WE Data Europe

Smarter Heating, Lower Emissions

Examples of Data-Driven Heating Optimisation in Buildings

EXECUTIVE SUMMARY

Heating and cooling is at the heart of Europe's energy challenge. **Buildings account for 40% of the EU's total energy consumption**[1], with **heating and cooling demand** alone responsible for **over a quarter of final energy use**[2]. Yet, most buildings still operate oversized, misconfigured heating systems, often running at unnecessarily high supply temperatures, wasting vast amounts of energy and blocking the integration of low-temperature heating sources.

Drawing on real-life case studies of digital solutions implemented in Germany, Denmark and Spain, this brochure demonstrates how **data-driven heating system optimisation**, enabled by submetering and smart control technologies, can tackle these inefficiencies and unlock sustained **energy savings of 20 - 40% without requiring structural changes or major investments**, while maintaining thermal comfort of residents.

Digital optimisation achieves these results by using consumption and temperature data to adjust heating system settings, improve hydraulic balancing, and lower return temperatures, ensuring that the energy is delivered in the building in the most efficient way possible, only when and where it is needed.

Beyond reducing energy waste, optimisation solutions make buildings **ready for low-temperature heating solutions**, such as heat pumps and district heating, and therefore directly support the decarbonisation objectives of the **Energy Efficiency Directive** and the **Energy Performance of Buildings Directive**.

[1] Eurostat, May 2025, Energy Balances, available here.
[2] Eurostat, June 2025, Energy consumption in households, available here.

TABLE OF CONTENTS

1 INTRODUCTION

Europe's buildings are at the heart of the energy transition. By unlocking consumption data, we can make them more efficient, more affordable, and more resilient, without compromising comfort. WE Data Europe supports this transformation by harnessing the potential of energy data, enabling smarter decisions that benefit residents, building owners, and society as a whole.

This brochure presents case studies from our members that demonstrate how digitalisation and smart technologies can deliver tangible energy savings in buildings. From adaptive heating controls to making buildings ready for low-temperature district heating and retrofittable smart thermostats, these examples show that meaningful reductions in consumption are possible without compromising comfort.

The following pages highlight how our members' technologies, from submetering and monitoring to adaptive control and user-friendly digital tools, are already making a difference today, and how these solutions can be scaled across Europe's housing stock in the years to come.

Background: How Does a Centralised Heating System Work?

To understand how digitalisation and optimisation improve energy efficiency, it helps to know the basics of how a heating system operates.

At the heart of a central heating system is the boiler, which heats water and pumps it through the building's network of pipes. This hot water flows into radiators, releasing heat into rooms and taps to provide domestic hot water. After giving off its heat, the cooler water flows back to the boiler to be reheated, in a continuous cycle of supply and return.

A key measure of efficiency is the difference between the supply water temperature *(TSup)* and the return water temperature *(TRet)*. If the return water is still warm, the system has not released much energy before coming back, which signals inefficiency. A lower return temperature shows that heat has been effectively used, indicating that the whole system is more efficient.

This simple principle is central to many of the solutions presented in this brochure. By optimising supply and return temperatures, and by aligning heat generation with real demand, digital tools can dramatically cut waste, lower costs, and prepare buildings for low-temperature, renewable heating sources.

2 SMART HEATING SYSTEM OPTIMISATION

Heating systems in multi-family housing often run on outdated settings, wasting energy without residents realising it. By using data and smart controls, these systems can be made far more efficient without major renovations. This chapter presents five examples that demonstrate how optimising heating systems with digital tools can cut energy use by 20 - 40%, preparing buildings for the next generation of low-carbon heat.

2.1 Brunata-Metrona: JenErgieReal Project

2.1.1 Introduction

The decarbonisation of the building sector is a cornerstone of Germany's energy transition.

Over the past decades, considerable efforts and investments have gone into improving the energy performance of buildings through better insulation and renovation measures. Yet, the stagnating energy demand for space heating in residential buildings suggests that to achieve better efficiency gains, investments on the building's envelope need to be complemented by the optimisation of their energy flows through data-driven, digital solutions.

More than 80% of heating systems in Germany are oversized and lack active management. This results in persistent misconfiguration and operation at unnecessarily high supply temperatures but also hinders the optimal usage of heat by the residents. This leads to excessive energy consumption and sustained high costs for both building owners and tenants, while also hindering the integration of low-temperature, renewable heat sources.

The JenErgieReal Project directly addresses these challenges with a holistic, cross-sectoral approach. As a real-world laboratory for the energy transition, it demonstrates how, in urban districts, energy generation, district heat distribution, and consumption can be intelligently interconnected, from the power plant at the city's edge to the radiator in each apartment.

The buildings in Jena exemplify typical multi-family housing built in the 1970s and 1980s, featuring centralised heating systems that require continuous circulation, resulting in significant standby and distribution losses. Without proper hydraulic balancing, some radiators are over-supplied while others are under-supplied, prompting residents to increase overall heat demand. Such infrastructure is ideally suited for a comprehensively managed service approach, where all data and operating parameters are continuously monitored to operate the system automatically in an efficient manner. Because this type of optimisation can be added to existing infrastructure, it avoids the need for costly investments or full system upgrades. Additionally, around 30% of tenants are high-consumption users, often consuming two to three times more energy than average. Their consumption particularly benefits from digital assistance and behavioural nudges.

2.1.2 Project Description

The JenErgieReal project brings together all key stakeholders in the heating transition: Stadtwerke Jena as the local energy supplier and grid operator, jenawohnen as Thuringia's largest housing provider managing ~15k apartments, and Brunata-Metrona as a value-added service provider delivering recurring energy and cost savings through tailored end-to-end solutions for the housing sector.

This initiative is a flagship project within Germany's "Reallabore der Energiewende," and has been strongly supported and managed by the Federal Ministry for Economic Affairs since 2020. JenErgieReal demonstrates how digitalisation, intelligent infrastructure, and user engagement can transform existing urban housing into smart, low-emission energy systems. It is recognised as a best-practice example for integrated energy systems at the district level, where energy generation, storage, distribution, and consumption are intelligently linked.

The project focused on three apartment buildings in Jena-Lobeda (built in 1983, 11 floors, ~290 apartments and permanently only 6cm insulation). These buildings underwent a modernisation process, including reconfiguration to a two-pipe layout with separate supply and return lines, and targeted small building envelope improvements such as sealing façade joints to reduce thermal bridges.

In parallel, digital measurement and control solutions were implemented to enhance both the physical infrastructure and operational intelligence of the heating system. Every heated room was equipped with an intelligent wireless heat cost allocator, continuously measuring both consumption and room temperature as well as radiator heat output at high resolution (every 6 minutes). Smart Thermostatic Radiator Valves (STRVs) replaced manual radiator valves, enabling digital and balanced room-by-room temperature control and open-window detection to temporarily reduce heating when windows are open. All measurement data is continuously transmitted to a central platform within the building, where it is aggregated and analysed in real time. Adaptive algorithms use this data to continuously adjust the supply temperature of the central heating system, ensuring that only the necessary amount of heat is generated and distributed, minimising losses. The holistic system automatically regulates the perfect flow to each radiator, ensuring proportional heat delivery based on actual demand. Additionally, tenants can control their heating via digital interfaces and receive targeted digital assistance, helping them to adopt more efficient habits and actively participate in energy-saving strategies. Furthermore, both the monthly reporting of heat consumption and the annual heating cost statement make the individual effort to continuously save energy and costs transparent.

The project began in 2020, with energy consumption compared against a minimum four-year baseline, showcasing impressive improvements of 37–46% per housing block:

Housing Block	Apartments	Floor Area	Consumption Before (kWh/m²)	Consumption After	Improvement (%)
9–11	117	5,133 m²	72.4	44.0	37
13–15	95	5,173 m²	79.5	48.3	37
17–19	78	5,218 m²	72.8	40.1	46

2.1.3 Impact

The JenErgieReal project demonstrates that a combination of continuously digital measurement, adaptive heating optimisation, and automated heat balancing can reduce heating energy demand by 37–46% - without compromising comfort. This unlocks significant CO_2 savings, recurring reductions in operating costs for building owners and tenants, and improves the energy efficiency class of the buildings, thereby ensuring compliance with evolving regulations.

A key innovation is the high-resolution data collection from every radiator and room, leveraging existing infrastructure such as heat cost allocators. This enables tenants to become active participants in the energy transition. By providing simple, smart technology, transparent feedback, and digital control, residents are empowered to make smart decisions about their energy use. This is particularly effective for high-consumption users, who benefit from targeted digital assistance.

The solution is designed as a cost-effective, scalable retrofit solution that can be installed on existing heating systems without any structural changes and no upfront investment or effort required from the building owners or tenants.

By lowering system temperatures and optimising heat distribution, the buildings benefiting from this technology are now ready for low-temperature district heating (LTDH) and the integration of renewable energy sources, such as heat pumps.

The JenErgieReal project exemplifies how digitalisation, holistic smart control, scalable solutions, and user engagement can unlock the full potential of energy efficiency in existing buildings. The project not only delivers measurable energy and CO_2 savings but also fosters citizens participation in the transition towards a decarbonised building stock. enhances social sustainability by involving residents in the transformation process. In doing so, JenErgieReal contributes to a holistic and integrated energy transition at the neighbourhood level, which can be scaled up nationally, a critical step toward achieving the EU climate goals.

2.2 Ista HeatPilot

2.2.1 Introduction

Ista HeatPilot is a solution using digitalisation and smart control to make heating systems more efficient. It is being installed and operated by Ista in a growing number of countries, including Spain, Germany, Switzerland, Italy, Luxembourg, the Netherlands, Turkey and the UK.

The approach consists of fully mapping the heating system of a building and automating its regulation according to actual heat demand, external and environmental conditions, and even forecasts. Instead of relying on fixed setpoints and manual adjustments, the system adapts dynamically, ensuring that buildings are heated only as much as needed and at the right times.

A key advantage of the solution is that it can be installed as a cost-effective, add-on technology to existing heating systems, even those that are decades old. This makes it possible to modernise buildings without expensive refurbishments, while significantly improving the performance of existing heating systems.

Through this method, heating systems can achieve up to 30 % savings in energy consumption and in CO_2 emissions, while reducing costs for residents without compromising indoor comfort. The system can also improve the building's energy efficiency class. This technology is offered as a full service, with Ista handling installation and operation, and costs covered through an annual service fee that includes all necessary hardware.

2.2.2 Project Description

The core of the HeatPilot is an integrated optimisation of both heat generation and distribution. This includes a customised heating curve for each property, which defines how much heat is supplied to the building depending on the outdoor temperature. By dynamically adjusting this curve, the system can prevent overheating and reduce energy waste. In addition, the optimisation also extends to the distribution system, where pumps and valves are continuously adjusted to further improve overall efficiency

The system continuously integrates data from temperature sensors outside the building and inside the building's heating room, together with current and forecasted environmental and external conditions. With these inputs, it can detect inefficiencies and correct them in real time. A control algorithm ensures that heat is distributed evenly across the different heating circuits, so that no part of the building is over- or under-heated. All data and operating parameters are monitored continuously, and while the system runs automatically, manual intervention and fine-tuning remain possible when needed.

1

Optimization of the Supply Temperature

- Customized heating curve for your property
- Dynamic adjustment of the control system during operation based on:
  - Temperature data from sensors
  - Current and forecast weather data

2

Optimization of the Distribution System

- Our control system detects inefficiencies within the system
- A PID algorithm ensures optimized heat distribution across the individual heating circuits

3

Remote Control & Monitoring via Dashboard

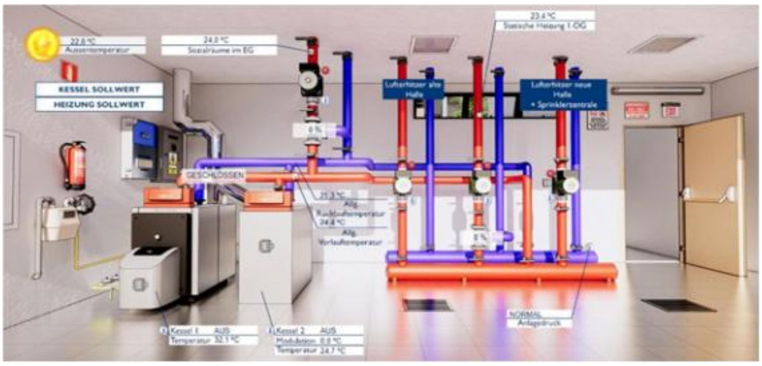
- All data and operating parameters are monitored in real time
- Manual intervention and adjustment can be made if necessary

2.2.3 Case studies

The first installation in Germany was realised in 2022 in a logistics centre in the city of Gladbeck. The building, constructed built in 1970, has a total area of 2,520 m² and is heated with gas. The building's original heating system consisted of one control unit for all field devices, with only a single digital output. Two boilers were installed, one for baseload and one for peak-load, but the modulation (the ability of the boiler to adjust its output) was barely used. Instead, the system relied on a fixed high setpoint temperature, combined with an inefficient three-way mixing valve, which is a component that blends hot water from the boiler with cooler return water to reach the desired supply temperature. When operated at high fixed setpoints, it often sends water back too hot, wasting energy. Optimisation involved introducing independent control of all components, prioritising one boiler dynamically through lower and more flexible setpoints, and improving the operation of the mixing valve. These changes produced energy savings of 26.6 %, equal to 130,750 kWh, and avoided 30.1 tonnes of CO_2 emissions.

2.2.4 Summary

Commercial Property: Logistics Center



Challange		Optimization
One control unit for all field devices with one digital output	▷	Independent control of all components
2 boilers: 1 base-load & 1 peak-load boiler → Modulation barely used → High & static setpoint temperature	▷	Heat generation through 2 boilers, then prioritized use of one boiler, optimized & dynamic setpoint
Inefficient 3-way valve due to high setpoint values	▷	Improved operating range of the 3-way valve due to lower setpoints

Savings[1]

26,6 %

Energy	130.750 kWh
CO_2	30,1 t

Building data

Area:	2.520 m²
Fuel:	Gas
Year built:	1970

The efficiency of the system has also been evaluated in Spain, where it has been installed in a multi-family house, in Valladolid. The equipped building, dating from 1970, has a total area of 2,274 m² and using oil as fuel. It was equipped with an older oil-fired boiler that operated in a simple on/off cycle: whenever the water temperature dropped below 75 °C, the burner would switch on at full power until it reached 80 °C again. This caused frequent start-stop cycles and wasted fuel. The system also used a three-way valve, but without intelligent control. With the smart heating optimisation, the valve was made to function more like a proportional valve, adjusting gradually to match demand. In addition, the boiler had two burners, which could now be operated independently at different levels, rather than both always running at full power. These changes allowed finer control of heat output and resulted in 42.6 % energy savings, corresponding to 8,250 litres of oil and a reduction of 26.9 tonnes of CO_2 emissions.

2.2.5 Impact

Case	Location	Year	Fuel	Size	Savings	Energy Saved	CO² Saved
Logistics Centre	Gladbeck, Germany	1970	Gas	2,520m²	26.6%	130,750 kWh	30.1 t
Multi-family Building	Nürnberg, Germany	2021	Gas	1,930m²	26.1%	29,672 kWh	5.9 t
Multi-family Building	Valladolid, Spain	1970	Oil	2,274m²	42,6%	8,250 L	26,9 t
Multi-family Building	Zaragoza, Spain	1978	Gas	23,373m²	21,6%	291,519 kWh	135.2 t

Across very different building types, from older oil-fired systems to modern gas installations, the results consistently demonstrated substantial energy savings, lower operating costs, and significant reductions in CO_2 emissions. Because the optimisation system can simply be added onto existing infrastructure, it avoids the need for costly replacement of boilers or full system upgrades. Even inefficient installations from the 1970s were able to reach savings of more than 40 %, while newer buildings also benefited from fine-tuning.

This shows that smart heating optimisation is both a scalable and cost-effective solution: it improves comfort for residents, cuts energy bills, and reduces climate impact, all without major upfront investments. By combining digital monitoring, smart valves and burners, and customised optimisation, Ista Heat Pilot demonstrates how both outdated and modern heating systems can be transformed into efficient, climate-friendly systems with minimal disruption.

2.3 Kalorimeta Solution for GEG Compliance in Multi-Family Housing

2.3.1 Introduction

Germany's Building Energy Act (GEG), specifically Article 60, requires that by 2027 multi-family houses (MFH) must achieve a defined level of heating system optimisation. This mandate pushes property owners to implement solutions that improve energy efficiency without compromising comfort.

2.3.2 Project Description

Kalo's approach addresses this requirement with a cost-effective retrofit solution based on smart heating controls. These controls can be installed on existing thermostatic radiator valves (TRVs) and connected to a central hub that manages all heating devices within the building. This setup allows dynamic adjustments to heat distribution, enabling the building to operate efficiently under real-world conditions.

A critical component of this optimisation is hydraulic balancing. In simple terms, hydraulic balancing ensures that every radiator in the building receives the right amount of heated water required proportionally to the room it is in. Without it, some apartments overheat while others stay cold, leading residents to compensate by increasing overall heat demand, and therefore wasting energy. Traditionally, balancing required manual adjustment of each radiator valve, but with smart thermostatic radiator valves (STRVs) and a central controller, this process becomes automatic and adaptive, significantly improving system efficiency.

Beyond hydraulic balancing, Kalorimeta's solution can also implement several other key measures to comply with GEG standards:

- Lowering supply temperature and optimising heating curves to match real demand.
- Activating night setback, reducing heating during low-use periods without sacrificing comfort.
- Optimising circulation pumps and domestic hot water systems while respecting health regulations.
- Lowering heating limit temperatures to prevent unnecessary heating during mild weather.
- Advising property owners on further savings measures and renewable energy integration.

2.3.3 Impact

Together, these adjustments not only help building owners meet legal obligations but also deliver tangible benefits: lower energy consumption, reduced CO_2 emissions, and improved system reliability, all without requiring expensive boiler replacements.

2.4 Techem: Digital Heat Chain (DHC)

2.4.1 Introduction

The Digital Heat Chain (DHC) a low-investment solution from Techem, enables comprehensive monitoring and optimisation of heating systems using digital sensors and artificial intelligence (AI), suitable for every heating system and energy source.

This not only provides transparency regarding the correct system settings but also reveals potential savings. Continuous monitoring allows faults to be detected earlier and resolved more quickly, thereby saving costs and resources. Customers can access analysis results and concrete recommendations centrally via a web-based portal. The service is now available for all heating systems and energy sources.

2.4.2 Project Description

The foundation is monitoring with AI-supported remote supervision and analysis. Temperature sensors are installed on the heating system, an ambient temperature sensor on the exterior wall, and a power-connected gateway. The gateway records temperature and meter data from the heating system every minute and then transmits this data to the cloud. In this way, combined with additional data, property-specific models can be trained and represented in a digital twin of the heating system. Using AI, a wide range of different analyses are performed, from which actionable recommendations can be derived. Furthermore, the self-learning technology contributes to the continuous optimisation of the analytical processes.

2.4.3 Impact

The Digital Heat Chain provides the housing industry with valuable insights, reduces complexity, and reveals optimisation potentials that can save an average of 15 % energy and reduce emissions. Techem’s analysis shows that although heat pumps have decent efficiency values, they usually do not reach the optimum operating state. It is therefore obvious that both the monitoring and the operational management of heat pumps need to be improved. A current evaluation confirmed that the use of the Digital Heat Chain in a portfolio consisting exclusively of heat pump systems enables an average reduction in energy consumption of 27 %.

2.5 Techem: Smart Zero

2.5.1 Introduction

The building sector remains one of the largest contributors to CO_2 emissions in Europe, accounting for approximately 36% of final energy use and nearly 40% of greenhouse gas emissions. Rising energy costs, volatile interest rates, and tightening climate targets are putting additional pressure on building owners and operators to act. At the same time, the fragmented subsidy landscape, high upfront refurbishment costs, and a diverse building stock make it challenging to plan cost-effective decarbonisation pathways.

To respond to this challenge, Techem developed Smart Zero, an integrated solution designed to help property owners and managers achieve climate-neutral building portfolios in a cost-efficient and data-driven manner.

2.5.2 Project Description

The Smart Zero Navigator supports decision-making by offering a transparent digital dashboard. It visualises portfolio-wide and building-specific emissions, energy use, and potential savings, while continuously updating the renovation roadmap based on real-time data.

Techem Smart Zero is built around a three-step approach that combines digitalisation, operational optimisation, and investment solutions:

1. Analysis

    - Digitalisation of the boiler room through the *Digital Heat Chain* solution, which collects and analyses heating system data using IoT sensors and AI. Energy consumption monitoring and evaluation of building envelope and plant technology. Data-driven generation of a renovation roadmap through the Techem Smart Zero Navigator which recommends the most cost-efficient decarbonisation measures including available subsidies – for individual buildings and the entire portfolio.

2. Operation

    - Complete takeover of plant operation and system optimisation through Techem digital management contracting.

    - Implementation of energy optimisation measures based on recommendations by the *Digital Heat Chain*, providing remote monitoring and AI-driven adjustments (e.g., heating curve optimisation, summer mode, night reduction).

3. Implementation

    - Planning, financing, subsidy management, and installation of efficient heating technologies such as heat pumps.

    - Offered via a contracting model, eliminating the need for upfront investment and transferring operational and performance risks to Techem.

    - Flexibility for immediate or gradual decarbonisation strategies aligned with net-zero targets.

2.5.3 Impact

Techem Smart Zero delivers measurable environmental benefits: Up to 15% reduction in energy consumption and emissions can be achieved through the use of the Techem Digital Heat Chain alone. Ultimately, Techem Smart Zero enables building owners to benefit from a cost-effective, scalable, data-driven pathway towards climate-neutral portfolios, while ensuring tangible short-term savings and long-term resilience.

3 HEATING BEHAVIOUR OPTIMISATION

Even the smartest systems can only be as efficient as the way they are used. Residents' heating behaviour, such as keeping radiators turned off in some rooms during winter, has a major impact on efficiency, return temperatures, and the feasibility of renewable heating. This chapter shows how data and submetering can help align behaviour with system performance, unlocking the potential of low-temperature decarbonised heat solutions.

3.1 Brunata: Research Project in Viborg

3.1.1 Introduction

This project was carried out in Denmark by BoligViborg, Viborg Varme, Grundfos, Brunata, and DTU. The goal is to enable low-temperature district heating (LTDH) in existing buildings by optimising heat distribution in individual apartments. Lowering heating temperatures not only reduces energy demand but also makes it possible to integrate renewable sources like heat pumps and waste heat into district heating networks.

3.1.2 Why Supply and Return Temperature Matter for Low-Temperature District Heating (LTDH)

Low-Temperature District Heating (LTDH) aims to run district heating networks at lower supply temperatures than traditional systems. This has three major benefits:

1. Reduced energy losses: lower supply temperatures reduce heat lost through pipes during distribution.
2. Integration of renewable energy: renewable sources like heat pumps, solar thermal, or waste heat work best at lower temperatures.
3. Lower CO_2 emissions: replacing fossil-fuel-based heat production with renewables directly cuts greenhouse gas emissions.

However, for LTDH to work effectively, return temperatures must also be low. If return water is too warm, it signals the system that heating demand is already met, even when parts of the building are still underheated. Systems where warm water returns too early waste energy but also limit the possibility of renewable integration.

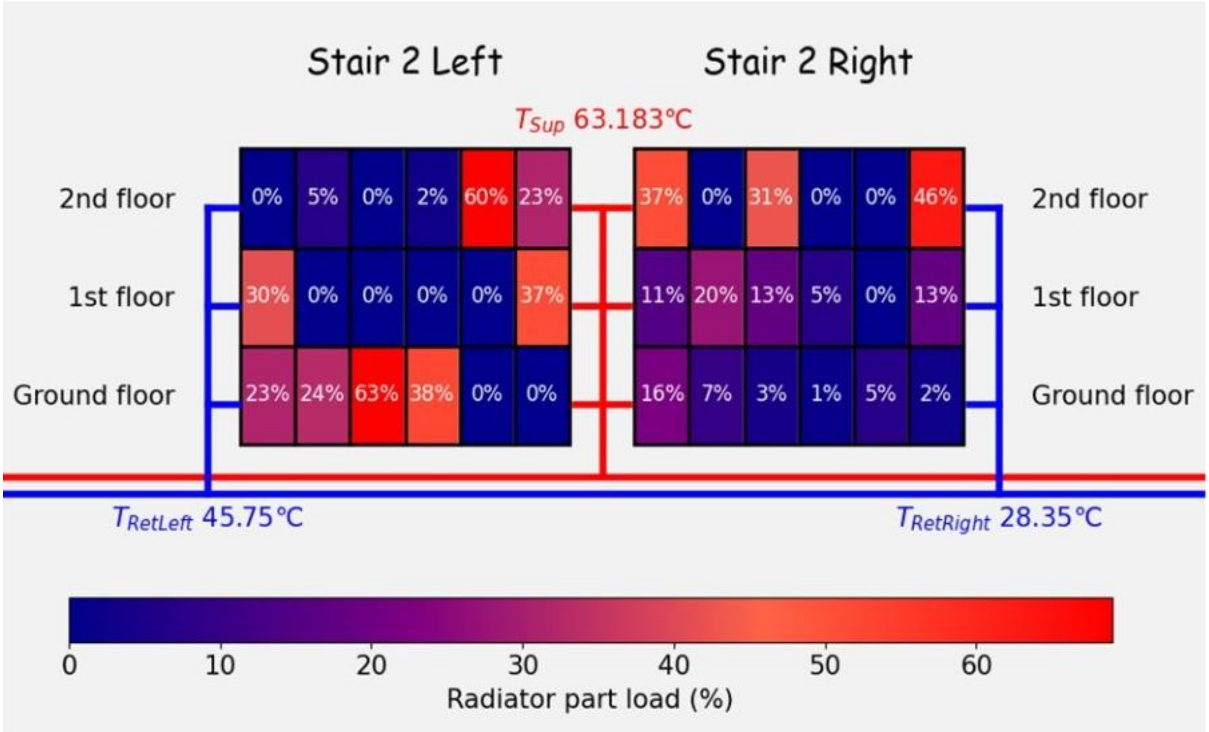
3.1.3 Project Description

3.1.3.1 Case Study: Heating behaviour and return temperature

As part of the study, researchers tested in an experimental setting the impact of residents turning off some of their radiators on return temperatures, a common behaviour thought to "save heating." In reality, this practice disrupts heat distribution across the building.

In the studied multi-family building (equipped with 251 Heat Cost Allocators, 50 hot water meters, and 40 temperature sensors), the supply temperature (TSup) was 63.2 °C for all apartments. On one side of the building, where many radiators were turned off, the return temperature (TRetLeft) was 45.8 °C. On the other side, where most radiators were left on, the return temperature (TRetRight) was only 28.4 °C.

This almost 20 °C difference is crucial. It shows that when residents keep their radiators properly adjusted instead of switching them off, the system can operate more efficiently at lower return temperatures without reducing indoor comfort.



3.1.4 Submetering to change behaviour

To make these improvements possible, the project relied on submeters, and temperature sensors installed in individual apartments. Submetering allows building managers to detect underperforming zones without simply raising supply temperatures or pump flow. It also empowers residents to monitor their own heating habits and receive guidance on how to use their systems more efficiently. On a larger scale, the data collected can be analysed to identify faulty valves, unusual heating patterns, or imbalances in the system. It can also be used to build digital twins of buildings, which allow managers to simulate performance, optimise operations, and shift heating loads away from peak demand periods.

3.1.5 Impact

The study shows that simple behavioural changes, such as encouraging residents to keep radiators properly adjusted rather than switching them off, can significantly lower return temperatures and make LTDH viable in existing buildings. Lower return temperatures allow the system to run at lower supply temperatures, which reduces overall energy use. At the same time, residents do not have to sacrifice comfort; on the contrary, balanced heating improves comfort and temperature stability across different rooms. Because submeters and digital tools can be scaled up, the same approach can be applied to many buildings, which in turn supports the wider adoption of LTDH. Ultimately, lowering system temperatures facilitates renewable integration and reduces CO_2 emissions, helping accelerate the transition away from fossil fuels.

4 SMART RADIATOR THERMOSTATS

Sometimes the simplest solutions are the most effective. Smart Thermostatic Radiator Valves (STRVs) offer households an immediate way to cut heating bills and CO_2 emissions without expensive retrofits. Easy to install and quick to scale, they represent a powerful tool for Europe's energy transition.

4.1 Kalorimeta: Smart Thermostatic Radiator Valves (STRV)

4.1.1 Introduction

To cut heating costs and reduce CO_2 emissions quickly, smart thermostatic radiator valves (STRVs) offer a simple and cost-effective solution. They can be installed in existing buildings without major renovations, making them an add-on technology in times when construction work is slow, expensive, or difficult to organise.

4.1.2 How it works

STRVs replace standard manual radiator valves with digitally controlled devices. They allow precise regulation of heating in each room or apartment and can be programmed to follow daily routines or react to outdoor temperatures. By monitoring indoor climate and adapting automatically, they prevent overheating and reduce wasted energy. Residents also gain insight into their consumption, helping them make better decisions about how they heat their homes.

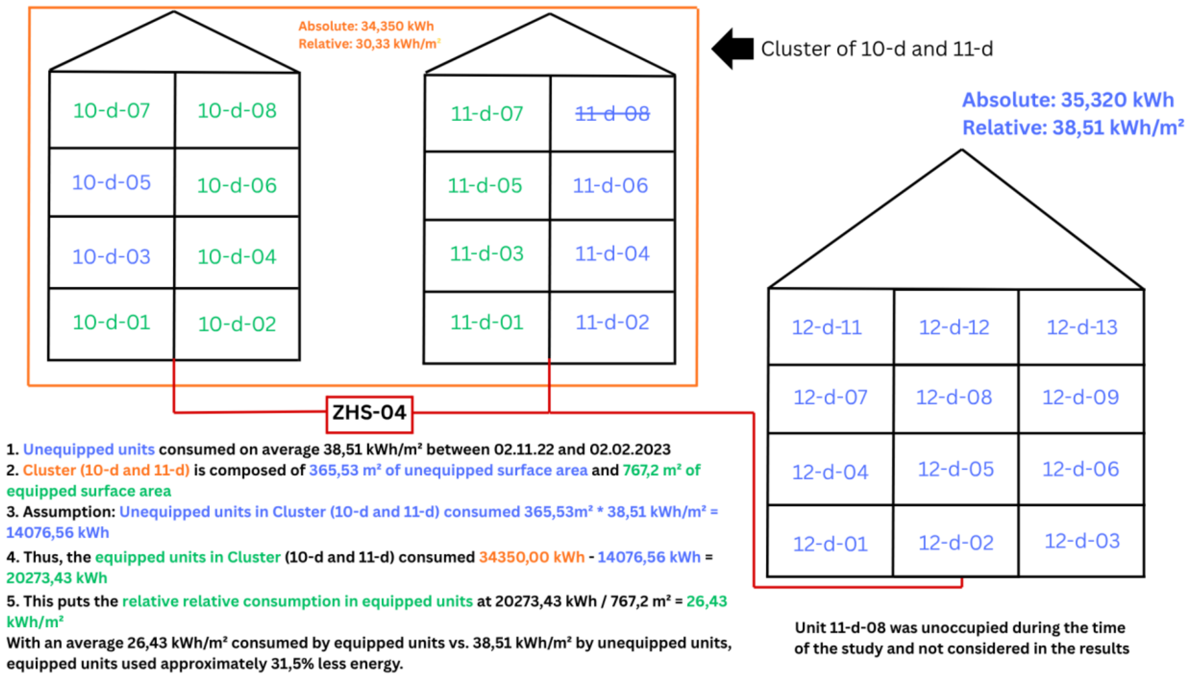
4.1.3 Case study: Karlsruhe Institute of Technology (KIT)

The Karlsruhe Institute of Technology (KIT) evaluated STRVs in several multi-family buildings of efficiency class D, a category that covers about 19% of Germany's residential floor area.

Between November 2022 and February 2023, two buildings were partially equipped with STRVs, while a similar "twin" building served as control. Comparing the energy use of flats with and without STRVs in the same building showed a 31.5% lower relative heat consumption for the equipped units.

To filter out other effects like the energy price shock or different user behaviour, KIT used historic consumption data from 2017 to 2021 and adjusted for weather. This analysis showed that STRVs still reduced heating demand by 15.5% on average across all tested units.

Even in the partially equipped buildings, the cluster of STRV flats used 21% less energy than their non-equipped neighbours.



4.1.4 Impact

These findings confirm that STRVs can deliver swift energy savings ranging from 15 to 30% on average, at low cost, even in older buildings. For households, this translates to lower heating bills, while at the same time reducing CO_2 emissions at scale. Importantly, because STRVs can be installed without major construction work, they represent a fast and scalable way to improve energy efficiency in existing housing stock.

5 CONCLUSION

The case studies in this brochure demonstrate that Europe’s building stock already holds enormous potential for efficiency gains. By harnessing energy consumption data, applying smart optimisation, and engaging residents, it is possible to reduce heating demand by 15–40%, without compromising comfort or requiring major renovations.

We believe these proven solutions must be scaled quickly to support Europe’s energy transition. By putting data at the centre of building energy management, we can unlock lower emissions, improve buildings’ energy efficiency without compromising their affordability, reduce costs, and achieve greater resilience for millions of households.

By doing so, we can ensure that every building in Europe is ready for a climate-neutral future and getting one step closer to climate neutral buildings by 2050.

Contact information

WE Data Europe - European Association for Energy and Water Data Management - aisbl (formerly E.V.V.E.)

International non-profit association - Association Internationale Sans But Lucratif (AISBL)

Avenue des Arts, 56, 1000 Brussels, Belgium

+32 280 11 395

office@wedata.eu

www.wedata.eu

EC register for interest representatives: ID number: 74838936515-43