practices. Finally, addressing maintenance issues and developing practical solutions for ongoing building care remain key priorities moving forward.

4. Key Lessons Learned from Luckenwalde and Krefeld and Recommendations for Municipalities

The experiences of Luckenwalde and Krefeld offer valuable insights and recommendations for municipalities pursuing sustainable construction and renovation. These case studies highlight successful strategies for integrating energy-efficient practices, circular economy principles, and community collaboration in municipal building renovation and construction projects. The following key takeaways are essential for local governments aiming to lead the way in sustainable renovation and construction:

Establish Clear and Binding Sustainability Standards

- Krefeld's introduction of mandatory sustainability standards for municipal building projects ensures that energy efficiency, health, and environmental considerations are integrated into every stage of construction or renovation project. These standards cover energy use, material selection, indoor air quality, and recyclability, ensuring a holistic approach to sustainability.
- **Recommendation:** Municipalities should establish and enforce binding sustainability standards for all public construction and renovation projects, focusing on life cycle assessments, energy-efficient design, the use of climate-friendly materials, integration

of circular economy principles, and the health and comfort of building occupants. These standards can be implemented through clear regulations and by incorporating sustainability requirements into public procurement processes.

Collaboration is Essential

- Luckenwalde's success in the redevelopment of the Dahmer Straße district stemmed from the effective collaboration between the local government, municipal utility company, property owners' associations, and planning professionals. By establishing a steering committee and maintaining open channels of communication among stakeholders, the town ensured the alignment of goals and a smooth project execution.
- *Recommendation:* Municipalities should foster collaboration early in the planning process, engaging all relevant stakeholders - property owners, utility companies, architects, and local businesses - to align on sustainability goals and overcome potential barriers.

Adopt a "One-Stop Shop" Approach for Property Owners

- Luckenwalde adopted a One-Stop Shop approach to assist property owners with energy-efficient renovations. This model provided comprehensive advice and support, ensuring owners understood the benefits of renovation and could navigate the process easily.
- *Recommendation:* Municipalities should establish similar support systems to engage private property owners in energy-efficient renovations. A central point of contact, with resources and guidance on funding, technical options, and regulations, can help overcome inertia and encourage building improvements.

Incorporate Circularity in Building Practices

- Krefeld's commitment to circularity in construction was evident in its adoption of green public procurement practices. The city emphasised the use of energy-efficient materials, non-toxic substances, and recyclable construction components, ensuring sustainability throughout the building lifecycle.
- *Recommendation:* Municipalities should adopt circular construction practices in all public projects, mandating the use of recyclable and sustainable materials, and ensuring that buildings are designed with future dismantling and material reuse in mind.

Utilise District Heating and Renewable Energy

- By integrating district heating into its urban redevelopment plans, Luckenwalde reduced its CO₂ emissions by 50% and improved the energy efficiency of its buildings.

This initiative aligns with the municipality's climate goals and the aim to reduce greenhouse gas emissions.

- *Recommendation:* Municipalities should prioritise the potential for district heating and other renewable energy solutions when planning energy-efficient renovations or new buildings. Conducting feasibility studies and collaborating with energy suppliers can uncover opportunities for large-scale renewable energy integration.

Explore and Secure Available Funding Opportunities

- Luckenwalde combined multiple funding sources, including national programs like KfW, to finance its refurbishment projects. This strategic use of funding allowed the municipality to support large-scale energy-efficient renovations.
- *Recommendation:* Municipalities should explore diverse funding opportunities, including national and regional grants, green bonds, and private-public partnerships (PPPs), to finance sustainable construction and renovation projects. This will help ensure that financial constraints do not hinder the transition to more sustainable building practices.

Focus on Capacity Building and Education

- Krefeld's experience underscores the importance of having planners, construction and procurements teams with expertise in sustainable building practices. A shortage of skilled professionals has occasionally hindered the ability to fully achieve sustainability goals.
- *Recommendation:* Municipalities should invest in targeted training and capacity-building programmes for their planning, construction and procurement teams. This will ensure that staff are equipped with the latest knowledge in sustainable construction and renovation practice, enabling them to effectively implement these projects.

Implementing these recommendations will empower municipalities to make significant strides towards creating sustainable, low-carbon, and healthier built environments. The success stories of Luckenwalde and Krefeld provide a practical blueprint for local authorities seeking to integrate sustainability into their construction and renovation projects. By taking a proactive role, these municipalities demonstrate the potential to drive a bottom-up shift in sustainable building practices, setting an exemplary standard for others to follow.

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