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RENOINVEST
sustainable renovation of buildings

D2.2-Best practice handbook of sustainable building renovations

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First edition

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REPUBLIKA SLOVENIJA
MINISTRSTVO ZA OKOLJE, PODNEBJE IN ENERGIJO

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List of acronyms / abbreviations

Acronym	Original	Explanation
BM VIT	Bundesministerium für Verkehr, Innovation und Technologie	Federal Ministry for Transport, Innovation and Technology
CD	/	Cooling demand
CE	/	Central European
CED	/	Cooling energy demand
CHP	/	Combined Heat and Power
CSOK	Családi Otthonteremtési Kedvezmény	Family Home Creation Allowance
DHW	/	Domestic Hot Water
ECA	/	Energy Consulting Austria
EE	/	Energy efficiency
EIB	/	European Investment Bank
ELENA	/	European Local Energy Assistance (Facility)
EPC	/	Energy Performance Contracting
ESCO	/	Energy Service Company
ETICS	/	External Thermal Insulating Contact System
GHG	/	Greenhouse Gas
GIWOG	Gemeinnützige Industrie-Wohnungs-AG	Non-profit industrial-housing-association
GOLEA	Goriška lokalna energetska agencija	Goriška Local Energy Agency
HED	/	Heating energy demand
HUF	/	Hungarian Forint
LED	/	Light Emitting Diode
MOK	Mestna občina Kranj	Municipality of Kranj
MOL	Mestna občina Ljubljana	Municipality of Ljubljana
MOM	Mestna občina Maribor	Municipality of Maribor
PV	/	Photovoltaic cells/panels
PV/T	/	Photovoltaic thermal collectors
REAAL	/	Renewable Energy Across the Alpine Land
RES	/	Renewable energy source
RRF	/	Recovery and Resilience Facility
SIR	Salzburger Institut für Raumordnung und Wohnen	Salzburg Institute for Spatial Planning and Housing
SEIF	/	Sustainable Energy Investment Forum
SME	/	Small to Medium Enterprise
SWOT	/	Strenght, Weakness, Opportunity and Threath Analysis
TOP	Terület- és Településfejlesztési Operatív Program	Territorial and Settlement Development Operational Program
ZBR	Zöld Beruházási Rendszer	Hungary National Housing Renovation Program
WNFL	Wohnnutzfläche	Usable living space
WUK	Wiener Werkstätten- und Kulturhaus	Culture centre Vienna

1 RENOINVEST PROJECT

The RENOINVEST project is co-funded by the European Union under the LIFE programme. The project intends to reflect cross-border challenges and opportunities for sustainable building renovation in the private and public sectors. The main aim of the project is to develop action plans on smart investments in sustainable renovation of buildings for 2025-2030 for Austria, Hungary and Slovenia by establishing three national roundtables building on the activities of the Sustainable Energy Investment Forums.

RENOINVEST provides a platform for open dialogue involving key financial, private and public experts through the green finance thematic working group activities to identify barriers to the upscaling of long-term financing instruments and propose improvements to support the development of large-scale investment programmes in existing private and public buildings. Three national policy briefs and a cross-border recommendation package will also be delivered.

Assessing the implementation of the Long-term building renovation strategies and documents and reviewing existing financial solutions and market conditions for stimulating financing of energy efficiency improvement of the existing building stock is an important starting point of the project.

Sharing knowledge among project partners, experts, national stakeholders and similar EU projects three international cross-border exchange events with site-visits will be organized in order to showcase collected 50+ good practices and elaborate six case studies to foster the roll out of smart financing possibilities.

The added value of RENOINVEST is that the consortium is providing specific technical knowledge by engaging key actors representing legislative advisory organizations, research institutes, large engineering manufacturers, SMEs and financial experts in three CE countries fostering sustainable investments.

Originating from a collective vision to address cross-border challenges and unlock opportunities for sustainable building renovation in both private and public sectors, RENOINVEST seeks to craft action plans for smart investments in sustainable renovation from 2025 to 2030. This project serves as a testament to collaborative innovation, bridging key financial, private, and public expertise through green finance thematic working groups. These platforms are instrumental in identifying barriers and proposing enhancements for large-scale investment programs, thereby revitalizing existing infrastructure with an emphasis on energy efficiency. The RENOINVEST project not only fosters and environment of knowledge sharing among its partners and stakeholders but also positions itself as a beacon for sustainable investment in the Central European region.

2 PROJECT CONSORTIUM

1. ÉMI Építésügyi Minőségellenőrző Innovációs Nonprofit Kft (ÉMI) – HUNGARY, coordinator

2. Solar Tech-Investment Tervezési Fejlesztési Tanacsado Kft. (ARCHENERG CLUSTER) – HUNGARY

3. Zavod za gradbeništvo Slovenije (ZAG) – SLOVENIA

4. Gospodarska zbornica Slovenije (CCIS) – SLOVENIA

5. RENOWAVE.AT eG (RENOWAVE) – AUSTRIA

6. Institut für Immobilien, Bauen und Wohnen GmbH (IIBW) – AUSTRIA

3 EXECUTIVE SUMMARY

The present document is a study of the executed practices in the financing of sustainable building renovations, which have already been carried out in Austria, Hungary and Slovenia with the catalogue of best available cases for three countries involved.

It provides a total of 50 renovation examples of buildings or building complexes of various sizes, 16 from Austria, 17 from Hungary and 17 from Slovenia. The examples are very different in size and structure, from individual buildings to entire settlements, from urban and rural areas, but mostly from larger (capital) or smaller cities. They cover public and private building sector and variety of fundings, with EPC being the dominant mechanism.

A major part of the study covers the presentation of each individual case with data on the building and its photography, the implementation of the renovation, financial data and expected results. The examples are complemented by analyzes of strengths, weaknesses, opportunities and threats. Finally, a list of 50 good practice examples, buildings or other built structures that were renovated using different financial models and sources of finance is presented, indicating which country the example is from, which building sector it covers and the type of funding.

The research showed that examples of financing comprehensive, i.e. sustainable renovations are rare, investing in the renovation of public buildings is more widespread and is implemented on larger buildings or in a combination of a larger number of buildings.

The study contributes to the understanding of the past and current uses of models, procedures and processes of financing the renovation of buildings or building complexes, which might be important in highlighting possibilities for solving challenges and in the further development of financial models. The question raised from the analyses will used in discussions at national thematic working group events and on national platforms. The collection will also be an opportunity for the three countries, Austria, Hungary and Slovenia, to learn from each other.

The detection and analysis of good practices in the financing of sustainable building renovations will continue during the project and the handbook of 50 best practices will be updated as a new planned report (Deliverable D2.3).

4 INTRODUCTION

4.1 The structure of the study

The study was prepared by the team of RENOINVEST project partners with the aim of collecting existing best practices of financing energy / sustainable renovation of buildings in all three partner countries, Austria, Hungary and Slovenia. The goal of the team was to analyze the cases and extract key findings that will represent one of the starting points for consideration in TWGs, national round tables discussions and international exchange events. They will also be presented in detail in form of a handbook (D2.2) and made available on the RENOIVEST online platform and partners websites.

In Sub-chapter 4.2 the study describes the common methodology of the introduction of best cases into the handbook of best practices and the processing content of each particular case together with some details. The chapter also provides an explanation of the understanding of the term “best practice”

Chapter 5 is the main part of the Handbook, providing the selected examples of financial models of the building renovation for all three countries. Section 5.1 first offer a general insight of the cases with the map of their locations. This is followed by Section 5.2 with descriptions and analysis of best practices, which follow one after the other, first the Austrian 16, then Hungarian 16 and finally the Slovenian 18. Finally, Section 5.3 provides a common list of best practices of financial models of sustainable building renovation for the three countries marking which case refers to public and which to private buildings and what type of funding was used.

Chapter 6 is the final chapter, dedicated to findings, instructions regarding the use and continuation of the task regarding the Handbook of best cases.

Shortly before the end of the project RENOINVEST (M27), this report will be followed by second, updated Handbook of best cases. It will be devoted to improvements and new case studies, additional analyses and evaluations. If necessary, representative cases from other countries will also be included. This report will be subject to review by the members of the RENOINVEST External Advisory Board (EAB), Dr. Winfried Braumann (Austria), Gábor Gyura (Hungary), Assoc. Prof. dr. Marjana Šijanec Zavrl (Slovenia).

4.2 Common methodology of the introduction of best cases

The common methodology for best practices related to the financing of measures to increase the sustainability aspects when renovating buildings in Austria, Hungary and Slovenia is presented in Figure 1. The methodology itself is based on previous experience and practice of the team participating in the research in the RENOINVEST project.

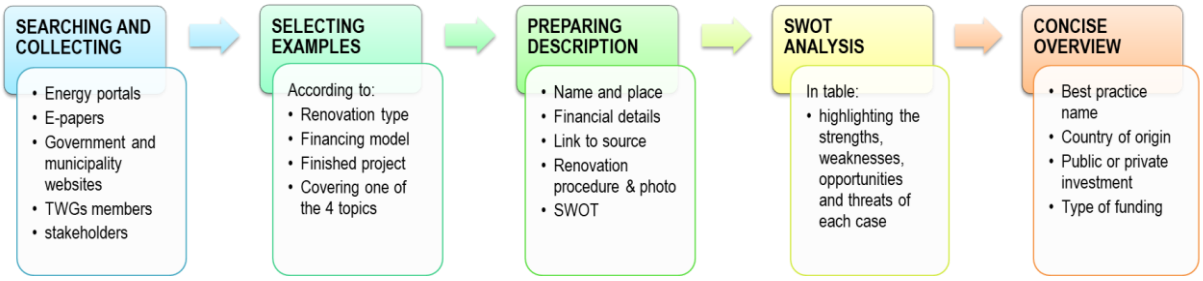


Figure 1: Flow chart of the common methodology for preparing best practices catalogue.

The process of finding best practices and detailed information about their technical implementation and funding took place using different methods depending on the availability of data. Names and sources for more than 80 energy renovation cases in the three project countries and abroad were first collected by searching through energy web portals, news, government, and municipal websites. Some best practices were highlighted by stakeholders and participants in thematic working groups. More details were obtained directly from the organisations, beneficiaries responsible for the renovations. A part of information about funding was only available online. Initially, this information (name of project, type of funding and source) was gathered in a separate spreadsheet that provided an easier overview.

After completing the list, the next step was to sift the best practices and to exclude those that were not appropriate for the report. Then filling in the template created for best presentation of individual best practice began. Each case was described separately with as much information as possible, presented with a photo and a SWOT analysis. The consortium has made a deliberate effort to ensure a roughly equal number of case studies from both residential buildings and municipal buildings.

Content details: For each best practice, the financial details of the renovation—such as the type of financing, year, financier, beneficiaries, and source of information—were initially highlighted. This is followed by a detailed description of the entire energy or sustainable renovation process, accompanied by a picture if available. The case studies provide comprehensive information, including details about the building, renovation measures and methods, types and amounts of funding, and other critical aspects specific to each project. For each case study, a SWOT analysis was developed to provide a concise overview of the strengths, weaknesses, opportunities, and threats, with a primary focus on technical and financial aspects. This adds value to the report, as the RENOINVEST project seeks to promote the enhancement of existing practices.

The examples described, were or are still considered a good practice within their respective national contexts, however, there is always room for improvement. This includes more continuous financial programs, schemes, or renovation projects as well as the achievement of higher standards in energy efficiency and the use of renewable energy sources. Therefore, the task of searching for the executed good practices with interesting and successful financial models will continue.

Finally, the 50 selected best practices are listed in the Table in a concise overview, highlighting best practice name, country of origin, type of renovated building (public or private), the investment and source of funding.

5 EXAMPLES OF FINANCIAL MODELS OF SUSTAINABLE BUILDING RENOVATION

5.1 General description of the cases

With fifty case studies in this report, we compiled a varied selection of renovation projects from urban and rural areas. The map below shows the locations of the best cases described below in each of the three partner countries, Austria, Hungary and Slovenia. In case of multiple case studies close to each other, the location is marked with one orange star.

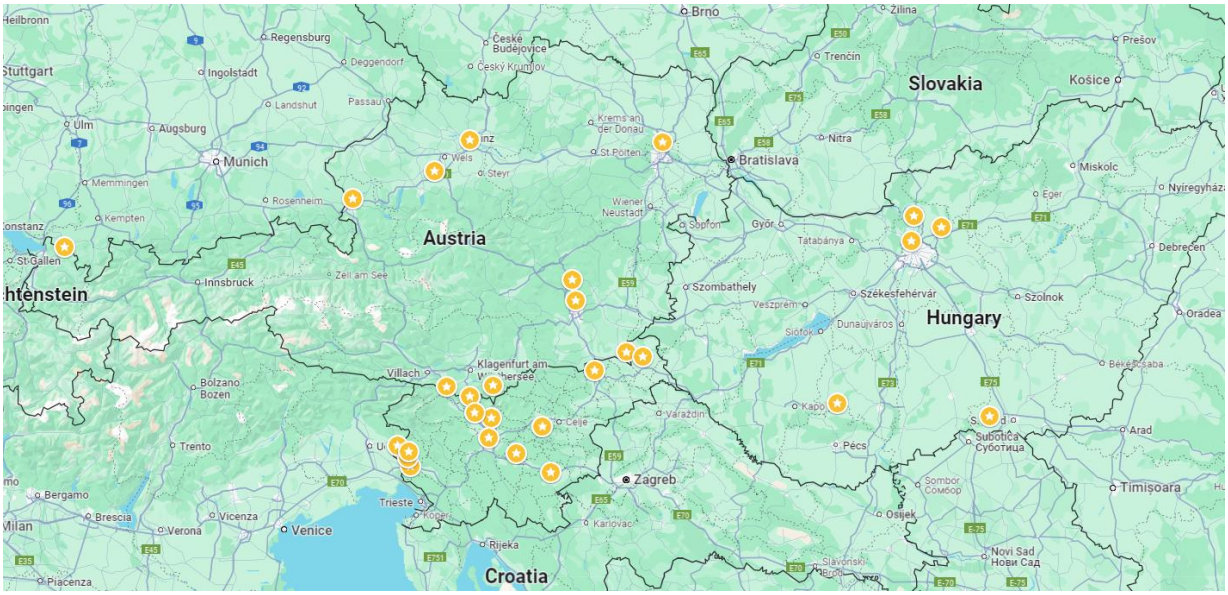


Figure 2: A map with locations of case studies marked with orange stars.

The national regulatory frameworks, market capacities, and sector-specific policies that support building renovations vary significantly across the three RENOINVEST countries. To address these differences, the RENOINVEST consortium has conducted a comprehensive analysis of the national contexts. The findings are detailed in the report titled "*Policy context and market capacities for sustainable building renovations*"[1].

The residential and municipal sectors present significant financing needs and opportunities for energy savings; therefore, this project addresses both building types. Given the distinct ownership structures within these sectors, a variety of financial options are required. Furthermore, national governments often implement divergent policy frameworks to encourage building renovations, shaped by each country's historical context and financial landscape.

For **Austria**, renovation cases from large cities like Vienna (6), Linz and Graz are listed, but also quite evenly represented are small cities, like Vorchdorf and Semriach. 9 out of 16 study cases we choose were residential buildings or complexes and out of that two were renovated though by private owners and with a mix of private funds and reserves. The rest of non-residential buildings presented in this study are municipal, for e.g. administrative buildings, schools and homes for seniors. Only three projects were implemented with the collaborations of ESCO in the form of EPC, while the rest show a varied mix of municipal, governmental and European loans, subsidies and fundings.

[1] Will be made available soon at: https://www.archenerg.eu/en/renoinvest

Most of the projects from **Hungary** originate in the capital, Budapest, and other major cities. However, there are also some cases from smaller cities and towns. The selection of these projects was not based on their geographic location but rather on the financial structures involved, which are generally independent of the location. The public buildings include mainly municipal buildings where most of the renovation described were financed by non-refundable grants (70-100 %), or by a combination of grants and the own contribution of the municipality. As municipalities have very limited access to loan financing and usually do not have much own resources grants are the only opportunity for many of them to implement investments in refurbishments or renewables. The presented example of renovation with financial combination of dedicated EU programmes (PIMES CONCERTO, Staccato), government´s grant programmes and own contributions of the municipality/homeowners, and to some extent third party finances/ESCO indicates that all funding sources had to be carefully planned, prepared and coordinated. In private apartments in the condominiums, the renovation is either financed by a combination of grants and own contribution of the homeowners, or only by the contribution of the homeowners. In private single-family homes, the renovations are financed either by the combination of grants and own contributions, preferential loans and own contributions, or by own resources only.

Slovenian case studies are evenly distributed across the country, with only two cases from the capital city of Ljubljana, while the rest are mostly from other major cities in the country, such as Maribor, Kranj and Novo mesto. It should be noted that some examples are typically very large, practically at the municipal level (Kranj, Ljubljana), that they are combinations of PPPs and that they started relatively early, i.e. at the turn of the 21st century. They mostly cover public buildings such as schools, kindergartens, sports halls, etc. It should also be emphasized that assistance to municipalities from local energy agencies is very important when it comes to tender documentation, organization and management of processes.

In terms of volume, the cases are very different in size, from individual buildings to entire settlements of up to 250 or more residential units and additional business premises. The same applies to the scope of works or the integrity of renovation measures, which vary from case to case. But what they all have in common is that they do not address building renovations from a comprehensive sustainability point of view and the entire life cycle of buildings.

5.2 Description and analysis of each case

5.2.1 Austria

No. 1: **Apartment block Markartstraße Linz – Passive house renovation**	
FINANCIAL DATA	
Type of financing, year	Reserves, funding & subsidised housing loan, 2006
Financier	Oberösterreichische Landesbank AG, BMVIT (non-repayable subsidy)
Specifics	First renovation to passive house standard, use of prefabricated façade modules
Beneficiary	GIWOG – Gemeinnützige-Industrie-Wohnungs AG (non-profit housing association)
Link	https://www.giwog.at/projekte/referenzen/linz-1-passivhaus-sanierung
DESCRIPTION and PHOTO	

Picture 1: Front Side Apartment Building, ©Gemeinnützige Industrie-Wohnungs-AG

Upgrading an apartment building in Makartstrasse, Linz, to near Passive House standard

The residential complex was built in 1957/58 and consists of 50 residential units, 5 storeys and the total usable living space (incl. balcony) is 2,981.92 m². This was the first time that an apartment building in Austria was renovated to Passive House standard; all the necessary steps were taken to achieve best air quality, comfort and low energy consumption even in an existing building. As part of this, heating energy demand was slashed from 179 kWh/m²a to 13.3 kWh/m²a which amounts to savings of approx. 455,000 kWh/a and a reduction in CO_2 emissions from 160 t/a to 14 t/a.

For the modernisation to a passive house standard included the following construction measures:

- Prefabricated façade elements with built-in windows and ducting for controlled ventilation
- A solar honeycomb façade was employed
- Living space is ventilated mechanically by means of single-room devices
- The balconies were enclosed, which increased the usable living area in total by 317.43 m² and sun protection for windows and loggia was installed
- Thermal insulation of basement and attic ceilings and new roof covering completed the modernisation of the building envelope.

The modernisation of the energy system consisted of:

- Installation of controlled ventilation with a 70 % heat recovery in the apartments for each room

- The existing district heating connection remained in place but instead of gas instantaneous water heaters, district heating instantaneous water heaters were installed.
- The existing radiators were supplemented with room thermostat which makes individual room temperatures and the heating operation during absence in the heating period possible.

The Renovation was carried out in a quite short period (thanks to prefabricated elements) and without much inconvenience for the occupants.

The total construction costs were approx. 2.446.000,00 Euro (787,00/m² usable living space)- The cost increase involved in achieving Passive House standard was roughly 27 % compared to conventional renovation.

The financing mix consisted of Reserves, non-repayable grant from BMVIT (funding for innovative additional costs, demo project), 5 years loan with 40 % annuities subsidy (federal state of Upper Austria) and statutory maintenance and improvement contribution (EVB) 2006 = € 1,39/m² WNFL/month.

As a result of the newly introduced passive house subsidy for the refurbishment of old houses in the Upper Austrian Residential Building Refurbishment Regulation 2005 of 8 April 2005, an increased annuity subsidy is granted for the repayment of loans. The extent of the annuity subsidy is granted at 40% for a maximum period of 25 years, but no longer than until the loan has been repaid in full. In connection with the new refurbishment subsidy with the non-repayable grant (subsidisation of innovative additional costs), and sufficient maintenance funds have been saved in accordance with the possibilities of the WGG (non-profit housing association law Austria), the additional costs will therefore not result in any increase of the monthly charges for the tenants.

The heating costs could be reduced by approx. 80- 90 %. Heating costs before average approx. 0.69 Euro/m² month incl. VAT, Heating costs after modernisation approx. 0.08 Euro/m² month incl. VAT.

The project won the Austrian Award for Architecture and Sustainability in the category modernisation in 2006.

Building owner: GIWOG – Gemeinnützige Industrie-Wohnungsaktiengesellschaft
Architectur: Arch+More ZT GmbH, Velden/Wörthersee – Linz, DI Ingrid Domenig-Meisinger
Energy planning: E-Plus, DI Bernd Krauß

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Through high renovation standards considerable decrease of energy demand side (efficiency and savings) and comfort for tenants. ▪ Through prefabrication and good planning inconvenience for tenants can be kept to a minimum during renovation period.	▪ Higher construction costs for passive house standard for non-profit housing only possible with enough reserves and the right subsidies.
Opportunities / Possibilities	**Threats / Barriers**
▪ Good replicability and upscaling. ▪ Prefabricated elements and industrial renovation –potential to unlock new markets for large-scale renovation projects.	▪ Regulation for non-profit housing subsidies (especially for high quality renovations) are volatile to political changes.

No. 2: Residential complex "Friedrich-Inhauser-Straße", Salzburg – Zero Carbon Refurbishment "Wir InHAUSer"

FINANCIAL DATA	
Type of financing, year	Housing Subsidy Salzburg, 2021
Financier	Federal State of Salzburg, Climate and Energy Fonds Austria
Specifics	Payback renovation costs through densification/extension of buildings
Beneficiary	Heimat Österreich (non-profit housing association)
Link	https://www.heimat-oesterreich.at/de/Unternehmen/Referenzen/Friedrich-Inhauser-Strasse_rf_1386

DESCRIPTION and PHOTO

The residential complex of the non-profit housing association "Heimat Österreich" was built in 1985. The energy efficiency of the complex was correspondingly to the year of construction. Lack of accessibility, poor lighting and an urgent need for refurbishment of balconies, roofs and moisture insulation necessitated renovation.

The aim of the extensive refurbishment was to reduce the CO2 emissions of the residential complex: an energy concept with an exhaust air heat pump and heat recovery from wastewater, a reduction in individual car use through a targeted mobility concept, as well as the use of eco building materials contribute to the Zero Carbon Refurbishment Concept.

The project also supports urban densification, that contribute to the medium to long-term reduction of land consumption and thus sustainable urban development. The extension was carried out in timber construction and to the existing 75 flats a total of 24 subsidised flats were added.

Picture 2: Wir InHAUSer Neighbourhood, ©Arch. DI Christof Reich

So that the refurbishment not only contributes to the Paris climate targets, but also within the specified cost of the Salzburg housing subsidy, the various technical aspects had to be well harmonised. Unique in this combination (subsidised housing, densification) is the modern heat recovery system. Waste heat from the room air and wastewater are used to cover the heat demand. Some of the electricity is also generated directly on site. Up to 20 % of the total electricity are supplied via the photovoltaic system on the roof. For this Salzburg AG is offering a new tenant electricity model which gives the residents a detailed overview of their electricity consumption. The combination of all measures leads to a reduction greenhouse gas emission. The greatest CO2 savings are achieved in operating energy and grey energy. The overall technical concept was drawn up by ECA- Energy Consulting Austria and developed together with the Fachhochschule

Salzburg and SIR- Salzburger Institut für Raumordnung und Wohnen and optimised step by step based on simulations.

The refurbishment project was accompanied by a research project with SIR. With the studies 'ZeCaRe' (Zero Carbon Refurbishment) and 'ZeCaMo' (Zero Carbon Mobility), the SIR developed an overall concept for refurbishment with a low ecological footprint. Comprehensive accompanying research was financed by the Climate and Energy Fund as part of the 'Smart Cities Initiative'. The architectural realisation was provided by cs-architektur (Christoph Scheithauer) and Stijn Nagels.

The total gross costs amounted to 2 250 Euros per square metre of gross floor area, the heating requirement is 28.6 kWh/m2a. Instead of gas, pellets are used for heating, 75 per cent of the heat supply is covered by heat pumps with heat recovery from wastewater, and 20 per cent of the total electricity requirement comes from photovoltaics. The issue of mobility was considered right from the start - a particularly important aspect in Salzburg, which is notoriously infatuated with individual transport. Today, a mobility point with sharing services, a bicycle garage and e-charging stations offers residents a range of options, and the car parking space ratio has been reduced from 1.2 to 0.8.

As a non-profit building organisation, Heimat Austria only charges the construction costs to the residents, beyond that there are no further surcharges.

The increase from 75 to 99 flats has created an additional 24 subsidised flats. The city of Salzburg has the right to allocate all flats, thus ensuring that they are allocated according to social criteria. In addition to operating costs, the rent also includes use of the 'Mobility Point'. The rents were also made possible by the City of Salzburg granting a building right to the property developer.

In Salzburg, the average rent on the open market is 18.50 euros per square metre. Thanks to the housing subsidy and densification, a rent of EUR 10.50 per m2 (guideline rent EUR 10.05) was maintained in the project.

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Savings for tenants in energy costs through switch to renewable energy and recovery of heating energy. ▪ Densification.	▪ Effort and inconvenience for relocation of residents during the construction site.
Opportunities / Possibilities	**Threats / Barriers**
▪ Comprehensive accompanying research – well documented for replication by other social housing associations.	▪ Dependency on subsidy conditions.

No. 3: **Liebenauer Hauptstraße – Graz, Passive House Renovation**

FINANCIAL DATA	
Type of financing, year	Reserves, funding & subsidised housing loan, 2014
Financier	Giwog's own funds, subsidies from the Province of Styria, a special subsidy from Kommunalkredit Austria
Specifics	Prefabrication façade modules
Beneficiary	GIWOG (non-profit housing association)
Link	https://www.giwog.at/projekte/referenzen/graz-giwog-passivhaussanierung

DESCRIPTION and PHOTO

Picture 3: New Façade Elements, ©GAP Solution GmbH

The residential complex on Liebenauer Hauptstraße in Graz consists of seven apartment blocks, divided into two rows that are diagonally offset and dates from 1979-1981. It had uninsulated walls, a central gas-fired heating system and electricity-powered boilers for decentralised hot water generation- typical of the standard of residential buildings up to the 1980s. Façade, windows and, above all, the loggias of the more than 30-year-old urgently needed to be renovated. A conventional thermal renovation would have been impossible due to the structural conditions and would have resulted in either considerable additional costs or inadequate results.

Instead of conventional refurbishment methods with a thermal insulation composite system, the modernisation was carried out using largely prefabricated wall components in timber construction. This eliminated the need for costly scaffolding, noise and dirt, and significantly reduced the construction time to 10 months. This solution is characterised by a significantly **longer usage cycle** and is accompanied by **considerably lower operating and maintenance costs.**

The refurbishment resulted in an almost 'solar self-sufficient' passive residential complex. The final energy consumption for heating was reduced from approx. 135 kWh/m²a to approx. 8 kWh/m²a - a total energy consumption reduction of >90%. The energy saving for hot water production is 55%.

The entire endeavour was carried out while the building was fully usable 'almost undisturbed'. This means that the tenants of the 137 flats were able to use their flats unhindered during the entire construction phase and there was no significant intervention in the existing housing stock.

This was achieved using a special façade, which was supplied with prefabricated functional panels (passive solar honeycomb panels, active air collector panels in combination with heat recovery ventilation units and façade-

integrated photovoltaic modules for DC-based hot water preheating, as well as generously dimensioned balcony and window areas). The exterior surface is also a visually very modern security glass level.

A few key components ensure energy functionality:

- ISO-solution: gap façade panels
- AIR-solution: façade-integrated fresh air/exhaust air ducting through the façade in combination with classic decentralised heat recovery units
- PHOTOVOLTAIC WATER solution: façade-integrated WATER solution as water preheating using photovoltaic modules
- Folding/sliding windows in the loggia area
- Airtight connection of the wall elements to the existing masonry

Financing, costs and savings:

The refurbishment costs totalled EUR 10.75 million excl. VAT incl. refurbishment of the residential area, lifts, stairs and outdoor facilities.

Giwog's own funds, subsidies from the Province of Styria for the major renovation and a special subsidy from Kommunalkredit Austria were used to finance the modernisation to passive house standard.

The special subsidy of the Kommunalkredit Austria was available in 2013 and 2014 and amounted to € 5.500,00 per apartment and for this a renovation agreement had to be concluded that no increase in rent for the tenants would take place because the additional costs are covered by the subsidy.

For the re-financing the statutory maintenance and improvement contribution (EVB) of € 1,62/m² WNFl*. excl. VAT (status 2013) to be paid by the tenants according to the non-profit housing law (WGG) is used.

The modernisation reduced the final energy consumption for heating from approx. 135 kWh/m²a to approx. 8 kWh/m²a (with a decentralised system). For hot water preparation, this was reduced from approx. 21 kWh/m²a to 10 kWh/m²a by using PV electricity directly to heat the water. Overall, the total energy consumption for heating and hot water was reduced by around 88% (space heating by 94%, hot water by 52%). The energy savings for heating and hot water amount to 1,350 MWh/year (88%), which corresponds to savings of over 100,000 euros/year in operating costs. The refurbishment achieves an annual CO2 reduction of 378 tonnes.

*WNFL = usable living space

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Renovation in occupied condition. ▪ Prefabrication of wall elements – shorter construction time with less inconvenience for inhabitants.	▪ Dependency on subsidies for no increase in rents.
Opportunities / Possibilities	**Threats / Barriers**
▪ Prefabrication reduces costs and construction time – wall elements can be used for ventilation, new pipes for heating, water, etc. ▪ Shows that renovation to passive house standard is possible.	

No. 4: Smart Block Geblergasse – refurbishment & district heating and cooling pilot project – Vienna

FINANCIAL DATA

Type of financing, year	Subsidy & ESCO, 2019
Financier	City of Vienna, ESCO – Beyond Carbon Energy
Specifics	Energy savings contracting
Beneficiary	Community of building owners – Geblergasse 11 and 13
Link	https://www.zeininger.at/inhalt/textonly/gebT.html

DESCRIPTION and PHOTO

The 'Smart Block Geblergasse' pilot project demonstrates that a CO2-free energy supply across buildings is also possible in Gründerzeit-style buildings. The in-depth study SMART BLOCK II Energy, funded by the Climate and Energy fund, focussed on a specific investigation block with a high population density and a need for renovation. Based on this study the pilot project "Smart Block Geblergasse" was realised.

Picture 3: Renovated Courtyard Geblergasse, ©Stadwien.gv.at

In 2019, an energy supply based largely on geothermal and solar heating was realised for the first time across all properties in a typical Viennese block of Gründerzeit buildings in the 17th district, which had previously been heated with natural gas. The prerequisite for this was that the comprehensive refurbishment of the buildings enabled a corresponding reduction in the heating requirement.

The initial situation of the energy supply posed some challenges: High heating requirement (125 or 160 kWh/m2a), no district heating network connection and gas floor heating with radiators. Through a comprehensive thermal renovation of the buildings **heating requirements were decreased by 60 to 70 %.**

The centrepiece of the energy system is an expandable anergy network that connects buildings, heat sources and heat storage units and is set up and operated as part of an energy supply contract. The buildings at Geblergasse 11 and 13 form its starting cell; further neighbouring buildings are to follow in the course of upcoming renovations.

About the buildings:

- Address: Geblergasse 11 and 13, 17th district
- Building type: multi-storey residential building from the Gründerzeit, built in 1869 and 1875
- Ownership: private
- Completion: 2019
- Usable living space: 1,770 m2
- Number of residential units: 16 and 9
- Heating requirement (existing building): 36 kWh/m2a (previously 125) or 66 kWh/m2a (previously 160)

After almost a year of exploration and negotiations with 4 energy companies, a contractor was found for the technical and economic implementation of the energy concept in the block, who would take on this new task with entrepreneurial agility and a long-term contract (20 years). The economic objective was to keep the energy costs for heating and hot water for the tenants below the costs of Viennese district heating. Summer temperature control is included as a flat rate. A solar system and PV system on the roof further reduce the energy costs for the buildings The 30% subsidy from the state of Vienna for the pilot project to set up a decentralised anergy network made this goal possible.

The thermal renovation of the two residential buildings was funded by the wohnfonds_wien (funding programs: "Sockelsanierung" and "Blocksonderförderung"). Both buildings were extended in timber construction and new living space was created. This makes it possible to refinance the refurbishment costs, even in the restricted rent segment. (Extension in existing buildings is treated as a new building and market rent can be demanded.)

The Smart Block Energy II research project was by the Climate and Energy Fund, the City of Vienna (MA 20 Energy Planning) and the European Union (Horizon 2020).

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Financing mix for comprehensive renovation and exchange of heating system. ▪ Neighbourhood approach – shared investment cheaper than for single house.	▪ Pilot project with a lot of subsidies from City of Vienna, other federal states do not offer such good funding conditions.
Opportunities / Possibilities	**Threats / Barriers**
▪ The pilot projects shows that Anergy networks in urban areas can be an alternative to district heating.	▪ Assumption Risks: Incorrect assumptions about equipment life, energy prices, or savings can result in unmet cost savings. ▪ Federal guarantees for contracting companies have still not been implemented.

No. 5: KA 7 Kaiserstrasse - Innovative refurbishment of a listed Gründerzeit building with interior insulation - Vienna

FINANCIAL DATA

Type of financing, year	Subsidies (2013)
Financier	City of Vienna, Ministry of Mobility, Innovation, Technology (BMVIT now BMK)
Specifics	Listed building and mixed use (dorm, apartments…)
Beneficiary	Kongregation der Mission vom Heiligen Vinzenz von Paul
Link	www.nachhaltigwirtschaften.at (project report)

DESCRIPTION and PHOTO

Picture 5: Monastry Building After Renovation, ©Schöberl & Pöll Gmbh

The four-story monastery building of the Lazarists at Kaiserstraße 7, constructed in 1904, is part of a heritage-protected ensemble surrounding the Church of the Immaculate Conception in the 7th district. In 2013, it was innovatively and sustainably renovated and subsequently monitored for two years by the Vienna University of Technology as a demonstration project for handling historical building fabric, to gather information for further renovations of protected buildings.

Due to heritage protection regulations, conventional thermal renovation was not an option. Instead, a highly efficient thermal renovation was achieved through an intelligent mix of measures: To avoid affecting the valuable brick facade with historical ceramic tiles and Viennese box windows, the thermal quality of the envelope was improved with a 5-centimeter-thick internal insulation (calcium silicate boards) and passive house standard wooden windows were installed behind the outer window sashes. Conventional external insulation with mineral wool was used on the firewalls and courtyard facades, where there are no decorative elements.

The roof structure was also thermally renovated, structurally improved, and converted for residential use while retaining the original slate roofing. The usable floor area was increased from approximately 1,935 m² before the renovation to around 2,750 m² after the renovation and attic conversion. Additionally, the entire building services system was renewed, and a comfort ventilation system with heat recovery was installed in all living and common areas. The existing district heating supply was maintained. The calculated heating energy demand was reduced by more than 80 percent through the implemented conventional and innovative efficiency measures. This demonstration project shows that a significant reduction in energy demand can be achieved even with strict heritage protection requirements.

The building underwent a comprehensive renovation using funding from the State of Vienna (special subsidy for the renovation of dorms, old people's homes…) and as demonstration project in the flagship initiative "Gründerzeit mit Zukunft" funding of innovative surplus costs from the program "Haus der Zukunft plus"

The construction costs amounted to 4.4 million euros (excluding VAT) and the total costs were 5.16 million euros (excluding VAT) for the renovation of the existing building and the attic conversion. With a total usable living area of 2,750 m² in the existing building and attic, this corresponds to construction costs of 1,600

euros/m² of usable living area (excluding VAT) and total costs of 1,876 euros/m² of usable living area (excluding VAT). Incidental and planning costs accounted for nearly 15% of the total costs.

The calculated heating energy demand was reduced from 132 kWh/m²a to around 26 kWh/m²a. Through conventional and innovative insulation measures, a highly efficient attic conversion, and a ventilation system with heat recovery, an 80% reduction was achieved. Including hot water, heat losses, and auxiliary energies, the reduction in heating energy demand was approximately 75%. Due to the existing district heating supply, no change in energy carrier was made. In terms of primary energy, the savings amounted to over 60% due to higher auxiliary energies and the poorer primary energy balance of electrical energy. Overall, the renovation and conversion measures resulted in specific savings of over 35%, ensuring that no more CO2 was emitted despite the increased living space.

Awarded a nomination for the 2014 State Prize for Architecture and Sustainability
Recipient of the Vienna Urban Renewal Award

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Through urban densification new living space was created and renovation costs can partly be repaid by rents (due to densification no restriction of rents).	▪ Higher renovation costs due to historic preservation of façade.
Opportunities / Possibilities	**Threats / Barriers**
▪ The project shows that listed Gründerzeit Houses can undergo energy-efficient renovation with affordable costs.	▪ Without proper funding owners of listed buildings tend to set only refurbishment (cosmetic) measures instead of deep energy renovation.

No. 6: "Gründerzeithaus" Kauergasse 2, Vienna

FINANCIAL DATA	
Type of financing, year	Funding demonstration project, 2022-2024
Financier	Climate Ministry Austria through Climate Fund Austria, City of Vienna
Specifics	Project name: Queen Gudrun II
Beneficiary	Schöberl & Pöll (Consortium Leader)
Link	Mehr als nur grüne Fassade: Gründerzeit-Haus nutzt Grauwasser- Klima- und Energiefonds- Klima- und Energiefonds (klimafonds.gv.at)

DESCRIPTION and PHOTO

Picture 6: Kauergasse 2 After Renovation, ©Trimmel Wall Architekten

The turn-of-the-century corner house at Kauergasse 2, 1150 Vienna, was built around 1900 with four-story street tracts and two courtyard tracts. From 2022 to 2024, the entire turn-of-the-century house was thoroughly renovated. The renovation was carried out via a base renovation using funding from the state of Vienna.

As part of the research project "QUEEN GUDRUN II" of the Climate and Energy Fund, a number of measures could also be implemented on the building at Kauergasse 2. These now show how innovative a comprehensive renovation of a turn-of-the-century house can work: Kauergasse 2 now serves as a lighthouse project, which is also available as a demonstration object for interested parties.

In addition, the economic feasibility of such a renovation was demonstrated with the Kauergasse 2 project. The comprehensive renovation of the project also contributes to the improvement of the microclimate (through greening measures), production of local renewable energy (through the operation of a PV system), and to the reduction of energy demand (through the installation of the grey water recycling system and the implementation of the renovation measures).

Building Data

- **Year Built:** 1895
- **EnerPHit Renovation:** 2023
- **Gross Floor Area:** 4,232 m²
- **Heating Demand (PHPP):** 24.2 kWh/(m²·a)
- **Primary Energy Renewable (PHPP):** 59.9 kWh/(m²·a)
- **Green Roof:** 125 m²
- **Green Facade:** 78 m²
- **Photovoltaic:** 17 kWp
- **Phase Out of Gas**

The project received a mix of different subsidies from the City of Vienna (thermal renovation, exchange fossil heating system to renewable heating), Climate and Energy Fonds (project Queen Gudrun II)

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ A demonstration case of comprehensive renovation. ▪ Economic feasibility. ▪ Improvement of the microclimate. ▪ Saving of the water.	▪ 35 owners, one apartment owner did not agree, and the apartment was not renovated. The WEG law is obstructive!
Opportunities / Possibilities	**Threats / Barriers**
▪ Further implementation this type of investments.	

No. 7: **Out of gas' showcase project Zwölfergasse 21- Vienna**

FINANCIAL DATA

Type of financing, year	Subsidies, Erste Green Housing Loan, 2023
Financier	City of Vienna, Erste Bank der österreichischen Sparkassen AG
Specifics	Pilot project for Gründerzeithaus renovation with geothermal heating
Beneficiary	Building owner private
Link	https://www.wien.gv.at/umwelt/vorzeigeprojekt-zwoelfergasse

DESCRIPTION and PHOTO

Picture 7: Courtyard View After Renovation, ©Graf Holztechnik

The pilot project shows how a Gründerzeit House can be converted to a centralised geothermal heating supply and what role a pavement can play in this.

A 4-storey Gründerzeit building with a courtyard wing at Zwölfergasse 21 in the 15th district was to be thermally renovated, modernised and converted from gas to a climate-friendly heat supply. In view of the poor building fabric, the lack of connection options to the district heating system and the cramped conditions on site, this project proved to be particularly challenging.

During renovation, 4 of the 12 existing flats were merged into 2 refurbished flats and 4 new flats were created, 3 of which were in the newly converted attic. All façades were extensively thermally refurbished with 18 centimetres of thermal insulation and new windows. The articulated façade on the first floor was given new windows and subtle internal insulation, while the other floors were fitted with classic external insulation. The lift in the courtyard provides barrier-free access to all floors, and the pergola theme was generously reinterpreted as a link between the street and courtyard wings, giving each flat a direct open space and transforming the peripheral location into a high-quality, modern residential building.

The building in Zwölfergasse was previously heated with natural gas. After renovation, it is heated and cooled using a heat pump with photovoltaic support. The system is based on energy recovery from geothermal probes. The probe field consists of seven probes. Four probes were installed in the inner courtyard of the building. To ensure a 100 per cent geothermal supply, three additional probes were installed at the roadside in front of the building. This possibility of utilising public property for the energy supply of a private residential building is new in Vienna. A solar thermal system on the roof is also part of the energy concept to regenerate - i.e. reheat - the soil in the area of the probes.

Initial situation of the energy supply: High heating requirement of 127 kWh/m2a and hot water and heating via gas heating with individual boilers and radiators.

Elements of the new energy system

- Expansion stage 1: four geothermal probes at 100-150 metres in the inner courtyard
- Expansion stage 2: an additional 3 geothermal probes at 220 metres in the pavement in front of the house (public property)
- 55 kW brine-to-water heat pump for heating and cooling
- Hot water is heated in the flats from the flow from the heating systems
- Heat output in new and fully renovated flats via underfloor heating or low-temperature radiators, in partially renovated flats via high-temperature radiators
- 100 kWp solar thermal system for 'over-regeneration' of the geothermal probes in the inner courtyard (Heat Harvest system)
- 6.48 kWp PV system on the roof of the street wing to supply the heat pump
- CO2-free full supply from completion in April 2023

Financing, costs, savings:

An investment totalling around 4.1 million euros was made, which should pay for itself in around 20 years due to savings in energy costs and higher achievable returns.

The project has got subsidies from the City of Vienna ("Sockelsanierung": mix of non-repayable subsidy (depending on energy savings) and subsidised loan (for around 40 % of renovation costs) and an additional special grant: "Blocksonderförderung" for urban structural improvement as non-repayable subsidy up to 100 % of costs for structural improvement).

The rest of the investment was financed through own resources and "ERSTE Green Housing Loan" (financed by the EIB program) over a period of 25 years with fixed interest rates.

The heating requirement could be reduced by around 65 per cent with comprehensive thermal measures.

The project was advised and accompanied by "Hauskunft" (One-Stop-Shop for renovation, City of Vienna) and is one of hundred showcases in the Viennese initiative "Raus aus Gas".

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Through involvement of EIB – fixed interest rates and good loan conditions. ▪ Vienna promotes urban structural improvements.	▪ Relatively high investment for deep drilling for geothermal energy. ▪ Lack of space in urban regions.
Opportunities / Possibilities	**Threats / Barriers**
▪ Vienna allows building owners to dig for geothermal heating also in public space to foster deep geothermal energy use.	▪ High investment costs and long-term returns discourage many building owners.

No. 8: Smarter Together- Hauffgasse 37 – 47, Vienna

FINANCIAL DATA	
Type of financing, year	Reserves, Subsidies 2017-2022
Financier	City of Vienna, EU – Horizon 2020 (Project "Smarter Together")
Specifics	Comprehensive renovation with participation of inhabitants
Beneficiary	BWS-Gruppe , Gemeinnützige allgemeine Bau-, Wohn- und Siedlungsgenossenschaft
Link	https://www.gsd.at/Home/projekte/hauffgasse

DESCRIPTION and PHOTO

Picture 8: Buildings Freshly Renovated, ©GSD

The residential complex at Hauffgasse 37-47 in 1110 Vienna was completed in 1984 and needed not only a facelift. Within the framework of the "Smarter Together" project, the large housing complex owned by non-profit housing developer BWSG was comprehensively renovated and extended. The refurbished building is a social/subsidised housing complex with a total of 485 residential units and around 1,000 residents. During the refurbishment, 79 new residential units were created in the attic.

Key realisations:

- Thermal-energetic refurbishment with
- 2-storey extension at stairs 2-9 (79 new flats)
- Enlargement of loggias
- Revitalisation of the community centre
- EU-funded urban regeneration initiative 'Smarter Together- Gemeinsam g'scheiter'
- Innovative e-car sharing pilot scheme

Construction started in May 2017 and was completed in mid-2020. Over a total of three implementation phases, a step-by-step renovation of the residential complex, which is divided into three separate blocks, was carried out.

In addition to the necessary removal of the external wall panels as well as general thermal refurbishment measures (including fitting of thermal insulation on the outer façade and ceiling using mineral wool, new windows and doors) to reduce energy demand, maintenance work was carried out (e.g. renovation of balconies, installation of blinds, replacement of electrical systems, thermal insulation of pipes, installation of thermostats in the flats).

General measures to improve comfort for the residents (e.g. creation of barrier- free access, relocation of the bicycle parking area to the ground floor, renovation of communal facilities) were also taken.

In addition to the renovation of the building envelope, measures were taken to improve the heating technology (renewal of the district heating and hot water transfer stations). Based on several feasibility studies by the energy

supplier, for structural reasons it was decided to install a PV system on the roofs of block 1 and block 3, covering approximately 275 m2 and 80 m2 respectively, and able to generate a total of 69 kWp. The electricity produced on site is now also used to heat water with electric boilers

Tenant support from wohnbund: consult was offered to residents throughout the entire refurbishment period. Residents were able to find out about the individual stages and measures of the refurbishment and voice their concerns as experts in the residential complex. Up-to-date information on the individual measures and the construction process was provided at the on-site Infopoint.

Questions about accessibility, open spaces/green spaces, the children's playground, the community centre and e-mobility were among the topics discussed.

The residents took part and helped shape their residential complex!

Financing, costs, savings:

With total refurbishment costs totalling EUR 36.9 million, the City of Vienna's funding amounts to EUR 17.7 million. With EU funding from the 'Smarter Together' project as part of the EU's 'Horizon 2020' research programme, an additional EUR 1.3 million will be made available for innovation measures in the areas of energy, mobility and participation.

This project highlights the significant energy efficiency improvements achieved while ensuring that the financial impact on existing tenants is minimized.

- **79 new apartments** ranging from approximately 45 to 95 m²
- **Existing tenants** will not be financially burdened by this addition
- **Additional funding** of 20 €/m² of usable floor area in the existing building (totalling over 800,000 € in non-repayable grants)
- **Energy performance indicator**: 23 kWh/m²a (119 kWh/m²a before renovation)
- **Improvement**: 80.67%

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Social support during the renovation process through additional funding. ▪ Better acceptance of tenants for measures taken through participation.	▪ Innovative measures for mobility, energy and participation need extra funding (are not part of regular renovation subsidies).
Opportunities / Possibilities	**Threats / Barriers**
▪ Project demonstrates that large scale residential complexes can undergo major changes in energy performance and living quality.	▪ Question: After additional funding for participation and social support ended, can the extras in mobility and community shared facilities be financially and socially continued? Who will finance it?

No. 9: Landespflegezentrum Bad Radkersburg - Carinthia

FINANCIAL DATA	
Type of financing, year	ESCO, 2009/2010
Financier	Siemens Österreich AG- Contractor
Specifics	Switch from fossil to renewable heating through energy savings contracting model
Beneficiary	LIG – Landesimmobiliengesellschaft Steiermark
Link	https://www.soziales.steiermark.at/cms/dokumente/11350033_52077529/feae4985/lpz%20ra.pdf

DESCRIPTION and PHOTO

Picture 9: LPZ Bad Radkersburg, ©Pachernegg

The building is a state care centre in the centre of Bad Radkersburg, owned by LIG - Landesimmobiliengesellschaft Steiermark in 2009. The nursing home was completed and opened in 1964 and offers space for 128 nursing guests and 100 carers. At the beginning of 2008, LIG Steiermark decided to reduce greenhouse gas emissions by heating the state care centre in Bad Radkersburg without the use of heating oil as a primary energy source and to reduce energy requirements for heat, water and electricity through energy efficiency measures in parallel with the heating switch.

The greatest savings potential came from switching from heating oil to wood for space heating. 'Before the renovation, the heating was provided by an oil boiler. Now the state care centre has been connected to the biomass local heating network operated by the regional supplier "Quelle GesmbH". By connecting to the local heating network, the installed heating output of 1,860 kW from the oil-fired boilers could be reduced to 500 kW (or 320 kW in the final expansion).

A solar thermal system with a collector area of 143 m² was installed for hot water consumption. The storage capacity of the system is twice 3,000 litres and is designed for 128 nursing patients and 100 employees.

Electricity consumption was also reduced by approx. 12 per cent through modernisation and conversion of the energy distribution system using speed-controlled circulation pumps, energy-saving lamps instead of light bulbs and electronic ballasts instead of conventional ballasts.

To safely operate the low-temperature system for heating and hot water a water treatment system to prevent legionella was also installed.

In a further expansion stage, the thermal building envelope was also modernised.

Financing, costs, savings:

Together with the Graz Energy Agency, LIG Styria developed the **'Integrated Energy Contracting'** model, in which the energy source conversion, efficiency measures and the price for energy supply, operational management and plant refurbishment were the award criteria for selecting the best bidder. Following an EU-wide tender, the contract was awarded to Siemens Österreich AG for heat distribution in the Bad Radkersburg state nursing home. In this energy contracting model, the contracting partner Siemens made the initial investment, which totalled €

340 000 for the heating system. The contract period is 15 years. Overall, a positive cash flow of € 260 000 including investment and annual costs was forecasted for the state care centre over 15 years.

Through the involvement of Siemens AG as ESCO the necessary investments can be amortised from the energy cost savings, which are made up of future savings and rising energy prices. In addition, subsidies from Kommunalkredit (environmental investment promotion) were utilised to cover the additional environmental costs for the switch from fossil to renewable energy.

As part of the renovation, 47 per cent of consumption was reduced through targeted energy-saving measures (regarding space heating and hot water) and the switch to low temperatures. The calculated energy savings amount to 35 per cent or 364 MWh for heat consumption and 12 per cent or 51 MWh for electricity consumption per year and have been verified by Siemens during the annual audit.

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Amortisation of investment through energy savings. ▪ Award criteria clearly stated with the aid of experts before tender.	▪ The model of energy-saving contracting has so far been slow to establish itself as an alternative financing instrument for energy renovations in the Austrian market.
Opportunities / Possibilities	**Threats / Barriers**
▪ In the following years hospitals and old people's home followed the example of Bad Radkersburg.	▪ Lock-In effect if not paired with thermal renovation of building envelop. ▪ Conflict potential over performance guarantees.

No. 10: **Schoolcenter Vorchdorf – Upper Austria**

FINANCIAL DATA

Type of financing, year	ESCO, 2013
Financier	Cofely Gebäudetechnik GmbH (Contractor) – since 2021 EQUANS Austria GmbH
Specifics	Energy-saving refurbishment with contracting supported by Upper Austria
Beneficiary	Marktgemeinde Vorchdorf
Link	https://egruppe-vorchdorf.jimdofree.com/projekte/schulzentrum-heizung/

DESCRIPTION and PHOTO

Picture 10: School Centre Vorchdorf, ©Energiegruppe Vorchdorf

The school centre of the municipality of Vorchdorf is home to the primary school, the new secondary school, the polytechnic school, the regional music school and the after-school care centre of the Almtal municipality. Around 550 pupils attend school there, taught by around 100 teachers. The school centre was the largest consumer of heat and one of the largest consumers of electricity in the market town of Vorchdorf. Inspired by courses organised by the Upper Austrian Energy Saving Association, the idea was born to finance energy-saving refurbishment measures through contracting. The savings potential revealed by the detailed energy analysis and the risk-free financing convinced those responsible.

The refurbishment project was realised in 2013, with the market town attaching great importance to the involvement of local companies. A key part of the project was the modernisation of the control system and the installation of the new building management system, which coordinates the building's entire heating and ventilation system via a bus system. In addition, inefficient heating pumps were replaced with speed-controlled ones, balancing valves were newly installed or replaced and thermostatic heads were installed. Hydraulic balancing rounded off the package of measures. In addition to optimising the heating system, silicone rubber seals were fitted to more than 450 windows to reduce the heating requirement.

Financing, costs, savings:

In brief:

- Contracting client: Market town of Vorchdorf, 7,228 inhabitants
- Contractor: Cofely Gebäudetechnik GmbH (since 2021 EQUANS)
- Type of contracting: Energy-saving contracting
- Investment volume: approx. 295,000 euros
- Funded by: Energy contracting programme, federal environmental funding Upper Austria
- Contract term: 8 years (2014- 2021)
- Savings:
- 280,000 kWh/year
- 32,100 euros/year

- 72 tonnes of CO2/year

Energy contracting is a service contract in which a contracting party (the municipality of Vorchdorf) commissions a contractor (such as the company Cofely) to carry out refurbishment measures to save energy. The contractor (Cofely) pre-finances the measures and the contracting party (the municipality) refinances the repayment from the energy savings. On top of this, there exists a subsidy from the province of Upper Austria.

These measures have reduced the building's heat consumption by 21% and electricity consumption by 14%. Saving energy in public buildings requires more than just technical measures. It is equally important to train building users so that energy-efficient technology and user behaviour complement each other to achieve the greatest possible success.

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Through energy-saving contracting, the municipal budget is only slightly or not at all burdened. ▪ Relativly simple and fast process of financing.	▪ Not widely known, lack of information for communities and mistrust that promises of savings can be kept by contractor. ▪ Promotion of energy saving contracting only in some federal states.
Opportunities / Possibilities	**Threats / Barriers**
▪ Especially for municipalities with low budgets and high energy costs attractive.	▪ Lock-In effect if not paired with thermal renovation of building envelop.

No. 11: School Campus Hittisau

FINANCIAL DATA

Type of financing, year	Municipal Loan, 2020
Financier	HYPO NÖE – Federal bank für Lower Austria and Vienna AG
Specifics	Three municipalities jointly cover the costs as a school maintenance association. The project is a mix of renovation and new construction.
Beneficiary	Schulerhalterverband Hittisau
Link	https://www.klimaaktiv.at/bauen-sanieren/staatspreis/nominierungen-staatspreis-architektur-und-nachhaltigkeit/schulkomplex-hittisau.html

DESCRIPTION and PHOTO

Picture 11: Volksschule Hittisau, ©Lukas Schaller

The Hittisau school maintenance association carried out a general refurbishment of the school site in the centre of Hittisau. The school maintenance association is run by the municipalities of Hittisau, Riefensberg and Sibratsgfäll.

The project includes a reorganisation of the site, the construction of a new secondary and polytechnic school, a community building housing an event hall with underground car park and 2 gymnasiums, as well as the renovation of an existing building for the primary school.

The existing primary school from the 1980s was renovated to make it more energy-efficient and upgraded with silver fir and a great deal of design flair. The three school buildings are heated with district heat, and ventilation is provided by a moderately designed controlled ventilation with heat recovery. To keep an eye (and ear) on the air quality each class is equipped with a CO2 traffic light with green, yellow and red.

The low-tech approach was pursued right from the planning stage with building services and control components as well as highly energy-efficient maintenance and operation. The selected components are assessed according to their behaviour over the entire life cycle, automation is only used sparingly and after a thorough examination of alternatives. The result is an extraordinarily efficient, climate-friendly building with maximum comfort, low energy requirements and above-average long-term value retention.

Financing, costs, savings:

HYPO NOE is acting as lender for this project through a municipal loan. The total investment costs amount to EUR 15 million with a term of 15 years for the municipality of Hittisau.

To maintain a good overview and to be able to allocate the buildings and parts, the project costs were divided up accordingly:

- Community centre EUR 7,958,000
- New secondary school and polytechnic school EUR 11,030,000
- Remodelling of primary school and creative areas EUR 7,882,000
- New outdoor facilities EUR 1,421,000
- Alternative school EUR 627,000

- New underground car park EUR 1,696,000

After considering the funding commitments already made by the federal state and the financial advance payments made to date (approx. EUR 1.2 million), a debt financing requirement of approx. EUR 18 million will remain.

Without the subsidies still to be expected or further contributions of own funds, the following loan requirements are calculated for the individual municipalities:

- Hittisau EUR 15.6 Million
- Riefensberg EUR 2.1 Million
- Sibratsgfäll EUR 264 thousand

After the contribution of the planned own funds, the loan requirement will be around EUR 15 million. Further expected subsidies under the Education Investment Act, from the federal government and for energy-efficient construction are also not yet included.

Building type: Refurbishment and new construction of educational buildings
Conditioned gross floor area: 7,091.4 m²
Key energy figures:
Refurbishment according to OIB 2015, lc = 3.5 m, BRH = 3.8 m
Heating requirement 24.4 kWh/m2a
Primary energy requirement 109.7 kWh/m²a
CO2 emissions 14.2 kg/m²a
PV yield (all buildings) 164,900 kWh/a

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Jointly covering costs through 3 municipalities. ▪ Project was professionally accompanied by Energie Institut Vorarlberg (cost control).	▪ Multiple funding bodies lengthen the deciding and planning processes for financing investments in public buildings (how much funding, when, from whom).
Opportunities / Possibilities	**Threats / Barriers**
▪ The detailed cost calculation shows that refurbishment can compete with new buildings in costs and long-term savings.	▪ The need for multiple funding can discourage smaller communities and postpone renovation projects.

No. 12 Kindergarten Bad Eisenkappel - Vellach / Carinthia

FINANCIAL DATA

Type of financing, year	Subsidies & Transfers, 2020
Financier	Federal State of Carinthia, KLIEN, Kommunal Kredit
Specifics	Mix of different fundings and transfer from federal estate and State of Austria, Model renovation funded by Climate and Energy Fund
Beneficiary	Municipality of Bad Eisenkappel- Vellach
Link	https://www.klimaaktiv.at/bauen-sanieren/gebaeude-in-oesterreich/objekt-des-monats-9-2020.html https://mustersanierung.at/projekte/kindergarten-eisenkappel-vellach/

DESCRIPTION and PHOTO

Picture 12: Kindergarden Eisenkappel, © Paul Ott

The existing building was constructed in the late 1960s and provided space for two kindergarten groups. Around ten years ago, there was a need for additional childcare places and a crèche, but the building was too small for this. Following a discussion about the location, it was decided to carry out a general refurbishment of the kindergarten and to increase the number of places by adding an extension.

The existing, filigree wooden roof structure was made of reinforced concrete and insulated. The existing roof was built over with the new ceiling construction. The façade and roof structure from the late 1990s was retained, insulated and provided with a uniform covering.

All window constructions were replaced with new wooden windows with triple glazing. The floors in the group rooms were made of wood, while the common areas on the ground floor were covered with linoleum or tiles. On the upper floor, the existing parquet flooring was retained and replaced. The ceilings on the ground floor were fitted with suspended areas, as cables were installed, or acoustic measures were taken.

The entire floor structure was demolished and insulated in accordance with the structural elements. The building products used bear the Austrian Ecolabel.

A crèche is now also housed in the kindergarten building. Care was taken to allocate separate, accessible areas to the different users, i.e. kindergarten teachers and nursery visitors.

The east-west orientation of the building offers each group continuous units with the possibility of playing according to the position of the sun. The flat roof areas serve as movement areas for the children. Barrier-free access is provided by a ramp, which also creates a connection to the green space at ground level.

Widely projecting canopies provide shade for the windows and glazing on the ground floor. At the same time, they form shaded terraces for the children to spend time on. There are also external venetian blinds with electronic controls.

A ventilation system with heat recovery ensures optimum indoor air quality in the group and exercise rooms. Heating is provided by biomass district heating.

All electrical wiring in the building has been replaced. Economical LED lighting enables considerable savings potential. The kitchen is equipped with energy-efficient appliances.

The Bad Eisenkappel kindergarten is run bilingually and, following the renovation, offers space for 65 children in three groups and a crèche. The building fulfils the basic objectives of the municipality: increasing energy efficiency and living climate protection.

Financing, costs, savings:

Total investment costs: € 1,912,000.00

Subsidies:
After deducting the non-eligible costs (disposal of old windows and light sources), environmentally relevant investment costs of EUR 696,831.00 remain. After deducting the reference costs (energy cost savings in 4 years: EUR 95,700.00), the subsidy base amounts to EUR 601,131.00. Applying the subsidy rate of 40% to the thermal-energetic measures and the subsidy rate of 25% to the use of renewable energy sources results in a subsidy of EUR 223,910.00. (Subsidy from Climate and Energy Fund Austria – program "Mustersanierung")

Carinthian federal estate subsidy: „Community Building Initiative" 396.500 EUR (2017 – 2019)

Community Investment program (State of Austria) 44.667 EUR (2019)

Savings:

Heating requirement/ before: 195.3 kWh/(m2a)
Heating requirement/ after: 40.3 kWh/(m³a)
Cooling requirement/ before: 0.0 kWh/(m³a),
Cooling requirement/ after: 1.0 kWh/(m³a)
Specific heating load:
Before: 56.0 kW, corresponds to 108.23 W/(m²BGF)
After: 29.7 kW, corresponds to 47.31 W/(m²BGF)
Expected CO2 savings: 103.39 t/a ...-77%

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ High energy savings. ▪ Higher costs could partly be covered by model renovation subsidy.	▪ Additional costs during the construction phase were incurred due to poor construction management and the municipality being overwhelmed (Court of Auditors report).
Opportunities / Possibilities	**Threats / Barriers**
▪	▪ Small communities with just a few co-workers can be easily overwhelmed by renovation projects and often lack technical knowledge and also have no active funding management.

No. 13: Volksschule Semirach - Model Renovation (Styria)

FINANCIAL DATA

Type of financing, year	Subsidies and transfers, 2020
Financier	Climate and Energy Fund (KLIEN)
Specifics	
Beneficiary	Marktgemeinde Semirach
Link	Volksschule Semriach • Mustersanierung

DESCRIPTION and PHOTO

Picture 13: New Façade Primary School, © Arch+More Architekten

The market town of Semriach (ST) has carried out a thermal renovation of the school building constructed in 1892. The three-story building is used exclusively for educational purposes. In addition to the renovation, the school building was expanded on the upper and attic floors.
The comprehensive renovation included extensive thermal insulation, the installation of a ventilation system with heat recovery, external shading, optimization of the lighting system, and the installation of a photovoltaic system. The building was predominantly insulated with materials certified by the Austrian Eco-label and natureplus.
The building meets the klimaaktiv Gold Standard.

The thermal renovation was done by applying an 8 cm mineral insulation board to the exterior walls, insulating the roof and the top floor ceiling with 20-46 cm cellulose fiber insulation, insulating the lowest floor ceiling with 14 cm XPS boards, insulating the walls in contact with the ground with 16 cm XPS boards, and insulating the ground floor with 20 cm XPS boards. The windows were exchanged with modern wooden-framed windows.

In addition, building service was renewed and some components were newly installed:

Heating is provided via an existing district heating connection (biomass). External shading elements were installed to reduce cooling demand. A ventilation system with heat recovery was installed. Hot water is now supplied through an existing district heating connection (biomass).

The lighting was upgraded to efficient LED lighting as part of the renovation. A photovoltaic system with a module area of around 125 m² and a capacity of 20.00 kWp was installed, generating approximately 14,690 kWh of electricity annually. The remaining electricity demand of the renovated building is covered by green energy.

Financing, costs, savings:

Total Costs: € 2.802.063,76 EUR

Interim financing: Raiffeisen Bank Passail with a loan of 2.800.000,00 EUR (term 25 years)

Federal Estate of Styra: Subsidy in form of repayment grant: 2.100.000,00 EUR in total

KIP (Community Investment program) – Subsidy: ~ 70.000,00 EUR

Subsidy for Model Renovation (Climate and Energy Fund)

- Basis for subsidy: 953.945,00 EUR (environmental-related additional costs)
- Subsidy State of Austria: 200.486,79 EUR
- Subsidy EU: 195.967,21 EUR

Heating Energy Demand / Before: 134.0 kWh/(m²a) = HWBref,RK
Heating Energy Demand / After: 36.2 kWh/(m²a) = HWBref,RK
Cooling Demand / Before: 0.0 kWh/(m²a) = KB*RK
Cooling Demand / After: 0.6 kWh/(m²a) = KB*RK
Specific Heating Load:
Before: 103.6 kW, equivalent to 80.55 W/(m²BGF)
After: 65.4 kW, equivalent to 44.46 W/(m²BGF)

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Ecological renovation. ▪ A relatively long loan term – 25 years instead of 15 years as usual for renovation projects.	▪ Small school buildings in Austria often date back to the 19th century, are listed and therefore each renovation is a highly individual and expensive process (no standardization).
Opportunities / Possibilities	**Threats / Barriers**
▪ Model renovations must achieve high quality standards and energy savings as good example for other projects.	▪ Without the high transfer and subsidy from other public bodies most municipalities could not afford comprehensive energetic renovation.

No. 14: Rathaus Mondsee - Model Renovation (Upper Austria)

FINANCIAL DATA

Type of financing, year	Model Renovation, Transfers (2022)
Financier	Climate & Energy Fund Austria
Specifics	Public listed building
Beneficiary	Municipality of Mondsee
Link	https://mustersanierung.at/projekte/oeffentliche-gebaeude/gemeindeamtmondsee/

DESCRIPTION and PHOTO

Picture 14: Frontview Town Hall (Front), ©Steiner-Watzinger

The municipality of Mondsee carried out a comprehensive thermal renovation of the town hall, which was built in 1774.

The gross floor area of the building was 1001.5 m² and was expanded to 1062.2 m² as part of the renovation. The heating of the existing and renovated building was provided by biogenic district heating. The electricity supply continued to be provided by a conventional electricity supplier. As an additional measure of the model renovation, the lighting was also converted to LED.

The building was renovated by applying a 16-20 cm hemp fiber insulation board to the exterior walls (U-value 0.23 W/m²K), insulating the roof with 30 cm cellulose insulation (U-value 0.13 W/m²K) or 20 cm EPS insulation (U-value 0.15 W/m²K), insulating the ground floors with 30 cm XPS (U-value 0.13 W/m²K), and insulating the top floor ceiling with 50 cm cellulose insulation (U-value 0.07 W/m²K). Additionally, the wooden windows (average U-value 0.90 W/m²K) were replaced.

The heating of the existing building was already provided by biogenic district heating. During the renovation, the district heating connection was reduced from 135 to 50 kW. Ventilation units with heat recovery (efficiency of 88% and 82%) and energy consumption monitoring were installed.

The existing halogen spots, halogen rods, fluorescent tubes, and incandescent bulbs for interior lighting were entirely replaced by LED systems with intelligent light control.

Financing, costs, savings:

Total Costs: ~€ 4,5 Mio EUR

Federal Estate of Upper Austria: Transfer (allocation of needs): 916,000 EUR

Subsidy for Model Renovation (Climate and Energy Fund): 412,600 EUR

Budget reserves municipality (inner loan): ~3,2 Mio EUR

Heating Energy Demand / Before: 302.6 kWh/m²a HWBref,RK
Heating Energy Demand / After: 115.1 kWh/m²a HWBref,RK
Specific Heating Load / Before: 135.2 kW corresponded to 135.01 W/m² BGF
Specific Heating Load / After: 72.3 kW corresponded to 68.06 W/m² BGF
Expected CO2 Savings: A reduction of 114 tons of CO2 emissions per year was achieved.

Expected Savings in short:

- Heating energy demand reference – Reduction: approx. 62%
- fGEE – Reduction: approx. 65%
- Electricity – Reduction: approx. 27%

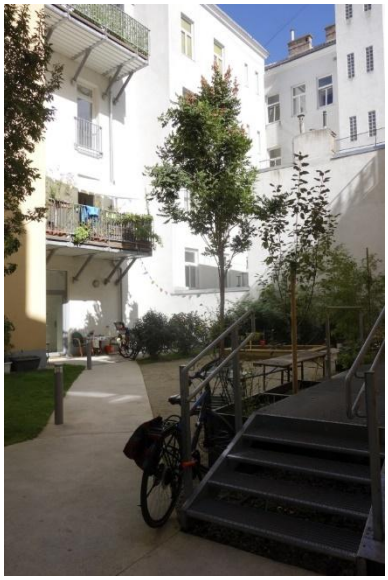
SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ The estimated costs of 4.8 million EUR were met and even reduced thanks to good collaboration, professional planning, and site management. ▪ High quality energy-efficient renovation of listed building.	▪ Municipalities could not stem the costs from their earnings budget without transfer and subsidies from federal states and Austrian State.
Opportunities / Possibilities	**Threats / Barriers**
▪ Model renovations are well documented, that makes it easier for replication.	▪ If transfers and subsidies for municipalities will decline in future, renovation rates for municipal buildings could drop further.

No. 15: Künstlergasse 14-16 – Puba Foundation (Vienna)

FINANCIAL DATA

Type of financing, year	Private capital & Subsidies, 2015
Financier	Puba Foundation, City of Vienna
Specifics	Private Foundation meets co-housing association
Beneficiary	Housing group "Wohnraum Künstlergasse"
Link	https://www.kuenstlergasse.at/

DESCRIPTION and PHOTO



Picture 15: Courtyard View Künstlergasse, ©raum & kommunikation

The Private Foundation for the Support and Education of Employees (PUBA) realized the "Wohnraum Künstlergasse" housing project in the 15th district of Vienna, focusing on artistic and educational activities within the group and the living environment. Following a successful project in the Grundsteingasse in the 16th district and growing demand for communal living forms, PUBA also provided rental apartments for a housing project at Künstlergasse No. 14.

The housing group consists of young people aged 0 to 39 – children, students, professionals in arts, culture, education, and social research – and from this group, the "Wohnraum Künstlergasse" association was founded.

The renovation faced challenges due to the building's poor condition and several vacant apartments. During the process, a one-story and a four-story building in the courtyard were demolished, and another four-story building was reduced to two stories, now housing three maisonette apartments and a rooftop terrace. Two elevators were added for barrier-free access, and the attic was developed to create additional housing units, reducing heating demand per wohnfonds_wien criteria.

A piggyback renovation was carried out for existing tenants, who moved to interim apartments during the process. The initial vacancies allowed co-housing apartments to be concentrated in one part of the building. Commercial and shared spaces on the ground floor and basement were also renewed.

The renovation resulted in 29 housing units, 14 of which are leased to co-housing group members. The shared spaces are collectively rented by the co-housing association Verein KulturLeben Künstlergasse, while the apartments are individually rented from the PUBA foundation.

Financing, costs, savings:

Renovation Costs: Funded by PUBA with public subsidies from the City of Vienna, repaid through cost-covering rent during the subsidy period. Purchases for additional equipment for the rooftop terrace and communal room are covered by the housing group's association. Larger expenses are discussed and shared

among members. The association applied for a subsidy to cover rent losses for the communal room due to COVID-19.

Rent:

- Secure, indefinite individual rental contracts with a deposit.
- Commercial lease for the communal room.
- Cost-covering rent according to WWFSG for the 15-year subsidy period, followed by guideline rent according to MRG for existing units.
- In the attic, rent is based on the guideline with a terrace surcharge.

The association has the right to propose tenants for the group's apartment quota to the owner. It is also agreed with PUBA that apartments can be exchanged if needed.

Year Built: 1902
Construction Duration: 01/2013 – 05/2015
Number of Apartments: 36
Total Usable Area: 3,103 m²
Number of Commercial Units: 6
Reduction in Heating Demand: 84.21 kWh/m²a (~ 57%)
Heating Demand After Renovation: 63.69 kWh/m²a
Heating Demand for Attic: 37.42 kWh/m²a

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Social community & participation for inhabitants. ▪ Mixed use (living, commercial) – makes repayment of renovation costs easier.	▪ Not highly replicable for large-scale projects, but good solution for "Zinshäuser" in urban areas.
Opportunities / Possibilities	**Threats / Barriers**
▪ Especially in larger cities with scarce housing and high apartment prices/rents alternative housing associations offer affordable living for young families.	▪ This kind of project needs individuals who feel highly responsible for the project.

No. 16: Bludenz- Model Renovation (Vorarlberg)

FINANCIAL DATA

Type of financing, year	Subsidies, 2024
Financier	FFG, BMK
Specifics	**Project Name:** SüdSan- Socially Compatible, Climate Goal-Compatible Renovation of Two Multi-Family Houses in the South Tyrolean Settlement in Bludenz, Project Lead: Energieinstitut Vorarlberg
Beneficiary	Alpenländische Gemeinnützige WohnbauGmbH
Link	https://www.energieinstitut.at/forschung-und-projekte/suedsan-beispielhafte-sanierung-von-2-gebaeuden-der-suedtirolersiedlung-bludenz

DESCRIPTION and PHOTO

Picture 16: South Tyrolian Settlement, ©Walser Fotografie, Hohenems

The South Tyrolean Settlement in Bludenz comprises about 400 apartments, currently housing around 650 people. Owned by Alpenländische Gemeinnützige Wohnbau GmbH, these small multi-family houses were built between 1942 and 1962 and remain largely in their original state, except for windows renewed in the 1980s. The buildings have poor thermal insulation, with decentralized heating systems like wood stoves, pellet stoves, and some gas or electric heaters. Hot water is provided by electric boilers. While the base rent is low, high energy costs make these buildings some of the “worst performing” in Vorarlberg. Many residents report poor thermal comfort in winter and excessive heat in summer, with winter temperatures in some apartments dropping to 13°C.

The buildings are representative of smaller multi-family houses from the 1920s to 1960s, which make up about 13% of Austria’s housing stock. The SüdSan project developed optimized renovation concepts focusing on energy, ecology, and economy, implemented in two model buildings. Challenges included the poor condition of the buildings, their classification as worth preserving, and the requirement to renovate while occupied.

The SüdSan project aims to facilitate the widespread renovation of older multi-family houses to meet agreed climate goals post-renovation. It collects reliable data on the additional costs of efficient renovations, focusing on lifecycle costs rather than just investment costs. Additionally, methods for energy-economic optimization are promoted. The project is intended to serve as a practical example of the compatibility between climate protection and social compatibility.

Both buildings had their roofs renewed, creating additional attic apartments. Roofs, walls, and windows were upgraded to high energy standards. The smaller building used a traditional insulation system, while the larger one used a prefabricated wood construction. Basements were insulated from both outside and inside. The improved building envelopes resulted in very low heating demand (29 and 23 kWh/m²BGFa) and excellent airtightness.

Both buildings feature central ventilation systems with heat recovery, ensuring good air quality and reduced ventilation heat losses. The heating load is very low (13 and 19 W/m²EBF), allowing for small heating systems. The smaller building uses a ground-source heat pump, while the larger one uses an air-source heat pump. Heat is distributed via a 4-pipe system with heat transfer stations in each apartment. The smaller building uses new radiators, while the larger one features a new wall heating system. Both buildings have nearly full-coverage photovoltaic systems on one side of the roof, and external blinds prevent summer overheating.

So far, the project team drew the following conclusions:

- Even for older, unrenovated multi-family houses, it is technically possible to achieve climate goal-compatible energy demands and greenhouse gas emissions.
- The additional costs of a high-quality energy-efficient renovation compared to meeting the minimum requirements of OIB RL 6 or the Building Technology Ordinance are negligible when considering current federal subsidies. (High-quality means, for example, very good building envelope quality, comfort ventilation with heat recovery, innovative heat pump solutions, upgraded heat distribution and emission networks, and large PV systems).uWhen renovating old buildings with significant renovation backlogs, there are many necessary repair works to address deficiencies in addition to energy upgrades. Therefore, it is not surprising that the total renovation costs approach the costs of new construction.

Project costs: 1.378.849 EUR

Subsidy FFG (Research) & Federal State: 714.556 EUR

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Through research project all findings concerning costs and financing will be published for replication.	▪ Buildings erected between 1942 and 1960 often apartment size and equipment do not meet modern needs and wishes.
Opportunities / Possibilities	**Threats / Barriers**
▪ A thorough project documentation makes solutions replicable. ▪ The life-cycle approach shows not only investment costs for renovation, but also possible savings of energy cost thereafter.	▪ To high requirements for future subsidies and technical requirements could lead to either no renovation at all or to take down the old buildings and built new ones.

5.2.2 Hungary

No. 17: Multi-apartment building at Hamvas Béla street 10-12, Szentendre

FINANCIAL DATA	
Type of financing, year	Grant, ESCO, private financing, 2014
Financier	EU + Hungarian State + Municipality of Szentendre + Apartment owners
Specifics	Multi Apartment building (80 dwellings) + shops on the ground floor PIMES CONCERTO project (flat rate) + ZBR National Grant + Own contribution + ESCO type financing
Beneficiary	Municipality of Szentendre (and their tenants), Apartment owners
Link	https://szentendre.hu/atadtak-az-elso-concerto-hazat-szentendren/ http://www.emi.hu/webadatbazisok/Rendezvenyek.nsf/EventsPreviewHTMLByDate/6DB5DE11A897EEF4C1257DD500401A79/$FILE/2014-11-14-EMI-PIMES-Conference-Vitoria-Gasteiz-MK.pdf

DESCRIPTION and PHOTO

Picture 17: Condominium with photovoltaic thermal panels @PIME'S Concerto project

The four-story apartment building with ground-floor shops was constructed in the late 1970s, and it was one of the first buildings near Móricz Zsigmond High School and the new swimming pool at the Püspökmajor Housing Estate. The renovation was part of the PIMES CONCERTO project and also benefited from support through the parallel National Housing Renovation Program (ZBR).

As part of the renovation, the flat roof was upgraded and transformed into a 'solar field' featuring hybrid Photovoltaic Thermal (PV/T) systems. The building's façade was enhanced with External Thermal Insulation Composite Systems (ETICS), and an 8 kWp photovoltaic system was installed on the south-facing side to generate renewable energy.

The windows, entrance doors, and glass walls in the stairwell were all replaced with modern, energy-efficient alternatives. The previously unused transparent areas in the shop fronts were converted into solid, well-insulated walls to improve energy performance. On the east-facing façade, 40 new balconies were added, providing shading and improving fire safety. Additionally, new adjustable ventilation elements were installed to allow for better airflow and comfort.

Under the CONCERTO program, the PIMES project utilized flat-rate financing for both energy efficiency measures (per square meter) and renewable energy installations (per kWp). In both cases, the EU provided 50% of the funding. The Hungarian grant, however, was tied specifically to achieving primary energy savings.

The difference between the total installation costs and the combined EU and national grants was partially covered by the apartment owners through the 'Lakástakarék' savings scheme. Meanwhile, the solar energy system was financed by the General Contractor through an ESCO-type (Energy Service Company) financing model, also known as energy contracting, which allowed for cost recovery through the energy savings generated over time.

Picture 18: Renovated building with PV @PIME'S Concerto project

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Very cooperative representative from the beneficiaries. ▪ Mixed and balanced finance. ▪ Outstanding funding rate. ▪ Clear and valuable flat rate financing. ▪ Value added renovation with multi purposes new balconies. ▪ Good cooperation with the stakeholders: Community of owners, Municipality, General Contractor, Designer, Project management (ÉMI).	▪ Lack of reserve in the implementation. ▪ Late decision on the National Grant caused delay in the implementation as well. ▪ Low budget and interest on fine tuning of the solar-thermal and the domestic hot water system. ▪ Change of the leadership and in consequence lower the interest by some key stakeholders.
Opportunities / Possibilities	**Threats / Barriers**
▪ As best practice examples it has been replicated several other renovation project in the estate without EU fund. ▪ Other extra activities beyond the energy focus measurements (Painting the staircase). ▪ Good reference of the key stakeholders.	▪ Lack of interest, losing the interest meantime. ▪ Insisting the old and useless/reasonless solution just by “we use for it”. ▪ Administration burden could kill the initiatives.

No. 18: Multi-apartment building at Kassai u. 8-16., Budapest

FINANCIAL DATA

Type of financing, year	subsidized loan, 2024.
Financier	OTP Bank Nyrt (90 %) + Apartment owners (10 %)
Specifics	subsidized loan focused on condominiums
Beneficiary	Condominium of Kassai u 8-16, Budapest 1043. (330 dwellings)
Link	No link available

DESCRIPTION and PHOTO

The condominium at Kassai u. 8-16., Budapest, 4th district operates a multi-apartment house of 330 dwellings (five staircases with 11 floors in each of them). The house is a 10-storey concrete panel building, built between 1983-1987. This specific project is part of a staged renovation, the project aims at the retrofit of the ventilation system of the house. The house ventilation system is responsible for circulating the air in a number of large tubes connecting the kitchens, bathrooms, staircases and other common parts of the building. The ventilation system is operated by old, out-dated motors placed on the roof of the multi-apartment building. The project was about changing the old motors to new, efficient ones including the necessary installation works as well. The ventilation system is operated by 40 pcs ventilator motors of 375 W each. The electricity bill for the operation of these motors is paid by the condominium. These ventilator motors are to be changed to new, energy-efficient ones: 20 pcs of 80 W motors and 20 pcs of 115 W motors. Together with the automatic control system that is to be also built in during the project, the quantity of the circulated air can be controlled, the performance of the system can be fine-tuned according to the needs of the apartment owners. Based on the efficiency of the new motors and the control system considerable energy savings can be achieved: according to the feasibility calculations, a reduction in electricity consumption of between 48 – 74 % can be achieved depending on how much a day the system operates (between 24-12 hours).

The investment is financed by a subsidized loan given by OTP Bank: “Thermo/Stílus loan” facility, which is available to condominiums, the interest rates are more favourable than the market rates as a consequence of the subsidy element. Maturity of the loan is 7 years; the loan will be taken out and paid back by the condominium. The condominium has to pay 10 % of the investment costs from own resources (payments by the apartment owners), 90 % will be financed by the loan. The collateral for the loan is a cash flow collateral given by the condominium, the basis of which are on one hand the condominium cost covered by payments of the apartment owners and on the other hand the savings on the condominium´s electricity bill. No mortgage will be registered to the individual apartments in the house. Based on the feasibility calculations the expected return of this investment is between 3,5-5,5 years.

SWOT ANALYSIS

Strengths	Weaknesses
▪ Very considerable savings on electricity consumption, which is accepted by the financing bank as part of the cash flow collateral.	▪ The condominium will have debt which might be disadvantageous in future projects. ▪ This project is only one element in the renovation stages, there are several stages remaining.

▪ Better living conditions to apartment owners, much better quality and clear air in their homes thanks to the improved ventilation. ▪ No mortgage is registered to the apartment owners. ▪ The savings on the electricity bill help to pay back the loan.	▪ State interest support is only available for the renovation of common property areas. ▪ There is no requirement for energy saving.
Opportunities / Possibilities	**Threats / Barriers**
▪ The financing can be used as best practice to other condominiums if their cash flow position is similar.	▪ Financing of further renovation stages is unknown yet; the level of indebtedness might hinder the financing of further retrofits.

No. 19: "Faluhaz project" (Village Block)

FINANCIAL DATA

Type of financing, year	Grant, preferential loan, private financing. 2006-2009
Financier	EU grant (Concerto program Staccato project), Municipality of Óbuda-Békásmegyer (40%) + National Fund (33%) + self-contribution of the residents (27%)
Specifics	The largest residential building in Hungary
Beneficiary	Multi apartment building in district III. of Budapest
Link	https://smart-cities-marketplace.ec.europa.eu/projects-and-sites/projects/staccato/staccato-site-obuda

DESCRIPTION and PHOTO

The Faluház multi-apartment building is located in Budapest's Óbuda district and is the largest residential building in Hungary: 884 apartments, 43,500 m2 floor area, 5,600 m2 of windows, 24,000 m2 facade surface, about 3000 people. The building was built in 1970.

Picture 19: Faluház multi-apartment building during renovation @Staccato project

Prehistory of the renovation: In 2004 and 2005, the building's nine different heating systems were consolidated into a unified system. This transformation involved upgrading the original one-pipe heating system to a two-pipe configuration and installing thermostatic valves on the radiators, allowing for individual temperature regulation in each apartment. The heating center for buildings with district heating is owned by the service provider, which is responsible for necessary repairs and maintenance. Consumers pay the provider continuously for these services, typically as part of a basic fee. Following the modernization of the heating system, heat consumption in the Faluház gradually decreased. By 2008, the building's heat consumption was approximately 10% lower than in 2004.

Present modernisation: In 2006, the local government of Óbuda-Békásmegyer, in collaboration with Amsterdam and Sofia, applied to the European Union's "Concerto" program to implement a model project. This complex investment aimed to enhance energy efficiency and promote the use of renewable energy, while also monitoring its technical, environmental, and social impacts.

The mega-project was launched in the summer of 2009 and was completed in just six months, by December 2009. The total cost of the project was approximately HUF 1.3 million per apartment, amounting to nearly HUF 1.2 billion for the entire building. This initiative was part of the Staccato project, which was financed by the

Concerto program. Panel-building retrofitting scheme and local funding were combined with EU-funding. Inhabitants had to contribute a small percentage to the overall cost but were able to receive a subsidized loan for this.

Technologies of the modernisation:

- 10 cm thick Styrofoam thermal insulation on the facade, the roof and the basement ceiling.
- Rockwool was installed on the walls above doors and windows for fire safety purposes.
- Approximately 90 percent of the total window surface area was replaced. The old windows were replaced by more modern plastic windows.
- The domestic hot water generation in the "The Village" was separated from the conventional district heating system and connected to a new grid, supplied by solar thermal collectors with a total surface of 1,515 m².

Results:

- Approx. energy saving: 355 MWh/y electricity and 2,188 MWh/y heating
- Approx. energy from RES: 726 MWh/y heating
- Windows transmit around 50% less heat.
- The thermal insulation capacity of the facade increased greatly.

SWOT ANALYSIS

Strengths	Weaknesses
▪ Technical success factors: Solutions allowed residents to stay in their flats during refurbishment, requiring only minimal access by builders. ▪ Social success factors: The information campaign continued after the general assembly's decision, keeping residents informed throughout the project since they remained on-site during the works. ▪ Institutional success factors: The municipality was fully committed to making this project a demonstration model to foster further energy efficiency initiatives.	▪ Heating cost allocation systems were installed in each apartment to measure thermal energy usage, which led to disputes. Previously, some residents turned off their radiators while others left them on, indirectly heating neighbouring flats.
Opportunities / Possibilities	**Threats / Barriers**
▪ It is believed that having the prominent demonstration project in Óbuda kick-started other refurbishment activities. Before the Faluház project many doubted the benefits of energy efficiency retrofitting, but now they can see proof of the benefits, especially that energy bills are lower. ▪ The building became an icon. Having the funding in place, which constituted a large proportion of over-all cost, made it easy to convince owners - 75% voted in favour. ▪ The participation of the municipalities together with the private house owners is unique in this project. ▪ The project was nominated by the European Commission for the Sustainable Energy Award 2010 in the category \"Dissemination and Demonstration\".	▪ Technical barriers: 50% of district heating should have been saved but, only 20-25% were saved. ▪ Economic barriers: harmonising the combination of funding was not easy. ▪ Social barriers: There was a conflict of interest between the dissemination team and technical monitoring team, as well as a general timing issue.

No. 20: Multi-apartment building at Pázsitos sétány 1-3. Budapest

FINANCIAL DATA

Type of financing, year	Private financing, 2018 and 2021.
Financier	100 % inhabitants of the condominium
Specifics	own resources (savings) of the owners
Beneficiary	Condominium of Pázsitos sétány 1-3, Budapest, XX.
Link	No link available

DESCRIPTION and PHOTO

The condominium at Pázsitos sétány 1-3., Budapest, 20th district operates a multi-apartment house of 100 dwellings. The house is a 4-storey traditional building. This specific project aimed at the replacement of the condominium´s gas boiler for a modern condensing boiler and installing the necessary heat quantity controllers and control valves. The condominium paid a gas bill amounting to 7,3 M HUF in 2019, before the change of the boiler took place and the aim was to reduce the gas bill with changing to an up-to-date gas boiler and control system. At the end of 2019 the heat quantity controllers were changed to efficient controllers and in a next step the old boiler was changed to a modern condensing gas boiler with the instalment of the necessary control valves (2021). The total investment amounted to 16 M HUF. After the investment the gas bill paid by the condominium went back to 4.6 M HUF (in the year 2023), which means a reduction of 37 % in costs paid for gas. The return of the investment is therefore 6 years based on the savings in costs paid for the gas.

Picture: Condominium at Pázsitos sétány 1-3. @ Szilbert Ingatlan Maganegement Kft.

The investment was financed by the inhabitants of the condominium themselves, based on the decision of the condominium´s general assembly, the inhabitants paid for the investment according to their share in the condominium. The proportional share of each inhabitant was paid to the account of the condominium by the inhabitants and the investment was prepared, organized and implemented by the condominium.

SWOT ANALYSIS

Strengths	Weaknesses
▪ Considerable savings in gas consumption, which reduces the future operational costs of the condominium. ▪ The inhabitants of the condominium understood their own interest for the reduction of the gas consumption.	▪ This project is only one element in the renovation stages, there are several stages remaining. ▪ The financing was based on the individual payments of the inhabitants only.
Opportunities / Possibilities	**Threats / Barriers**
▪ Based on the successful implementation of this project further building renovation stages can be implemented.	

No. 21: Implementation of smart cost-sharing systems and radiator replacement in a condominium located in the 3rd district of Budapest

FINANCIAL DATA

Type of financing, year	Subsidy and private financing; 2020
Financier	ÉMI Non-profit Llc. (Hungarian State)
Specifics	Promotion of smart cost-sharing applications and radiator replacement program (ZFR-ÉMI-TÁV/2020) Source: Green Economy Financing System 50 % National fund program + 50 % own contribution
Beneficiary	Multi apartment building in district III. of Budapest
Link	No link available

DESCRIPTION and PHOTO

The project's goal is to support investments aimed at reducing carbon dioxide emissions through heating system modernization in residential cooperatives and condominiums involved in district heating services. This initiative targets enhancing energy efficiency in existing residential properties for the benefit of the public. The building affected by the investment consists of 4 stairwells and contains a total of 240 apartments.

Total investment cost was HUF 103,582,497, out of which the non-refundable grant covered 50% and the rest had to be financed by the owners.

The project's technical content includes the following activities:

- **Installation of Smart Heating Cost Allocation System**: This involves setting up a system for smart measurement and cost-sharing, which allows fee payers to access consumption data daily or at least weekly. This will include installing smart cost-sharing devices and data collectors associated with the system.
- **Upgrade of the Piping System**: Conversion of the existing single-pipe system to a two-pipe system or at least an intermediate connection layout, including modernization and/or insulation of the pipes.
- **Hydraulic Balancing Fixtures**: Installation of devices to ensure hydraulic balance in the building's heating system, particularly including riser regulators.
- **Hydraulic Adjustment of Heating Risers**: Fine-tuning the hydraulic settings of the heating risers.
- **Installation of Individual Radiator Controls:** Installation of radiator valves (thermostatic radiator valves) and automatic adjustment mechanisms (e.g., "thermo heads") for individual control of radiators in apartments.
- **Installation of Return Valves or Ball Valves:** For two-pipe heating systems, installation of return valves; for single-pipe systems, installation of ball valves.
- **Replacement of Radiators:** Replacement of existing radiators with new aluminum radiators, ensuring that the new radiators maintain or reduce the necessary heating water temperature.

The modernization and renovation of heating systems involved in district heating must result in measurable energy savings and a reduction in CO2 emissions. For this project, it is planned to achieve an expected annual reduction of 69.8 tons of CO2. This commitment will be verified through data provided during the monitoring and maintenance period.

Among the objectives of the condominium building was a commitment to a 10% reduction in energy consumption, which is supported by the heating energy consumption (district heating) data provided by the

district heating suppliers. The project's completion date was December 1, 2022. The project is currently in the maintenance period, and during the first year of monitoring, an actual reduction in energy consumption resulted in a decrease of 283.1 tons of CO_2 per year.

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Implementation of heating modernization for the entire building/building complex. ▪ Achieving energy savings and reducing carbon dioxide emissions, which also leads to reduced expenses.	▪ Difficulties in the cooperation of condominium/residential cooperative owners and achieving quorum for general meetings. ▪ Securing personal financial resources.
Opportunities / Possibilities	**Threats / Barriers**
▪ Implementation of complex technical content.	▪ Uncertainty about the willingness and financial capacity of property owners.

No. 22: Multi-apartment building at Budapest, 1068 Benczúr street 43.

FINANCIAL DATA

Type of financing, year	Private financing, 2020; 2023.
Financer	100 % owners of the condominium
Specifics	extraordinary contribution by the owners of the condominium
Beneficiary	Owners of Benczúr street 43. condominium
Link	No link available

DESCRIPTION and PHOTO

The condominium at Benczúr utca 43 in Budapest, 6th district operates a multi-apartment house of 46 dwellings. The house is a 6-storey traditional building. This specific project aimed at the replacement of the condominium´s gas boiler for a modern condensing boiler and replacement of the central cooling system. The condominium paid a gas bill amounting to HUF 5.9 M in 2018, before the change of the boiler took place and the aim was to reduce the gas bill with changing to an up-to-date gas boiler and control system. The total investment amounted to HUF 9.5 M. After the investment the gas bill paid by the condominium went back to HUF 4.3 M (in the year 2023), which means a reduction of 27 % in costs paid for gas. The return of the investment is therefore 6 years based on the savings in costs paid for the gas.

Picture 20: Multi-apartment building at Benczúr street 43.

The central cooling system became unreliable and replaced in 2023. The old 71.5kW system was replaced for a heat pump enhanced unit which resulted in 20% in energy saving. The new unit cost was HUF 21M and resulted in HUF1.4M reduction in energy bill. The payback time is about 15 years. After switching to green tariff this payback time will be reduced significantly.

The investment was financed by the inhabitants of the condominium themselves, based on the decision of the condominium´s general assembly, the inhabitants paid for the investment according to their share in the condominium. The proportional share of each inhabitant was paid to the account of the condominium by the inhabitants and the investment was prepared, organized and implemented by the condominium.


Picture 21: New gas boiler and central cooling system.

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Considerable savings in gas consumption, which reduces the future operational costs of the condominium. ▪ The inhabitants of the condominium understood their own interest for the reduction of the gas consumption. ▪ The unreliable equipment was replaced by state-of-the-art unit.	▪ The cooling unit needed to be replaced in the attic, which required craning of high expense.
Opportunities / Possibilities	**Threats / Barriers**
▪ Switching to green tariff system for geothermal energy use.	▪ Due to lack funds the switching to geothermal tariff had to be postponed to 2025.

No. 23: Municipal multi-apartment building renovation in Szeged

FINANCIAL DATA

Type of financing, year	Private financing
Financier	Tenants, Municipality of Szeged
Specifics	savings or bank loan (free-to-use) An apartment with 4 rooms (178 m2) on the third floor in the more than 100 years old building (20 dwellings) + shops on the ground floor. 6720 Szeged, Feketesas u. 19-21. 2/18.
Beneficiary	The municipality of Szeged
Link	https://www.ikv.hu/node/843

DESCRIPTION and PHOTO

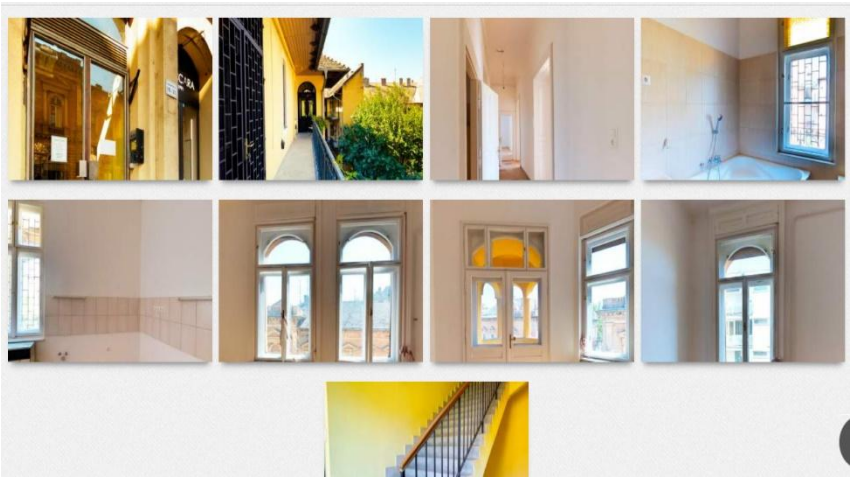
In Szeged, Real Estate Management and Asset Management Ltd. (IKV Zrt) is the leading property management company in terms of the number of managed units. This activity has a nearly 20-year history. Since the end of 2015, IKV manages buildings with majority or minority municipal ownership, as well as entirely privately-owned condominiums. For properties that are 100% municipally owned, renovation decisions are made by the municipality based on available financial resources. In contrast, for multi-apartment buildings with mixed or entirely private ownership, renovation decisions are made by the condominium's general assembly.

Renovation of vacant municipal apartments is:

- Partially carried out by IKV
- Partly completed by the future tenant through a tender process

IKV home renovations

During apartment renovations, worn-out flooring, doors, windows, and built-in furniture are repaired or replaced. Gas appliances, heat emitters, and utility meters are inspected and fixed or replaced if needed. Electrical work includes updating plugs, switches, and wiring. These apartments, ranging from 28 to 68 square meters, are mainly rented as social housing, with rents between HUF 9,500 and HUF 23,000.



Picture 22: Vacant municipal apartment on Feketesas Street, Szeged @ IKV Zrt.

IKV handles some renovations through indefinite-term lease agreements, particularly for costly repairs in older, mostly listed buildings. The IKV does not set strict energy standards for the renovation, but it is in the future tenant's interest to improve energy efficiency. These apartments often have an interior height of more than 3 meters, so the insulation of the trenches and the modernisation of the heating are important in their own interest. These apartments are often in listed buildings. The IKV primarily expects hygiene and safety aspects; aesthetic aspects are secondary.

Tender conditions for vacant municipal properties requiring renovation

Any adult Hungarian citizen can apply for multiple apartments. The winning applicant signs an indefinite-term rental contract and must complete the required restoration within a year (or after obtaining permits for listed buildings). Failure to meet this deadline may result in contract termination.

Tenants are responsible for carrying out restoration and modernization as specified by the lessor. The cost, up to 50%, can be deducted from the monthly rent. The restoration budget for the apartment consists of the name of the minimum restoration work to be performed by the tenant in the apartment by type of work, as well as the cost of performing the work. The winning applicant is obliged to carry out the restoration and modernisation work specified by the lessor at his own expense, with the allowance indicated above, at least at the technical level determined by the lessor.

Renovation cost for the apartment with 4 rooms (178 m2) is calculated to be HUF 1.163.231. The winning applicant will have to pay HUF 153.792 as renting cost, if the renovation is carried out.

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Urban apartments in the city centre are being renovated. ▪ Condition of the property is improving. ▪ Value of the property increases. ▪ Non-municipal funds are used for the renovation.	▪ No clear plan neither for the intended overall performance, nor the detailed expected works and its real value. ▪ No energy requirements are expected, therefore the payback time of the investment is not clear. ▪ They do not require the use of renewable or environmentally friendly materials. ▪ The principle of circularity does not appear among the criteria. ▪ Unclear, how the common part of the renovation is working and how it is financed.
Opportunities / Possibilities	**Threats / Barriers**
▪ In the case of applicants with capital, a quality renovation will be carried out. ▪ If the government take part in the renovation (financial as well), higher performance and controlled performance could be achieved.	▪ In the case of high renovation costs and fines, low interest in the field. ▪ If a renovation contract is not concluded, the condition of the property will deteriorate. ▪ Uncontrolled and low quality of the renovation, the missing technical knowledge sometimes even could cause greater problems.

No. 24: Single-family house refurbishment in Gödöllő

FINANCIAL DATA

Type of financing, year	Grant, preferential loan, private financing; 2023- ongoing
Financier	National Refurbishment Program, PV installation National Program, prenatal loan ("babavaro hitel"), own contribution, family housing allowance ("CSOK")
Specifics	National refurbishment and PV program, family with child supported program
Beneficiary	Privat owner – family with two children
Link	No link available

DESCRIPTION and PHOTO

Picture 23: Single family house in the city of Gödöllő after refurbishment

After the change in ownership, a staged renovation process began, including the addition of a new extension. The goal was to transform the house into a low-energy building by utilizing a national renovation subsidy available for families with children. The original house, a typical cube-shaped structure, had old windows, poorly insulated exterior walls, and only the roof slab was insulated with an additional 20 cm of glass wool.

In the first phase, the windows were upgraded, and a heat recovery ventilation system was installed. This phase cost 6 million forints, with half (3 million forints) covered by the national refurbishment program subsidy.

The second phase involved adding 16 cm of Rockwool insulation to the exterior walls, which cost around 5 million forints. This was partly financed through a HUF 10 million national prenatal loan, which could be used freely. Additional renovations, including retrofitting the roof and building the new extension, were funded through a combination of loans and personal savings.

Currently, a 5.6 kWp solar panel system with 10 kVA storage is being installed under a national program, with 66% of the cost covered by the government. The expected energy savings are around 65%, and detailed monitoring of actual energy consumption is planned.

SWOT ANALYSIS

Strengths	Weaknesses
▪ Well organised staged renovation. ▪ Utilising EE/RES focused and general grants. ▪ Reasonable grant share (50%, 66%). ▪ Relatively easy process. ▪ SME oriented grant .	▪ Limited scale comparing the need. ▪ Low flexibility. ▪ Short time period for the tendering. ▪ High administration burden.
Opportunities / Possibilities	**Threats / Barriers**
▪ Longer program periods (some years). ▪ Higher budget limit, more matching the real cost. ▪ Join to an energy community.	▪ Useless multiple processes caused by careless design of the processes and its interlink. ▪ Underestimated cost could results crisis in the financing. ▪ Market loan interest rate could rise.

No. 25: Renovation of single-family house in Tatabánya

FINANCIAL DATA

Type of financing, year	Preferential loan, 2018
Financier	Hungarian Development Bank
Specifics	Loan aimed at increasing energy efficiency and renewable energy use in residential buildings (Call identifier: GINOP-8.4.1/A-17- Loan programme)
Beneficiary	Homeowners
Link	https://archive.palyazat.gov.hu/ginop-841-a-17-lakpletek-energiahatkonysgnak-s-megjul-energia-felhasznlsnak-nvelst-clz-hitel#

DESCRIPTION and PHOTO

The preferential loan programme allowed complex renovation of private buildings, condominiums and housing cooperatives choosing from different eligible activities, such as: 1) Energy efficiency measures: outer wall insulation, replacement of doors and windows, installation of shading structures, modernization of heating and/or domestic hot water systems, Modernization of heat recovery equipment, Modernization of lighting system; 2) Renewables: installation of solar collector, briquette, pellet, wood chip and wood gasification boiler systems for domestic hot water, solar panel, heat-pumps.

Picture 24: House with insulation and new windows

The project included complete insulation of the building, such as:

- wall insulation with 5-10-15 cm graphite expanded polystyrene insulation and foundation insulation
- roof insulation with 2x10 cm mineral wool
- replacement of windows.

The total cost amounted to HUF 2.15 million, of which 90% was covered by a preferential loan at a 0% interest rate, while the remaining 10% was financed through self-funding. The loan repayment term is a maximum of 20 years, providing favourable conditions and resulting in relatively low monthly instalments.

The call requires energy performance certificate before and after the renovation. Energy efficiency improvements have resulted in a reduction of 4,570.284 GJ/year in primary energy consumption. Greenhouse gas emissions have decreased by 299.742 tons/year, and the annual primary energy consumption of the residential building has been reduced by 1,269,523 kWh/year.

SWOT ANALYSIS

Strengths	Weaknesses
▪ Other related costs, such as project preparation activities, project managements and cost of experts (notary, energy, etc.) are eligible costs. ▪ Low own contribution requirement. ▪ Interest-free loan.	▪ The support is refundable. ▪ As a loan product, additional supplementary costs may arise. ▪ Available only for homeowners (not for tenants).

▪ Extensive eligible technical content. ▪ Energy efficiency and renewable energy development investments can also be implemented within the program allowing comprehensive building energy renovations. ▪ Fast administrative processing. ▪ Clear communication. ▪ Personalized administration at Hungarian Development Bank Points. ▪ Free choice of contractors. ▪ Realistic implementation timeline.	
Opportunities / Possibilities	**Threats / Barriers**
▪ Support for investment elements that do not directly increase energy efficiency or renewable energy use but are essential for the investment. ▪ Could always be available, not only for limited time. ▪ More stringent requirements for reaching deep renovation could be set. ▪ Although indicators must be provided higher energy saving targets could be set for projects.	▪ The program does not include provisions for long-term monitoring data, preventing assessment of actual energy savings or greenhouse gas emission reductions.

No. 26: Single family house refurbishment and PV installation in Tahitótfalu

FINANCIAL DATA

Type of financing, year	Non-refundable grant and own resources, 2022- ongoing
Financier	National Authority, owners of the building
Specifics	6.2.1- 2021 call: Support for residential solar systems and electrification of heating systems combined with solar systems. Source: Recovery and Resilience Facility (~71%) + National fund (~14%) + own contribution, savings (~15%)
Beneficiary	Building owners
Link	https://www.palyazat.gov.hu/programok/helyreallitasi-es-ellenallokepessegi-terv/rrf/rrf-621-21-2/alapadatok

DESCRIPTION and PHOTO

This project involves the renovation and upgrade of a building originally constructed in the 1980s as a holiday home, which has since been reclassified as a residential property. The building features 30 square meters of living space spread over two levels.

The building renovation includes the following major improvements:

- Replacement of the 40-year-old doors and windows with modern, triple-glazed units to improve energy efficiency.
- Installation of an air-to-air heating system, with the addition of four split air conditioning units alongside the original wood-burning stove for improved climate control.
- Installation of a solar panel system on the roof to reduce electricity consumption and promote renewable energy use. This is still in progress.

Picture 25: House with new windows

At present, specific energy savings data is not available, as the project is still in the implementation phase.

The non-refundable grant covers nearly the entire renovation cost, with only minor ineligible expenses to be borne by the owner. The funding scheme supports comprehensive renovations, excluding thermal insulation. The owners plan to invest in thermal insulation of walls in the future using own resources.

The favourable conditions of the call have resulted in a substantial number of applications submitted.

SWOT ANALYSIS

Strengths	Weaknesses
▪ 100% non-refundable grant for the eligible project cost. ▪ Frequent power outages in the area due to local conditions and aging electrical wiring, making this project advantageous for mitigating such issues.	▪ Thermal insulation is not funded by the grant. ▪ Delays in the permitting and commissioning processes are attributable to the high workload of the Distribution System Operator (DSO) and contractors.

▪ Supplementing the existing system with an alternative heating solution. ▪ Direct energy saving and improved thermal transmittance factor. ▪ Complex energy efficiency and renewable energy measures. ▪ Based on social needs, available for low-income households. ▪ Due to direct supplier financing and advanced payment, the owners are not required to pre-finance the renovation.	
Opportunities / Possibilities	**Threats / Barriers**
▪ A more user-friendly and optimized application management system for individual applicants (homeowners). ▪ Building insulation could be also eligible as an optional activity, as most houses lack insulation, and this would significantly Improve energy efficiency. ▪ Eligible activities may include mechanical upgrades, replacement of piping networks, and enhancements to the heating system (e.g., installation of underfloor heating). ▪ The funding program could be available for condominiums, offering options for leasing or ESCO in addition to non-refundable grants. ▪ Repayable grant for unforeseen increased costs or non-eligible items could be also applied.	▪ Limited capacity of contractors to implement a large number of complex projects. ▪ Shortage of skilled professionals. ▪ Regional grids are insufficient to accommodate the increased energy production from solar panels. ▪ Changes in feed-in legal conditions: Introduction of a feed-in moratorium and the option for annual net metering for residential solar panels have been discontinued since January 2024. ▪ Limited availability of the funding scheme. ▪ Increase of building material and appliance cost (e.g. due to inflation) during project implementation, which cannot be covered by the grant.

No. 27: Single-family house refurbishment in Budaörs

FINANCIAL DATA

Type of financing, year	Private financing, 2021 February-July
Financier	Homeowners from own savings, HUF 4M (€11k)
Specifics	6.5 kW, 2kW 96m2
Beneficiary	Privat owner
Link	No link available

DESCRIPTION and PHOTO

Budaörs, Munkácsy utca 3 energy refurbishment project: HUF 3.6M PV panels, HUF 200k boiler retrofit for electricity heating, HUF 200k refurbishment of the electrical wiring. The electricity bill has been reduced from HUF 436k to zero and the gas bill from HUF 703k to HUF138k. Hence the payback time is about 4 years.

Picture 26: Single-family house in Budaörs with rooftop solar PV installation

SWOT ANALYSIS

Strengths	**Weaknesses**
▪ Well organised staged renovation. ▪ Full control of the project. ▪ Very considerable energy savings that can be seen in the electricity/gas bills. ▪ Strong commitment by the owners to finance the investment from own resources by understanding their own intertest.	▪ Utilities companies' limited capacity of processing applications and approvals caused 1 month delay.
Opportunities / Possibilities	**Threats / Barriers**
▪ Having HUF 1M more cash in hand a 40% larger PV unit could have been installed. ▪ This will be completed in 2025.	▪ Sceptical advice on payback times from professional and technical experts. ▪ Lack of support for bank loans.

No. 28: Municipality office building renovation VSZ Zrt., in Szentendre

FINANCIAL DATA

Type of financing, year	Grant, ESCO, own resources (Municipal investment); 2012-2014
Financier	EU grant, Municipality of Szentendre, Installer company
Specifics	EU grant (PIMES CONCERTO project), Municipality, ESCO by the installer
Beneficiary	Non-profit city service company owned by the Municipality of Szentendre
Link	https://smart-cities-marketplace.ec.europa.eu/sites/default/files/pimes_detailed_design_specifications_of_szentendre_energy_systems.pdf http://www.emi.hu/webadatbazisok/Rendezvenyek.nsf/EventsPreviewHTMLByDate/1D02818581BAA932C1257DD50039AC04/$FILE/2014-05-06_06-12-PIMES-EMSZ-RSZN-Szfhvar.pdf

DESCRIPTION and PHOTO

Picture 27: After the refurbishment @PIME'S Concerto project

The building owned by the Municipality of Szentendre's City Service Company underwent a comprehensive renovation between 2012 and 2014, aimed at enhancing energy efficiency and modernizing its infrastructure. The project included the installation of a newly designed, simplified roof structure, featuring new roof windows to optimize natural light. Exterior upgrades were also made, with improved doors and windows to increase insulation and reduce energy loss. Furthermore, 16 cm of ROCKWOOL thermal insulation was added to the building's façade, significantly boosting its thermal performance.

In addition to structural improvements, advanced energy systems were incorporated. Hybrid PV/T (photovoltaic-thermal) panels and standard PV systems were installed on the south-facing roof and chimney to harness solar energy for both electricity and heating. A biomass Combined Heat and Power (CHP) unit was also introduced, complementing the existing gas burners to provide an eco-friendly heating solution. These upgrades not only improved the building's energy efficiency but also contributed to its sustainability by reducing reliance on conventional energy sources.

Within the framework of the CONCERTO PIMES project, the European Union provided funding for energy efficiency measures and renewable energy installations. A flat rate of 50 €/m² was allocated for energy efficiency improvements, 2,500 €/kWp for photovoltaic (PV) installations, and 500 €/kW for the installation of Combined Heat and Power (CHP) systems. This financial support significantly reduced the upfront costs of the project.

Picture 28: VSZ Zrt. building with PV/T system @PIME'S Concerto project

The remaining portion of the expenses was covered by the installer, who adopted an energy contracting model, specifically an Energy Service Company (ESCO) system. Under this arrangement, the installer recouped the investment through the annual savings generated by the building's enhanced energy efficiency. These savings were substantial, as the improved

systems led to a reduction of more than 50% in the building's original energy consumption. This innovative financing model not only ensured the project's feasibility but also demonstrated the long-term cost-effectiveness of integrating energy-efficient technologies and renewable energy sources into building renovations.

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Installer interest in working saving system is evitable. ▪ Value added renovation with simplifying the sophisticated and energy consumed old layout. ▪ Benefit from solar energy harvesting in hybrid way. ▪ Distributed and highly adjusted system results high energy saving potential, and low operational cost. ▪ Low investment cost from the Client side.	▪ Biomass CHP has high maintenance cost and treated wooden chips. ▪ The covered storing place has not been scheduled and occurs extra cost. ▪ Shading of the trees cause reduction on solar efficiency. ▪ Payback time proved longer than predicted due to the low and subsidized gas price.
Opportunities / Possibilities	**Threats / Barriers**
▪ Securing the biomass raw material quality and reasonable price. ▪ Improve the efficiency of the hybrid system by smart BEMS technology. ▪ Service contract for operation and maintenance with the installer.	▪ Lacking qualified personal for the Biomass CHP daily operation. ▪ Unbalanced systems could result reasonable decrease of efficiency of the hybrid systems. ▪ If Installer took loan for financing, the increase the interest rate this loan could turn be critical.

No. 29: Püspökmajor Kindergarten, Szentendre

FINANCIAL DATA

Type of financing, year	Grant, own resources (Municipal investment), 2012-2013
Financier	EU, Structural Fund (EU + National Fund), Municipality of Szentendre
Specifics	EU flat rate (PIMES CONCERTO project), Structural Fund and own contribution
Beneficiary	Municipality of Szentendre
Link	https://smart-cities-marketplace.ec.europa.eu/sites/default/files/pimes_detailed_design_specifications_of_szentendre_energy_systems.pdf http://www.emi.hu/webadatbazisok/Rendezvenyek.nsf/EventsPreviewHTMLByDate/1D02818581BAA932C1257DD50039AC04/$FILE/2014-05-06_06-12-PIMES-EMSZ-RSZN-Szfhvar.pdf

DESCRIPTION and PHOTO

The renovation of the kindergarten in Szentendre, originally built in the 1970s, was carried out in three distinct phases. The first phase focused on upgrading the windows and the parapet above them to improve energy efficiency and insulation. During this phase, a strong emphasis was placed on the use of recycled and natural materials, promoting sustainability in the renovation process.

In the second phase, as part of the PIMES CONCERTO project, the foundation, parapet wall and roof were retrofitted for improved thermal performance. This phase also included the addition of a new sunspace at the entrance of the building, which helped regulate indoor temperatures by capturing sunlight in winter and providing shade in summer. A green roof was installed on part of the building to enhance insulation and contribute to environmental sustainability. Photovoltaic (PV) panels were mounted over the sunspace, designed to serve a dual purpose—providing shading in the summer while being adjustable to a different angle in winter to maximize solar energy generation.

Picture 29: Püspökmajor Kindergarten building after renovation @PIME'S Concerto project

The third phase involved the installation of additional PV panels over the terrace, providing further shading and energy generation.

The financing for the first phase was partially supported by a Structural Fund project, a joint effort between the European Union and the Hungarian Government. The second and third phases were financed by both the EU and the Municipality of Szentendre.

The combined energy-saving measures implemented across the three phases resulted in a reduction of over 55% in the kindergarten's energy consumption, highlighting the success of the project in terms of both sustainability and cost-efficiency.

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ High EE and RES performance. ▪ Value added renovation: Green roof, sun space. ▪ With careful design optimal solutions for the cold bridges at the joints. ▪ Smart metering and the annual balance of consumption and production lead to high efficiency for the PV system. ▪ Low carbon footprint via recycled materials.	▪ Shading on the PV. ▪ Long time waiting for to join the grid. ▪ No practice moving the PV between “summer” and “winter” position.
Opportunities / Possibilities	**Threats / Barriers**
▪ Create/join to the local energy community for PV production and electricity consumption. ▪ Involving the installer in the capital financing with energy contracting scheme. ▪ Heat recovery ventilation for better indoor air quality.	▪ Establishing energy communities is not promoted yet. ▪ Lack of adequate ventilation results low Indoor air quality.

No. 30: Decarbonized Mórahalom, Hungary

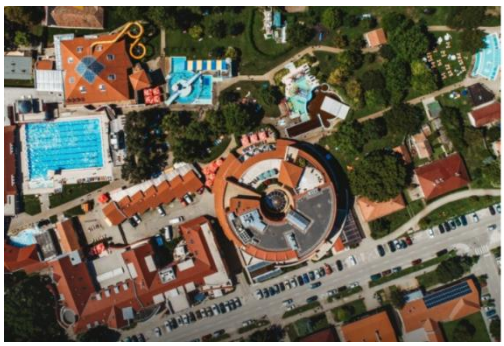
FINANCIAL DATA

Type of financing, year	Subsidy, own resources (Municipal investment); 2020-2024
Financier	National Research, Development and Innovation Office of Hungary (Hungarian State) 99,7 %, Municipality of Mórahalom 0,3 %
Specifics	State supported project for ensuring the energy supply of settlements using alternative supply methods replacing natural gas, as well as using modern technologies and flexibility services (2020-3.1.3-ZFR-TEFH- Green Economy Financing System),
Beneficiary	Municipality of Mórahalom
Link	https://www.morahalom.hu/hu/reszletek/dekarbonizalt-morahalom-geotermikus-alapu-fenntarthato-kombinalt-zoldenergetikai-mintaprojekt-kistelepulesek-szamara

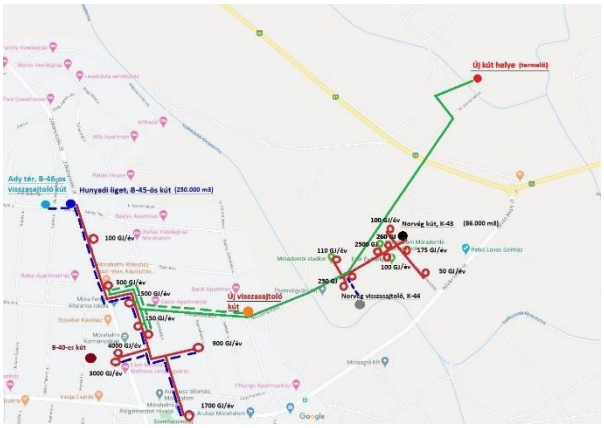
DESCRIPTION and PHOTO

The Town of Mórahalom (population: 6,200) is located in the Southern Great Plain Region, along the Hungarian-Serbian border, near the regional centre, the City of Szeged. The main attraction of Mórahalom is the St. Elisabeth Spa of national significance. It is visited by nearly half a million guests every year. The spa has its own geothermal system. https://erzsebetfurdo.morahalom.hu/en/spa

Between 2008 and 2010, the Mórahalmi Geothermal Cascade System was established, providing geothermal energy for heating 16 municipal, state and church institutions located in the central parts of the town. Almost in parallel, a separate geothermal heating system (Norwegian Geothermal Utility System) was established in the eastern part of the town between 2009 and 2011, supplying nine additional institutional consumers with heat. All institutions connected to the system have been fully energy retrofitted in alignment with the "energy efficiency first" principle and include building-integrated renewable energy solutions.



Picture 30: St. Elisabeth Spa in Mórahalom @Thermal Panzio



Picture 31: Geothermal district heating network @Innogeo Kft.

In 2020, the concept of connecting the two systems was developed, for which a consortium led by the Mórahalom Municipality successfully mobilised public funding of HUF1.5B (€3.78M). The project, entitled "Decarbonized Mórahalom - a geothermal-based sustainable combined green energy pilot project for small communities", aims to integrate the two geothermal heating systems in Mórahalom with a newly established geothermal system and thereby connect the existing and additional consumers to an integrated geothermal utility system. By deploying intelligent control, the unified system is able to provide heat with the required flexibility at all points

of the geothermal district heating network. The integrated system can meet a total annual heat demand of 55,000 GJ instead of the previous 22,500 GJ entirely offsetting natural gas use (i.e. 660,000 m3 at 34.11 MJ/m3 or HUF 493M at HUF 747/m3). This results in annual savings of €1,25M, so the project payback time is about 3 years (without taking into consideration other supplementary costs).

The project completed in early 2024, also aimed to carry out technical development and innovation related to the design, construction and testing of the system as well as investigating the project replicability in same size communities. The project has laid the foundations for showcasing a local geothermal energy community, as well.

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Avoidance of mandatory thermal water reinjection, because the existing spa can utilize effluent warm waters. ▪ Raising awareness of sustainability and opportunities of green energy use.	▪ This type of grant funding is not available for residential use of district heating. ▪ The project was funded by subsidy to almost 100 %, with a minimal own resource of the municipality.
Opportunities / Possibilities	**Threats / Barriers**
▪ Formation of an energy community among public and private partners. ▪ Utilization of effluent lukewarm waters by using heat pumps. ▪ Projects with similar high returns could be financed with the inclusion of market participants (industrial partners, ESCOs, etc).	▪ Municipalities cannot obtain government guarantee for taking out bank loans, not even for short payback time project financing.

No. 31: Energy modernisation and smart energy management development of the “Autumn Light“ Home for the Elderly in Alsómocsolád

FINANCIAL DATA

Type of financing, year	EU Grant (KEOP) 2015. Own resources (Municipal investment) 2023.
Financier	European Regional Development Fund, Central Government, Municipality of Alsómocsolád
Specifics	1. The development of the "Autumn Light" Home for the Elderly in Alsómocsolád (KEOP-4.10.0/F/14-2014-0155): the project was financed by the European Regional Development Fund and national central budget appropriations in the form of non-reimbursable grants. Amount of EU support: 80% (HUF 62.167.060) Municipal investment: 20% 2. Smart energy management improvements in the Autumn Light Home for the Elderly (self-financed investment) Municipal investment: 100% (HUF 4.800.000)
Beneficiary	Municipality of Alsómocsolád
Link	https://www.youtube.com/watch?v=O5eCnLdinUs&t=2s Energymanagement in the Elderly Home of Alsómocsoád

DESCRIPTION and PHOTO

Picture 32: Home for the elderly in Alsómocsolád

In August 2014, the Municipality of Alsómocsolád submitted an application for the call for proposals entitled "Development of the building energy efficiency of the "Autumn Light" Home for the Elderly in Alsómocsolád", announced by the Deputy State Secretary for Environmental and Energy Efficiency Operational Programmes of the Ministry of National Development in the convergence regions".

Prior to the renovation, the residential care home, built in 2006, had an energy rating of BB, which was upgraded to A+ with the renovation.

The building currently accommodates 46 people in rooms with 2 and 3 beds. Two rooms (apartments) have 1-1 bathroom (shower + toilet). There is also a 300-capacity kitchen and a restaurant serving tourism.

The aim of the project was the energy modernisation of the "Autumn Light" Home for the Elderly. The investment included external thermal insulation, plasterboard suspended ceiling, attic insulation, plinth insulation, installation of 5 solar collectors with bivalent storage and a 16.5 kW solar panel system. The project resulted in an annual energy cost reduction of HUF 3,000,000.

The energy crisis of 2022 has further strengthened the need to reduce the energy consumption of the elderly home by using smart solutions. Our measurements in March 2023- at the end of the heating season- showed that the windows (in the rooms and bathrooms) are open on average 41% of the time during the heating season, which can lead to correspondingly higher gas consumption in the winter months and, in addition to higher electricity consumption in the summer months, can also cause dehydration-related health problems in the event of overheating.

Based on these measurements, rooms and bathrooms are equipped with opening sensors that detect when windows are open for more than 10 minutes. In this case, the Loxone system automatically turns down the heating.

Functions of the system:

- night and day heating comfort adjustment (automatic temperature control)
- automatic heating and cooling control
- preventing overheating: by setting maximum and minimum values in every room
- alarm in case of higher or lower than healthy temperatures
- automatic ventilation, warning to ventilate when air is exhausted

Picture 33: Automation system

The system's installation and operation were self-financed, with the investment projected to achieve full payback within 3 to 4 years through energy savings. Beyond cost reductions, the implementation has also streamlined operations through automation, significantly lowering staff workload and contributing to a healthier living environment.

Other development goals include the replacement of the existing 9-year-old solar panel system, the expansion of the smart energy management system, the deployment of a smart grid system - with the involvement of other public buildings in the municipality -, the purchase of an electric minibus for energy storage, the installation of an electric charging station, and the creation of an energy community involving the inhabitants and local businesses.

To finance these improvements, the municipality plan to use the ESCO model, the EKR (Energy Efficiency Obligation System) scheme, the involvement of businesses' own investments and the creation of an energy community fund for the inhabitants.

SWOT ANALYSIS

Strengths	Weaknesses
▪ The stable economic situation of the municipality as the maintainer. ▪ Availability of funding. ▪ Existing project management experience. ▪ Relatively new building with favourable but not perfect energy performance. ▪ Constructive cooperation between the municipality and the institution.	▪ The smooth running of the nursing home and kitchen had to be ensured during the renovation. ▪ Meeting grant/supporter requirements. ▪ Limited financial resources available. ▪ Lack of local expertise and skills.
Opportunities / Possibilities	**Threats / Barriers**
▪ The energy efficiency potential of smart energy management and automation. ▪ Scalability of projects. ▪ Attracting additional financial resources (ESCO, Energy Efficiency Obligation System). ▪ Use and transfer of knowledge acquired. ▪ Support for renewable energy sources. ▪ Opportunities in Smart Grid developments. ▪ Possibility of creating an energy community, including other municipal buildings and residential buildings.	▪ Changes to support options. ▪ Deterioration of the economic situation. ▪ Significant and continuous increase in prices of goods and services. ▪ Restructuring of the political and economic framework. ▪ Unpredictability of the regulatory environment. ▪ Lack of public resources and lack of motivation.

No. 32: Energetic modernization of Tarján Bilingual Primary School

FINANCIAL DATA

Type of financing, year	Subsidy, own resources (Municipal investment), 2016-2020
Financier	Prime Minister's Office, Managing Authority of the Territorial Development Operational Programs (Hungarian State), European Regional Development Fund; Municipality of Szeged
Specifics	Territorial and Settlement Development Operational Program (TOP-6.5.1-15): non-refundable grant from European Regional Development Fund (75%) and National fund (15%) + own resources of the municipality
Beneficiary	Municipality of Szeged
Link	https://www.palyazat.gov.hu/eredmenyek/tamogatott-projektek/788040201

DESCRIPTION and PHOTO

The floor area of Tarján Bilingual Primary School is 4,114 m2. The results of the preliminary energy review showed that the school's energy consumption was higher than expected, which results in significant operating costs for the municipality.

The planned energetic modernization included the following investment elements:

- Modernization of External Boundary Structures
- Outdated facade doors and windows of school buildings were replaced.
- The entire facade and, if necessary, the roof slabs were thermally insulated and waterproofed.
- Modernization and Replacement of DHW Systems
- Outdated boilers in the building complex were replaced. New pipelines, fittings, circulation pumps, and manifolds were installed, with adequate thermal insulation provided. The main lines were designed according to the building's orientation.
- Heating pipelines and radiators were replaced, and high- and low-current systems were developed for building engineering operations.
- Design of a Photovoltaic System
- A household-sized photovoltaic energy utilization system was built with solar panels placed on a flat roof. Necessary support structures, electric lines, equipment, and supply and demand measuring points were prepared.
- Modernization of Electrical and Lighting Systems
- The internal electrical network of school buildings was partially renovated, including the installation of necessary wires, fittings, and energy-efficient lighting fixtures that provided adequate light intensity.
- Barrier-Free Access
- Project-proportionate barrier-free access was implemented.

The Tarján Bilingual Primary School, renovated as part of the project, is located in the Tarján district of Szeged. The school consists of a two-story main unit and single-story wings that house the gymnasium, kitchen, utility room, teachers' rooms, and additional classrooms, with a usable floor area of 4,098 square meters. The municipality aimed to make the school technically and energetically efficient, meeting current standards.

The facade was insulated with an average of 16 cm of expanded polystyrene, and fire sections were insulated with 16 cm of rock wool. The facade colour was chosen based on guidelines from the city’s chief architect. Existing windows and entrance doors were replaced with energy-efficient models. The outdated building

engineering systems were modernized, including an updated electrical network, new lightning protection, and the replacement of old lighting fixtures with modern LED options. In addition to the energetic upgrades, the school underwent aesthetic renovations, with fresh paint applied to classrooms, corridors, and other interior spaces. Barrier-free access was ensured by constructing a new ramp at the main entrance, and new barrier-free toilet and washroom facilities were created as part of the renovation.

As part of the project, 54 solar panels with a total output of 39.9 kW were installed in the institution, which will partially cover the building's energy needs. Dél-Konstrukt Zrt. was the winning bidder during the open public procurement procedure announced for the construction, which accordingly carried out the full scope of the construction. Vázterv Engineering Office Construction, Planning, Execution and Service Kft. carried out the technical inspection tasks.

Picture 34: Tarján Bilingual Primary School

The contracted support for the TOP program amounts to HUF 409,583,424, while the local government's own contribution stands at HUF 77,843,150 (gross).

SWOT ANALYSIS

Strengths	Weaknesses
▪ The annual primary energy demand decreases (PJ/year, kWh/year). ▪ Energy is produced from a renewable energy source. ▪ The condition of the property is improving. ▪ The value of the property increases. ▪ The environment becomes cleaner and healthier at the settlement level.	▪ The principle of circularity does not appear among the criteria. ▪ The payback time will depend on the operation skills as well. ▪ Wider stakeholders engagement recommended.
Opportunities / Possibilities	**Threats / Barriers**
▪ Depending on available funding sources, use of high-quality and long-lasting materials. ▪ Smart metering, smart solution, BEMS could be a good option for better overall performance and operational control. ▪ Indoor Air Quality could be measured and increased with smart operation of a new heat recovery ventilation system.	▪ Availability of grant. ▪ The energetical modernisation takes a long time. ▪ Without smart measurement and visualisation, the efforts will be non-visible.

No. 33: Retrofitting of Zahony Municipal Buildings for Renewable Energy Use

FINANCIAL DATA

Type of financing, year	Subsidy, 2019
Financier	Prime Minister's Office, Managing Authority of the Territorial Development Operational Programs (Hungarian State), European Regional Development Fund
Specifics	Territorial and Settlement Development Operational Program (TOP-3.2.2-15-SB1-2016-00018): 100% non-refundable grant of HUF 573.21M (€1.43M) out of which 85% European Regional Development Fund and 15% State fund
Beneficiary	Záhony City Municipality
Link	www.zahony.hu

DESCRIPTION and PHOTO

The municipality has set the goal of creating a "Green City" model by supplying its buildings with green energy. This initiative is supported by the residents of the settlement based on an informal public consultation.

The long-term direct goal and expected result of the planned development is to significantly reduce the operation and maintenance costs of the buildings. Within the framework of the planned investment, only 100% municipally-owned buildings will be supplied with renewable energy that perform public functions in the fields of public education, kindergarten care, basic health care, family and women's health care, public services provided by non-professional sports facilities.

The functions in the individual buildings do not generate income, they can only cover their operating costs from state subsidy and the support of the project owner. The energy classification of all buildings in their current state reached the relevant 176/2008. (VI. 30.) Classification category "FF" according to government decree.

As part of the planned investment, the energy needs of 7 buildings in Záhony serving public functions will be met by the heat pump and solar panel systems that will be installed in them. The heat pump and solar panel systems to be installed for each building provide 95% of the energy needs of the 7 buildings.

Picture 35: Zahony Municipal Buildings

Picture 36: Zahony Municipal Buildings, PV panels.

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Use of state subsidy made available for investment in renewables for municipalities. ▪ No own contribution was necessary.	▪ The use of subsidy was limited to renewable energy use; therefore, building renovation is yet to be completed, therefore energy consumption could not be reduced before installing the renewable system. ▪ The adoption of the old, outdated heating systems to the modern energy resources caused difficulties.
Opportunities / Possibilities	**Threats / Barriers**
▪ Switching to modern heating and cooling systems is yet to happen.	▪ Absence of resources for further development can cause damages and keep energy consumption high. ▪ Lack of experienced operating and maintenance personnel.

5.2.3 Slovenia

No. 34: Energy efficiency measures in Municipality of Kranj, SLOVENIA	
FINANCIAL DATA	
Type of financing, year	Energy Performance Contracting (EPC), 2001 (phase 1) Energy Performance Contracting (EPC), 2018 (phase 2)
Financiers	MOK, Petrol d.d. MOK, Petrol d.d., Domplan d.d. and Gorenjske elektrarne d.o.o.
Specifics	PPP between municipality and private company (phase 1); PPP between municipality and private companies (phase 2)
Beneficiary	Municipality of Kranj (MOK)
Link	https://www.petrol.si/znanje-in-podpora/2019/clanki/mestna-obcina-kranj---trajnostno-zgodbo-skupaj-gradimo-ze-19-let.html
DESCRIPTION and PHOTO	

In 2001, the Municipality of Kranj (MOK) and company Petrol signed a 15-year contract based on the energy contracting model. This was the first project of contractual financing of measures for the efficient use of energy in Slovenia. The contract included 14 buildings with a total area of 73,000 square meters owned by the MOK. The business model included assurance of savings, assurance of energy supply and energy management. The buildings that were part of the contract were in poor energy condition with high energy costs.

With the contract, Petrol undertook to provide an average 18.7% saving in energy for heating by introducing energy measures in nine selected buildings. After the implementation of the first measures, the project was upgraded with some additional implemented measures. The project was mostly financed by Petrol, and the investment was repaid from the savings achieved. Additional upgrade measures also included funding from the MOK, grants from the tenders of the Republic of Slovenia and the Swiss Renewable Energy Across the Alpine Land (REAAL) mechanism, which supported projects in the field of renewable energy sources in the Alpine region to improve energy efficiency in public infrastructure. Investment risks, responsibility and possible consequences due to failure to achieve the predicted effects were assumed by Petrol.

Picture 37: Olympic pool in Kranj, source: https://www.zsport-kranj.si/vsi-sportni-objekti/pokrit-olimpijski-bazen

The project started in 2002 and ended in August 2017 with the following results: in 15 years, 14 contracted buildings saved 3 years of heat consumption as regard to reference year. With the implementation of measures in nine buildings, the use of heat in these buildings during the implementation of the contract was almost halved.

In the covered Olympic swimming pool and open swimming pool in Kranj, despite the increased use of the facilities, the use of primary energy for heat decreased by 62% compared to the reference use. All devices operated uninterrupted at all times. The project also included staff training on proper ventilation and energy management, technical details of system operation, thermostat settings, proper ventilation, etc.

This positive experience encouraged the MOK to continue the renovation of buildings according to the same 15-year contract model in the consortium of the companies Petrol, Domplan and Gorenjske elektrarne. The project (started in 2018) includes a comprehensive energy renovation of 10 public buildings and a partial energy renovation of 12 buildings (all together 68,450 m^2). The investment amounts to 6.18 million euros, of which private partners invest 3.1 million euros, 2.25 cames from European cohesion funds, and 0.83 million euros was the investment of MOK. The total guaranteed annual saving of energy is 2,473,000 kWh.

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Uninterrupted operation of all devices. ▪ Significant improvement of the energy efficiency of selected buildings. ▪ Big energy savings. ▪ Increase of the value of real estate and impact on the quality of life. ▪ Demonstration case on which trust in contracting is built. ▪ The established trust and good experience encouraged the continuation of the process in a similar project.	▪ Measures were targeting energy efficiency renovations only and not sustainable renovation. ▪ Commitment to a contracted supplier for 15 years. ▪ Inadequate methodology of evaluating the profitability of energy efficiency renovation: usual cost-benefit analysis is not useful in evaluating side benefits, such as improved health and well-being, better living and working conditions, general more favourable environmental effects, etc.
Opportunities / Possibilities	**Threats / Barriers**
▪ Possibility to obtain additional funds. ▪ Support measures such as stuff training and additional learning about technical details of system operation, ventilation, etc.	▪ Relatively long return of investment (due to low price of energy).

No. 35: Energy renovation in Municipality of Ljubljana (EOL-1, EOL-2), SLOVENIA

FINANCIAL DATA	
Type of financing, year	Energy Performance Contracting (EPC), 2017 (Phase 1) Energy Performance Contracting (EPC), (Phase 2)
Financier	MOL, Petrol d.d. MOL, Resalta d.o.o., Javna razsvetljava Ljubljana d.d.
Specifics	PPP between municipality and private company (phase 1); PPP between municipality and private companies (phase 2)
Beneficiary	Municipality of Ljubljana (MOL)
Link	https://www.petrol.si/znanje-in-podpora/2019/clanki/energetska-obnova-ljubljane-150.000-dreves-vec-in-tri-tisoc-ton-izpustov-manj.html

DESCRIPTION and PHOTO

In 2017 Municipality of Ljubljana (MOL), company Petrol and Resalta signed the largest PPP contract based on energy contracting model in Slovenia. The total costs of the EOL-1 project was 15 million euros, with the two private partners providing the majority of the investment funds, as much as 51%. In addition, all technical and economic risks of project implementation and management were on their side. The contract included 48 buildings.

As part of this large energy renovation of Ljubljana, a consortium of partners renovated kindergartens, primary schools, sports halls and other public buildings. The buildings were equipped with modern and environmentally friendly energy infrastructure for more efficient energy use and reduction of greenhouse gas emissions into the environment. These very important renovations also included the Central Swimming Pool in Tivoli, the Tivoli Sports Hall, the Kodeljevo Sports Park Hall, the Rudnik Shooting Range and the Bežigrad Unit of the Ljubljana City Library.

The result was an annual saving of 8 million kilowatt hours, which is more than one million euros, and a reduction of greenhouse gas emissions by approximately 3,000 tons annually.

The project won the prestigious **European Energy Service Award** in Brussels, which is awarded by the European Commission for outstanding results or efforts in the field of energy services in Europe.

Several technical measures were implemented in the Kodeljevo Sports Park Hall, for example, it was connected to a district heating system for heating, a new heating station was installed, and the existing energy-wasting lighting was replaced with energy-saving LED lights.

Picture 38: Kodeljevo hall in Ljubljana, source: https://www.renovate-europe.eu/reday/reday-2019/online-resources/ppp-slovenia-p6/

The Ljubljana project continued into the second part of the renovation of the buildings together with Resalta company and the company Javna razsvetljava Ljubljana. As part of this project, additional 11 buildings are planned to be renovated and equipped with heat pumps and PV panels (where possible). The additional 5 million euros from the second part enables implementation of measures that can assure annual savings of more than 300,000 euros and reduction of greenhouse gas emissions by as much as 463 tons per year.

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Significant improvement of the energy efficiency of selected buildings and energy and CO_2 savings. ▪ Increased value of real estate. ▪ Consolidation of trust in this type of contracting. ▪ Establishment of new energy contracting for large renovation. ▪ Establishment of EPC guidelines at the national level and launch of the energy contracting market in the country. ▪ Reference case for companies involved. ▪ A new educational program on the efficient use of water, energy and renewable energy sources (MOL has committed to allocate 10% of savings for education of children).	▪ Measures were targeting energy efficiency renovations only and not sustainable renovation. ▪ Commitment to a contracted supplier for 15 years. ▪ Inadequate methodology of evaluating the profitability of energy efficiency renovation: usual cost-benefit analysis is not useful in evaluating side benefits, such as improved health and well-being, better living and working conditions, general more favourable environmental effects, etc.
Opportunities / Possibilities	**Threats / Barriers**
▪ Further EPC phases and process continuity in MOL and other municipalities. ▪ Further implementation of such projects (EPC) by contracting companies. ▪ Transfer of knowledge.	▪ Relatively long return of investment (due to low price of energy).

No. 36: Energy renovation of Ministry of justice in Celje, Murska Sobota and Slovenj Gradec, SLOVENIA

FINANCIAL DATA

Type of financing, year	Energy Performance Contracting (EPC), 2018
Financier	Resalta d.o.o., Ministry of justice, Republic of Slovenia
Specifics	PPP between municipality and private company; public source: Operational Programme for Cohesion Policy Funding (OP-EKP 2014–2020)
Beneficiary	Ministry of justice
Link	https://www.resalta.si/reference/ministrstvo-za-pravosodje https://www.energetika-portal.si/nc/novica/n/vlada-rs-odobrila-pilotni-projekt-energetske-prenove-sklopa-treh-sodnih-stavb-v-upravljanj-3563/ https://www.gov.si/assets/ministrstva/MP/SIKP/Predstavitev-4-prednostne-osi-na-MP.pdf

DESCRIPTION and PHOTO

In line with the Longterm strategy for encouraging investment in energy efficiency renovations of buildings and the Operational Programme for the implementation of European Cohesion Policy 2014-2020 the Ministry of Justice began the pilot project of energy efficiency renovation on buildings on Prešernova ulica 22, 3000 Celje, Slomškova ulica 19, 21, 23; 9000 Murska Sobota and Kidričeva 1; 2380 Slovenj Gradec in 2018.

They chose Resalta as the private partner in renovation. The total investment in the energy renovation of the buildings amounted to 1.8 million €, 49.9% of which was financed by the public partner, 560.482 € from European Union and 98.909 € from Republic of Slovenia.

Picture 39 : Judicial building in Celje, source: https://www.celje.info/kronika/nekdanji-sodni-zapisnikar-ki-je-izdajal-tajne-podatke-celjskega-sodisca-bo-sedel-pet-let/

Integrated energy renovation of judicial buildings of the building sector was to include reduction of annual primary energy consumption in public buildings, reducing greenhouse gas emissions, increase the total floor area of energy renovated buildings owned and used by central or sub-central government, increase in the number of demonstration projects implemented energy renovation projects of different types, increase in the total floor area of energy renovated buildings public sector.

Among measures that were to be implemented were: renovation of heating systems, installation of additional thermal insulation on roofs and facades and replacement of lighting. Yearly saving amounted up to EUR 112 000 €, with 164 MWh saved yearly in heating energy and 53 MWh in energy.

The renovation was implemented in 2018 and the energy efficiency contract is currently running in phase 2, until 2032, when Resalta gave the management back to the Ministry of justice.

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Reference for public-private partnership in renovation. ▪ Short time of Resalta management (3 years) before the system was handed over to the courthouses. ▪ Significant improvement of the energy efficiency and large energy and CO_2 savings. ▪ Satisfaction of end users of buildings. ▪ Increased total floor area and value of real estate. ▪ Consolidation of trust in this type of contracting. ▪ Reference case for company.	▪ Lack of public information about the process. ▪ Practically no promotion actions.
Opportunities / Possibilities	**Threats / Barriers**
▪ Further implementation of such projects. ▪ Development of criteria for determining eligible costs for sustainable energy renovation of public buildings.	▪ Rapid changes in the energy market can hinder to achieve the contractual results. ▪ Complicated public procurement procedure.

No. 37: Renovation of boiler house in Deteljica housing estate, Tržič, SLOVENIA

FINANCIAL DATA

Type of financing, year	Energy Performance Contracting (EPC), 2017
Financier	Interenergo d.o.o.
Specifics	No public source
Beneficiary	Apartment owners, premises owners
Link	https://www.finance.si/okolje-energija/%28video%29-z-energetsko-prenovo-do-pol-milijona-prihrankov/a/8947028

DESCRIPTION and PHOTO

The Deteljica housing estate in Tržič comprises 12 apartment buildings. The inhabitants own the boiler house, which heats 278 apartments and 15 commercial premises. The boiler house and the heat substations were outdated, so the residents decided to renovate and replace the heating system.

The goals of the contractor were: the overall organisation, investment and implementation of the renovation of the heating system, the refurbishment of the boiler house with state-of-the-art natural gas boilers, the implementation of the system in control centre and the continuous monitoring of its operation, remote access to the system and on-call service, the refurbishment of the heating stations and the reduction of heat transfer losses, the switch to the more environmentally friendly energy source natural gas, the reduction of carbon dioxide emissions and cleaner air, the maintenance, the insurance and the care of the proper functioning of the system with regular and emergency servicing services.

After signing the contract, the project was completed within two months. The complete renovation of the boiler house included a new 1 000 kW gas boiler, mechanical installations with equipment for pumps, exchangers and a new chimney, new electrical installations, a modern central control system with monitoring, settings, alarming via email and SMS, and more.

Picture 40: The renovated boiler room in Deteljica, source: https://www.finance.si/okolje-energija/%28video%29-z-energetsko-prenovo-do-pol-milijona-prihrankov/a/8947028

The energy contracting project between Interenergo and the floor owners of the Deteljica neighbourhood was divided into three parts. The first phase was the renovation, followed by the second phase, which covers seven years of management, maintenance and insurance of the equipment, as well as a reliable supply of heat energy. In the third phase, Interenergo will hand over ownership of all the newly installed equipment and system to the users.

The investment was completed before the start of the 2018/19 heating season, so the new system is already delivering savings. The energy savings of the boiler are 730.69 megawatt hours per year or per 1,500

operating hours, and the environmental savings are 306.18 tonnes of carbon dioxide per 1,500 operating hours. Both savings are calculated according to the Regulation on methods for determining savings.

The renovation will result in total annual savings of approximately € 46 000 in Deteljica. Before the renovation, the total heating costs with maintenance and management amounted to just over € 137 000 per year, while after the renovation they amount to less than € 91 000 per year.

The figure is valid for the first seven years after the renovation. During this period the equipment will be paid off through savings, so the heating, maintenance and management costs after this period will be less than € 77 000 per year, with annual savings of almost € 61 000. In total, the energy renovation will save Deteljica more than half a million euros over ten years.

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Quick and efficient implementation and conclusion of the renovation. ▪ Cooperation of the floor owners, building managers and the private contractor. ▪ A case study for renovation of multi-owner apartment buildings.	▪ The predicted savings can be lower due to rapid changes in the energy market.
Opportunities / Possibilities	**Threats / Barriers**
▪ To learn about organisational steps for a large number of units / apartments and commercial premises. ▪ Opportunity for promotion of this successful project	▪ Upkeeping the new equipment after Phase 3 is not concluded. ▪ Rapid changes in the energy market threat the further investments. ▪ Financially vulnerable people can be an obstacle as usually they cannot invest.

No. 38: Energy renovation of buildings in Municipality of Maribor, SLOVENIA

FINANCIAL DATA	
Type of financing, year	Energy Performance Contracting (EPC), 2018
Financier	Municipality of Maribor (MOM), Petrol d.d
Specifics	PPP between municipality and private company; public source: Energy Renovation of Public Buildings Programme of the Ministry of Infrastructure and includes cohesion funds from the 2014-2020 financial perspective
Beneficiary	Municipality of Maribor
Link	https://www.petrol.eu/sl/aktualno/2018/podpis-koncesijske-pogodbe-za-izvedbo-projekta-energetskega-pogodbenistva-na-objektih-mestne.html

DESCRIPTION and PHOTO

In 2018 the Municipality of Maribor and its partner PETROL, Slovenska energetska družba, d.d., Ljubljana, concluded a public-private partnership for the implementation of energy renovation of public buildings in the Municipality of Maribor, which at that period represents one of the largest public-private partnership projects in the field of energy contracting in Slovenian municipalities. The project was prepared and implemented in accordance with the provisions of the Energy Renovation of Public Buildings Programme of the Ministry of Infrastructure and includes cohesion funds from the 2014-2020 financial perspective.

The energy renovation project of the public buildings of the Municipality of Maribor was implemented according to the principle of public private partnership (PPP) and EPC over a 15-year concession period. The private partner invests in the energy renovation of the building and provides certain savings with the same or higher comfort in the premises, and the public partner repays the private partner with these savings over the contractual period. At the end of the contract period, all savings in energy costs remain with the public partner. The private partner will also ensure the management and maintenance of the newly installed or rehabilitated energy installations and systems during the 15-year concession. 24 buildings were renovated as part of the energy renovation of the MOM: kindergartens, primary schools, sports halls and public buildings.

Due to the wide range of facilities, the project was divided into two lots. Strand 1, which covers the comprehensive energy renovation of 14 buildings, dealt with technological as well as construction measures for which it was possible to obtain cohesion grants amounting to 40% of the investment. The comprehensive energy renovation measures included thermal insulation of façades, replacement of joinery, insulation of unheated attic ceilings, installation of thermostatic valves, renovation of gas and ELKO boiler rooms, renovation of heating sources with installation of heat pumps and renovation of DO heat stations, renovation of interior lighting systems, installation of an energy management system.

Strand 2, which covers the renovation of 10 buildings, focuses mainly on the rehabilitation of the building's technological systems: heating, ventilation, refrigeration, ice-making and efficient lighting systems.

The total investment value of the project amounted to EUR 10 539 293. The majority of the investment (88%) is in the overall energy renovation of the buildings, while the technological renovation of the buildings represents 12% of the total investment. The private partner (PETROL d.d.) invested EUR 5,280,186.14 (50.1%), EUR

3,706,601.83 (35.17%) came from the European Cohesion Fund and the municipality's share was EUR 1,552,505.72 (14.73%).

The total guaranteed annual savings of heat and electricity amount to 3,367,419 kWh or EUR 555,804 (excluding VAT) per year, which also means a reduction of 1,325 tonnes of CO2 per year, equivalent to the equivalent of 147 hectares of forest in a greenhouse gas accumulation.

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Significant improvement of the energy efficiency of selected buildings. ▪ Guaranteed annual energy savings up to 3,367,419 kWh ▪ Savings with the same or higher comfort in the premises. ▪ Private partner ensures the management and maintenance of the newly installed systems during the 15-year concession.	▪ Measures were targeting energy efficiency renovations only and not sustainable renovation. ▪ Commitment to a contracted supplier for 15 years. ▪ Mechanical ventilation was not included in the renovation measures, which could provide additional energy savings. ▪ Lack of public promotion.
Opportunities / Possibilities	**Threats / Barriers**
▪ Obtaining users' assessment of additional benefits in cases of comprehensive renovation. ▪ To include simple findings and results into the learning process.	▪ Uncertain outcome of energy savings, emissions savings and cost savings calculations.

No. 39: Energy renovation of boiler house and the replacement of the heating network, Kranj, SLOVENIA

FINANCIAL DATA	
Type of financing, year	Housing savings fund, deferred payment of investment, 2017, 2018
Financier	Apartment owners of Šorlijevo naselje, Domplan d.d.
Specifics	The possibility and burden of delayed payment was taken over by the private company Domplan d.d.
Beneficiary	Apartment owners of Šorlijevo naselje
Link	https://www.domplan.si/energetika/toplotna-oskrba/prenova-ogrevalnega-sistema-sorlijevo-naselje

DESCRIPTION and PHOTO

In 2017 and 2018 a community of housing settlement Šorlijevo naselje in Kranj decided to renovate their boiler house. The investment was covered from their own savings (in their housing fund). The conditions for the start of the investment were made possible by the management of Domplan, which, together with the heating committee, prepared the starting points for the preparation of the technical documentation and the terms of the deferred financing.

The total investment was around €800 000. Around €250 000 has been saved by users over the past two years in the form of payments into a maintenance fund, and Domplan has allowed the remainder of the investment to be repaid over nine years, in the same form and amount as before. Thus, the amount of heating bills would not increase, but a reduction in variable heating costs of around 12 % was expected as a result of the modernisation of the system.

Picture: Boiler room in Šorlijevo naselje, source: https://www.domplan.si/energetika/toplotna-oskrba/prenova-ogrevalnega-sistema-sorlijevo-naselje

The renovation of the boiler house included construction, mechanical and electrical works. The construction work on the boiler house included the renovation of the roof, replacement of windows and doors, rehabilitation of concrete surfaces, and painting of external and internal surfaces. The mechanical work included the installation of two hot water boilers with an attached gas burner of 1 400 kW each, the construction of two new flue gas stacks, the installation of a heat exchanger, the replacement of distribution pumps, valves, piping, etc. The renovation switched the entire heating system to a closed static pressure maintenance system, with attached dictation pumps and a degassing plant. In the boiler room, the entire electrical installation was replaced, a controller was installed to control the operation of the plant and auxiliary devices were installed for remote control of the boiler room.

With the replacement of the heating pipelines in the estate, a total of approx. 3,300 m of pipelines were replaced. The existing steel were replaced by pre-insulated pipelines with leakage indication fitted. The route of the new

pipelines mostly follows the existing AB kinettes. At the same time as the heat pipes were replaced, electrical cabling was installed to allow the connection, remote monitoring and control of the heat stations. After the renovation, the boiler house and all the heat substations to which the heat pipeline was being renovated were remotely controlled and operated from the headquarters of Energetika.

After the renovation of the boiler house and the heat pipeline, no additional financial burden was imposed on the apartment owners, who would repay the remaining difference through their established earmarked savings. However, the savings due to lower heat losses in the heat pipe, better boiler efficiency and more optimal control were passed on to the apartment owners in January 2018, with a reduced variable heating cost of approx. 12%.

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Initiative from apartment owners and building manager. ▪ A new model for paying off a large private investment, while also having lower electricity cost immediately.	▪ The residents covered 100% of the investment with their savings fund, with deferred payment for the next 9 years. ▪ The process covered only energy renovation, not sustainable renovation.
Opportunities / Possibilities	**Threats / Barriers**
▪ Combining this model with EU or national subsidies. ▪ Using the case as a promotion for other similar renovations.	▪ 100% consent and cooperation from all owners is still required for a model like this. ▪ The existing boiler room may be too small for the installation of new appliances.

No. 40: Energy renovation of public buildings, Novo mesto, SLOVENIA

FINANCIAL DATA

Type of financing, year	Energy Performance Contracting (EPC), 2017
Financier	Municipality of Novo Mesto, Petrol d.d., European cohesion fund
Specifics	PPP between municipality and private company; public source: Operational Programme for Cohesion Policy Funding (OP-EKP 2014–2020)
Beneficiary	Municipality of Novo Mesto
Link	https://www.petrol.eu/sl/objave/2017/02/mestna-obcina-novo-mesto-in-druzba-petrol-podpisali-pogodbi-za-energetsko-sanacijo-javnih.html

DESCRIPTION and PHOTO

In cooperation with Petrol, the Municipality of Novo mesto improved the energy efficiency of 24 public buildings in the project of energy renovation of municipal buildings. This part was largely implemented according to the public-private partnership model. The partner also ensured the management and maintenance of the newly installed energy installations and systems during the concession period.

The project was divided into two parts. The first part consists of 16 buildings, for which it was planned to undergo a partial energy renovation. The measures mainly included the establishment of a high-tech energy management system for the buildings with the implementation or upgrade of central control systems, optimisation of the operation of heating and cooling systems, renovation of boiler rooms and renovation of interior lighting. **The implementation was fully funded by the private party** and the total guaranteed savings in heat and electricity amount to 1 037 114 kWh or EUR 147 437,28 excluding VAT per year.

Picture 41: General hospital Novo Mesto, source: https://www.radio-odeon.com/novice/novomeska-bolnisnica-lani-z-2-9-milijona-evrov-presezka/

The second set of renovation measures comprises eight buildings where comprehensive energy renovation was planned. The comprehensive renovation mainly involved thermal insulation of façades, replacement of windows and doors, thermal insulation of unheated attic, installation of thermostatic valves or heat pumps, replacement of lighting, renovation of boiler rooms, etc. For these buildings, the private sector provided a minimum of **51 % of the funds, up to 40 % from cohesion funds, the rest is provided by the municipality.** The total guaranteed savings in heat and electricity amount to 831 038 kWh or EUR 97 394,76 excluding VAT per year.

The total investment for the renovation of the 24 buildings amounts to EUR 3,157,893 excluding VAT, with Petrol investing EUR 1,610,526 excluding VAT, European cohesion funds EUR 993,626 excluding VAT and the Municipality of Novo mesto EUR 553,741. VAT on the entire investment is covered by Petrol.

The Municipality of Novo mesto was additionally planning comprehensive energy renovations of three more buildings, where the expected savings did not meet the criteria of the public-private partnership and were therefore renovated within the framework of a public procurement procedure and with the help of financial resources from the European Cohesion Policy.

The energy renovation was financed by a cohesion grant of up to 40%, the rest being provided by the municipality. The energy measures on three primary schools did mainly involve installation of thermal insulation on the facades, ceilings and replacement of windows. The investment is worth €457,942 excluding VAT, of which €183,177 excluding VAT are European Cohesion funds and €307,797 was the share of the Municipality of Novo mesto. VAT on the entire investment was covered by the Municipality of Novo mesto.

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Private partner covering 51% of investment. ▪ Renovation split in 2 parts for easier management. ▪ Comprehensive energy renovation of second part.	▪ For 6 buildings only partial energy renovation was implemented.
Opportunities / Possibilities	**Threats / Barriers**
▪ To prepare simple analysis of the results and the measures to be included into educational process. ▪ Visualisation of the results for the promotion of the whole process (including the financial model, results, improvements, etc.)	▪ 3 buildings that did not meet the criteria for public-private partnership had to be renovated through separate process.

No. 41: Energy renovation of boiler room in OŠ Komenda, SLOVENIA

FINANCIAL DATA

Type of financing, year	Energy Performance Contracting (EPC), 2011
Financier	Republic of Slovenia, Municiaplity od Komenda, Energen d.o.o.
Specifics	PPP between municipality and private company
Beneficiary	Primary school of Komenda
Link	https://www.gzs.si/pripone/DISEMINACIJSKI%20%20PRIRO%C4%8CNIK%20DOBRIH%20PRAKS%20projekt%20PROFILIfinal.pdf

DESCRIPTION and PHOTO

Picture 42: Primary school Komenda, source: https://www.modre-novice.si/aktualno/prestavitev-solskih-pocitnic-bo-prekinila-ustaljen-ritem-solskih-zavodov/

In Slovenia, public-private partnerships have already been used to renovate primary schools, colleges, health care institutions, retirement homes, student hostels and other public buildings. One of the earliest renovations was carried out in 2011, the renovation of the boiler house at the Komenda Primary School. Energen d.o.o. was selected as the private partner following a public tender and was awarded a concession for a period of 15 years. The private partner modernised the heating system by installing a 500 kW Buderus boiler and a 50 kW CHP unit.

Renovation of all the equipment in the boiler room was included as well. The heat is used for heating the premises and the sanitary water, while the electricity generated is mainly used for the school's own needs. In addition to the real value of reducing energy consumption and costs, the positive educational and educational aspect for the pupils is also important in the renovation. The renovation included the installation of an energy information point in the school - a touchscreen, through which students and parents can learn about the new boiler technology, cogeneration electricity and the energy efficiency of the renovated boiler house.

SWOT ANALYSIS

Strengths	Weaknesses
▪ Early case study, 2011. ▪ Installation of an energy information point students and parents can learn about the new technologies.	▪ No other energy / sustainability measures were taken.
Opportunities / Possibilities	**Threats / Barriers**
▪ An opportunity to use a similar approach to increase the energy efficiency of a building.	▪ The general condition of the building (materials) can be so bad that energy efficiency measures do not make sense.

No. 42: Installation of a solar power plant on the noise barrier of the expressway at Bazara, SLOVENIA

FINANCIAL DATA

Type of financing, year	Combination of public funding, 2010-2014
Financier	Slovenian-Swiss cooperation programme to reduce economic and social disparities in the enlarged European Union, Municipality of Nova Gorica
Specifics	Slovenian-Swiss cooperation programme: 83 %, Municipality of Nova Gorica: 17 %.
Beneficiary	Municipality of Nova Gorica
Link	https://sempeter-vrtojba.si/postavitev-soncne-elektrarne-na-protihrupni-ograji-hitre-ceste-pri-bazari-svicarski-prispevek/

DESCRIPTION and PHOTO

The installation of a solar power plant on the noise barrier of the A2 expressway from Bazara to Vrtojba is the first activity of the Renewable Energy Sources in Primorska Municipalities project. The project is coordinated by the Goriška Local Energy Agency (GOLEA) as the implementing agency. The power output of the PV power plant is: 167 kWp. The PV plant consists of 644 panels, with the length of the plant being 648 metres and the height 2.6 metres. The plant generates 196 MWh of electricity per year. In financial terms, this means €39,000 per year. The calculated payback **period for the investment was 2 years**. The solar power plant on the noise barrier is the first of its kind in the country Slovenia. The work was carried out by the company selected in a public tender, Adriaplan d.o.o. from Sežana.

The electricity produced is intended for the municipality's own use, which means that the municipality does not sell this electricity on the market. It is used for public lighting and municipally owned premises. According to the provisions of the Regulation on the limit values for ambient light pollution, the annual electricity consumption of all luminaires installed in the municipality's territory for the lighting of municipal roads and the lighting of public areas must not exceed the target value of 44,5 kWh per inhabitant. The municipality therefore generates 30.83 kWh per inhabitant per hour from the solar power plant, which represents 69 % of the required energy. This significantly improved the energy self-sufficiency of the municipality.

Picture 43: The PV panels on Bazara, source: https://sempeter-vrtojba.si/postavitev-soncne-elektrarne-na-protihrupni-ograji-hitre-ceste-pri-bazari-svicarski-prispevek/highway

SWOT ANALYSIS

Strengths	Weaknesses
▪ Short payback period (2 years). ▪ A case study for the Swiss contribution financial model. ▪ Improved electricity self-sufficiency of the municipality.	▪ Production of electricity strongly depends on the weather conditions. ▪ No storage is predicted.
Opportunities / Possibilities	**Threats / Barriers**
▪ PV panels could be expanded and cover a 100% of lightning needs, not only 69%.	▪ Risk of PV damages, covering of surfaces with dust and dirt and consequently lower PV performance and unexpectedly poorer results.

No. 43: Energy renovation of municipal administrative building and OŠ Dobrovo, Brda, SLOVENIA

FINANCIAL DATA

Type of financing, year	Slovenian-Swiss cooperation programme to reduce economic and social disparities in the enlarged European Union, Energy Performance Contracting (EPC), 2014
Financier	Swiss contribution, Republic of Slovenia, Municipality of Brda
Specifics	Slovenian-Swiss cooperation programme to reduce economic and social disparities in the enlarged European Union, Energy Performance Contracting (EPC), 2014
Beneficiary	Municipality of Brda
Link	https://www.energetika-portal.si/nc/novica/n/energetska-sanacija-obcinske-stavbe-po-principu-energetskega-pogodbenistva-2967/ https://www.obcina-brda.si/sl/o-obcini/projekti-in-investicije/energetska-sanacija-os-dobrovo-2013-2014-podruznicne-sole-kojsko-2014-in-obcinske-stavbe-2014-2015/

DESCRIPTION and PHOTO

Brda Municipality is one of the first municipalities in Primorska Region to have adopted a Local Energy Concept (LEC), and a SEAP- Sustainable Energy Action Plan, and to have joined the EU Covenant of Mayors. For the energy renovation of the Dobrovo Primary School and Kindergarten, funds were obtained from the Cohesion Fund through 2013's call for tenders for the renovation of buildings owned by local authorities from the Ministry of Infrastructure and Spatial Planning, as well as funds from the **Swiss contributio**n for the Kojsko School and Kindergarten.

Picture 44: Brda municipal buildings, source: https://www.robin.si/lokalne-novice/briska-obcinska-proracuna-za-leti-2024-in-2025-se-naprej-med-najvisjimi-v-zgodovini-obcine-brda/

The municipality wanted to renovate the 1945 municipal building in Dobrovo comprehensively, despite the fact that it did not have its own funds for this purpose. Therefore, the ESCO contractor for the renovation through the energy contracting model was selected. This is the Energy Performance Contracting (EPC) through an Energy Service Company (ESCO) selected following a public call for tenders. The principle of the model is that the public partner, which has limited own resources, first obtains all possible grant and the remaining funds are obtained as an input from the contractor into the project, thus not committing any of its own resources to the implementation of the projects. The key to implementing energy efficiency measures under the principle of contracting for savings is therefore to achieve savings that will cover all the costs of implementing the measures and the subsequent management and delivery of the energy over the contract period.

The energy renovation of the municipal administration building in Dobrovo was carried out by the selected contractor, the renovation of the Dobrovo Primary School was carried out by the municipality through a public tender for energy renovation of public buildings, and the renovation of the Kojsko primary school is being financed by the municipality through the Primorska Municipalities project of the Swiss Contribution. In all three

buildings, the contractual partner supplies heat in addition to the contractual savings. The energy renovation of the buildings in all three facilities resulted in lower energy consumption, and consequently the annual energy costs was more than halved (from EUR 90,162 before the energy renovation to EUR 40,521 after the energy renovation). The savings achieved paid for the investment in the comprehensive energy renovation of the municipal administration building.

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Comprehensive energy renovation of municipal administration building. ▪ Successful energy renovation which resulted in lower energy consumption and halved annual energy costs. ▪ Case study for a combination of different financial models to renovate a municipality.	▪ No other sustainability measures were taken. ▪ Lack of public promotion.
Opportunities / Possibilities	**Threats / Barriers**
▪ To promote possible combination of different financial models. ▪ To inform general public about benefits. ▪ To visualize the results and benefits. ▪ To prepare simple analysis of the results and the measures to be included into educational process.	▪ Complicated public procurement procedure. ▪ Unplanned and improper use can jeopardize the estimated savings calculations.

No. 44: District heating for educational facilities Ivančna Gorica, SLOVENIA

FINANCIAL DATA

Type of financing, year	Energy Performance Contracting (EPC), 2013
Financier	Eltec Petrol d.d., Municipality of Ivančna Gorica
Specifics	PPP between municipality and private company; public source: Operational Programme for Cohesion Policy Funding
Beneficiary	Municipality of Ivančna Gorica
Link	https://www.ivancna-gorica.si/objava/525876 https://www.gzs.si/pripone/DISEMINACIJSKI%20%20PRIRO%C4%8CNIK%20DOBRIH%20PRAKS%20projekt%20PROFILIfinal.pdf

DESCRIPTION and PHOTO

The school building, built in 1904 and located on a hill in the centre of Stična, shares its premises with the Ivančna Gorica kindergarten unit. In 2012 the process of energy efficiency renovation through public-private partnership began. As in the case of the Muljava school, the contractor (DULC d.o.o.) took over the renovation works. The renovation of the school was part of a comprehensive energy renovation of public buildings, which also included the Ambrus and Muljava schools and the Polžek kindergarten unit in Višnja Gora.

Picture 45: Elementary school Stična, source: https://www.ivancna-gorica.si/objava/525876

The renovation of heating systems and the switch to heat pumps, the renovation of boiler rooms, the renovation of lighting and plumbing, the installation of thermostatic valves, attic thermal insulation and the renovation of ventilation systems further improved the conditions for building occupants. It also improved the functionality and extend the lifetime of public buildings.

This is an example of a **fast-track public-private partnership**. It is the cooperation between the Municipality of Ivančna Gorica and the private partner Eltec Petrol d.d., which has already implemented similar projects. In 2012, the partners signed a contract for the construction of a biomass boiler house with district heating and heat stations. A kindergarten, a primary school and a secondary school in Ivančna Gorica are connected to the system, with the possibility of expansion for new users. Just one year after the signing of the concession agreement, the system was already operational in autumn 2013.

A new boiler house has been built, housing two wood biomass boilers with a rated output of 800 kW. The buildings are connected by a 350 m long heat pipe. The net heating area is 14 200 m2. The estimated annual heat consumption is 1 500 MWh, which is provided by an estimated 1 700 m3 of wood chips. Fossil fuels are therefore replaced by a renewable energy source, which reduced heating costs by 20%, reduce CO2 emissions by 450 tonnes and heat public buildings in a sustainable way. The private partner, Petrol, has obtained a concession for 15 years and will also provide biomass from the local environment. During this period, it will manage, develop and expand the system. The total investment was worth €750,000. The existing heating system

will remain as a backup source. As this system is also integrated into educational organisations, the modernisation naturally raises young people's awareness of renewable energy and environmental protection.

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ Fast public-private partnership renovation. ▪ A good case study of an old building renovation (built in 1904). ▪ Raising awareness of young people about sustainability.	▪ Long concession and operational time for Petrol partner: 15 years. ▪ Dependence on Petrol company as a supplier of biomass for 15 years.
Opportunities / Possibilities	**Threats / Barriers**
▪ Opportunity to use this renovation as a promotion case and make the results public. ▪ Possibility to integrate some simple findings and results into educational process.	▪ Variable costs over a long period of management (15 years). From previous examples we know that the reception of fixed costs to pay of the investment are not well received in comparison to energy savings cost, that the new systems are producing.

No. 45: Energy renovation of School centre, Nova Gorica, SLOVENIA

FINANCIAL DATA

Type of financing, year	Energy Performance Contracting (EPC), 2023
Financier	Synco d.o.o., Municipality of Nova Gorica
Specifics	PPP between municipality and private company; public source: Operational Programme for Cohesion Policy Funding (OP-EKP 2014–2020)
Beneficiary	School centre Nova Gorica
Link	https://www.scng.si/energetska-sanacija-stavb-sc-nova-gorica-v-novi-gorici/

DESCRIPTION and PHOTO

The main purpose of this investment project was to carry out the necessary technical measures for the comprehensive renovation and establishment of energy efficient management in public buildings in Nova Gorica. The aim was to functionally improve and increase energy efficiency, reduce energy costs and maintenance/management costs of buildings, and reduce greenhouse gas emissions and dust particles. The private partner selected in the public tender to carry out the energy renovation was Synco d.o.o. The implementation of energy renovation measures improved living and working conditions for the users of these buildings.

Picture 46: School centre Nova Gorica, source: https://www.scng.si/energetska-sanacija-stavb-sc-nova-gorica-v-novi-gorici/

The objects intended for energy renovation were: The School of Mechanical Engineering, Transport and Woodworking, The School of Electrical Engineering and Computer Science, The Secondary School of Economics and Commerce building in Nova Gorica.

The operation was implemented under the Operational Programme for the implementation of the European Cohesion Policy for the 2014-2020 programming period. The general objectives of the investment planning were to include costs for comprehensive energy renovation and refurbishment of three public buildings of the Nova Gorica School Centre. This means partially covering the costs of the energy renovation from the savings to be achieved after the project implementation. The renovation should improve the energy efficiency of the buildings, reduce electricity and heating costs, as well as running and investment maintenance costs, reduce of CO2 emissions, thereby reduce negative impacts on the environment, optimize the management and maintenance of the energy system of the buildings in a way that improves energy efficiency at the cost of the invested resources,

ensure smooth operation of heating and other energy systems in the building in order to increase thermal comfort, improve working and living conditions for building users (employees, school children, other building users), and to improve the quality of the educational process and the operation of the buildings.

The specific objectives of the energy renovation investment project were: total final energy savings in the buildings after the renovation: 978,098 kWh annually, 3 energy renovated public buildings owned by the SJU, total net heated area of the energy rehabilitated public buildings owned by the SBS: 14.137 m2, CO2 emissions reduction per year: 297.474 kg.

The value of the operation at current prices including value added tax was estimated at € 5 415 804,14. The operation was financed by the founder's own resources (€ 158,990.24), the private partner's resources (€ 2,656,269.72) and the EU Cohesion Fund (€ 2,600,544.18), of which the national contribution amounts to € 390,081.63.

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ New case study of energy efficiency renovation through private-public partnership for energy contracting. ▪ Private partner was a different corporation (Synco d.o.o.) than in majority of Slovenia (Petrol d.d.). ▪ Large improvement of living and working conditions for the users of these buildings.	▪ There was no promotion about the successfully implemented financing model.
Opportunities / Possibilities	**Threats / Barriers**
▪ To analyse additional benefits, such as improved thermal comfort, acoustical comfort, etc. between the users and to use the results for publication and promotion in public ▪ To use the results of the renovation (measurements) for visualisation and the educational process.	▪ Condition of building as regard the seismic and fire hazard that needs to be solved first (before energy renovation) and usually there is no funding for these measures.

No. 46: PV panels installation on multi-apartment building, Jesenice, SLOVENIA

FINANCIAL DATA

Type of financing, year	Energy Performance Contracting (EPC), 2019
Financier	GEN-I d.o.o., apartment owners of the multi-apartment building in Jesenice
Specifics	Private investment, no public source
Beneficiary	Floor owners of the multi-apartment building in Jesenice
Link	https://www.dnevnik.si/1042873136

DESCRIPTION and PHOTO

The first Slovene multi-apartment building to meet its own electricity demand with a PV self-supply system from inexhaustible and clean energy, the sun, was set up in Jesenice. The PV system was installed on the roof of the building block. The whole operation was planned by private partner GEN-i, floor owners of the 23-apartment building block and the building manager.

The investment in the solar power plant cost €36,400, but because they agreed with Gen-I to finance the investment, individual owners did not need to acquire debt and won't be paying higher electricity bills than before. The bills remained the same, at an average of around €20 per apartment, but the cost of electricity would only be half, and the other half being used to pay off the investment over seven years. In the eighth year of management, electricity bills per home will be €10 or €11 lower per household.

Picture 47: PV panels on the multi-apartment building in Jesenice, source: https://www.dnevnik.si/1042873136

The solar power plant on a 23-apartment apartment building a capacity of 36.7 kW and will generate 37,000 kilowatt hours of green electricity per year. It will reduce carbon dioxide emissions by 17 tonnes per year and will generate annual savings of over €4,500 in electricity consumption. The owners of the €36,4000 investment, which will pay for itself in full in seven years, will be able to cover most of the building's energy needs from their own production. 15.1 kW of the modules were intended for use in the common areas and the heating station, while the remaining 21.6 kW are for consumption in each of the 23 apartments.

The implementation was based on an innovative business model: the residents paid nothing for the investment in the solar power plant, but the €36,400 investment was covered by GEN-I Sonce. For seven years, the residents will pay for electricity similarly to before the investment, and after seven years (2027), when the plant is paid off, their electricity costs will be roughly halved, as the electricity generated by the solar plant will be free for them.

In 2019, the law currently allowed for only 50% self-supply of energy, but an amendment was being prepared to allow 100% self-supply. Then, they had 129 solar panels on the roof but left the space for 110 more. The goal in planning was to be 100% self-sufficient.

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ First implementation of this kind. ▪ Initiative came from the building manager and floor owners themselves. ▪ The financial model of the project was promoted as an investment for the future generations (“their kids will have free electricity”).	▪ Long decision and application process (6 months). ▪ Main incentive for the renovation was a lower cost of electricity in the future, without the consideration for a more sustainable future. ▪ Only 50% of self-supply with PV panels was allowed by law in 2019 when the project was implemented. ▪ Lack of appropriate legislation for fast implementations. ▪ A 100% consent from floor owners is needed for any changes on the building.
Opportunities / Possibilities	**Threats / Barriers**
▪ Simplifying decision making processes among floor owners and private partners to shorten the implementation time. ▪ Promoting trust and awareness before decision making processes so that the building occupants feel confident in their own decision. ▪ Better legislation for implementing energy efficient projects on multi-apartment buildings.	▪ This type of renovation is only feasible after appropriate facade, heating and isolation renovations have already been implemented. ▪ 100% approval from floor owners is needed for any decision. ▪ A good relationship and preestablished trust between building manager and floor owner is necessary. As well as already existing awareness about sustainable renovations in floor owners.

No. 47: Energy renovation of Secondary school for economic, service and construction (School centre Kranj)-Building B, Kranj, SLOVENIA

FINANCIAL DATA

Type of financing, year	Energy Performance Contracting (EPC), 2022
Financier	Municipality of Kranj, Interenergo d.o.o.
Specifics	PPP between municipality and private company; public source: Operational Programme for Cohesion Policy Funding (OP-EKP 2014–2020)
Beneficiary	School centre Kranj
Link	https://www.sckr.si/documents/20222023/sanacija/Odgovor.pdf https://interenergo.kelag.at/slo/kranj.htm

DESCRIPTION and PHOTO

In order to become more energy efficient, the Secondary School of Economics, Services and Construction of the Kranj School Centre decided to cooperate with Interenergo. One of the main reasons for the comprehensive energy renovation was the excessive energy consumption for heating. Using the public-private partnership (PPP) model of energy contracting, the school centre was able to access the missing funding.

Picture 48: Secondary school Kranj, source: https://interenergo.kelag.at/slo/kranj.htm

The investment of € 828.000 was supported with € 294.020 by European and Slovenian grants, Interenergo covered 56.5% of the investment, while School centre Kranj contributed 7.99% of its own funds, with the concession period of 20 years. The project had a short implementation time of three months. The overall energy renovation comprised: refurbishment of the boiler house, replacement of lighting, replacement of windows, replacement of the glass façade, thermal insulation of the attic.

In addition to the financial savings of €55,218 per year, the renovation also reduced emissions by 140 tonnes per year, which would otherwise have required more than 4,200 trees to absorb.

SWOT ANALYSIS

Strengths	Weaknesses
▪ Short implementation time (3 months). ▪ Access to missing funding made the renovation possible.	▪ A very long concession period of 20 years.
Opportunities / Possibilities	**Threats / Barriers**
	▪ The building is from the era of modern architecture (1930s), so interventions in the façade were very limited.

No. 48: Energy renovation of Student dormitory Vič, Ljubljana, SLOVENIA

FINANCIAL DATA

Type of financing, year	Energy Performance Contracting (EPC), 2022-2023
Financier	Resalta d.o.o., Ministry of education
Specifics	PPP between ministry and private company; public source: Operational Programme for Cohesion Policy Funding (OP-EKP 2014–2020)
Beneficiary	Student dormitory Vič
Link	https://ljubljanainfo.com/novica/lokalno/zgradba-brez-toplotne-izolacije-z-vec-kot-40-let-starimi-okni-zdaj-so-koncno

DESCRIPTION and PHOTO

Picture 49: Student dormitory Vič, source: https://ljubljanainfo.com/novica/lokalno/zgradba-brez-toplotne-izolacije-z-vec-kot-40-let-starimi-okni-zdaj-so-koncno

The renovation project of the Vič Student dormitory included the implementation of the necessary measures for the comprehensive energy renovation and the establishment of an efficient energy management of the building. The works themselves were carried out on the old administration building and the student dormitory. The main objective of the project was to carry out a comprehensive energy rehabilitation of the two public buildings with the aim of reducing energy consumption and, consequently, the running costs.

The project included the replacement of the window and lighting, thermal insulation of the external walls and attic, renovation of the heating system with the installation of thermostatic valves, ventilation of the kitchen and dining room, rehabilitation of the setting up of a central control system. The measures renovated an estimated 13 214,80 m2 of net floor area. Resalta and Dijaški dom Vič signed a 15-year concession contract, through a model of energy contracting, with public-private parnership. European cohesion funds covered 1 613 969 EUR, School dormitory Vič 100 000 EUR, Ministry of education 143 379 EUR and with the private capital (Resalta) 1 501 683 EUR, coming together at 3 359 032 EUR.

SWOT ANALYSIS

Strengths	Weaknesses
▪ The energy renovation did not disturb the students living in the dormitory.	▪ 15-year long concession contract with the same energy provider.
Opportunities / Possibilities	**Threats / Barriers**
▪ An opportunity for raising local awareness and learning about sustainability because the solar plant is implemented on a student dormitory.	▪ Improper use and behaviour of occupants can negatively affect the expected results.

No. 49: The first cooperative community solar power plant, Hrastnik, SLOVENIA

FINANCIAL DATA

Type of financing, year	Own resources, grant and loan, 2024, 2024
Financier	Energy community Zeleni Hrastnik (public and private users/owners of the power plant), Ministry for Infrastructure, Eco Fund
Specifics	PPP between ministry and owners: Zadruga Zeleni Hrastnik 20 %, Ministry for Infrastructure 20%, loan by Eco Fund 60 %
Beneficiary	Users of the solar power plant
Link	https://www.caszazemljo.si/zelena-energija/soncna-sola-hrastnik.html

DESCRIPTION and PHOTO

The Hrastnik Solar School is Slovenia's first community-owned, self-sustaining solar power plant set up by a cooperative group (*zadruga*) on the roof of a public building. It differs from other community power plants in an important way- all customers own the power plant at the same time, so major energy intermediaries are removed from the calculation.

The solar power plant is made up of 662 PV panels and is therefore much bigger than the ones you usually see on domestic roofs. With a capacity of around 300 kW, the Hrastnik Solar School is one of the largest solar power plants for community self-sufficiency in the country. It supplies 16 homes in nearby blocks of flats, three public buildings- a municipal building, a school and a swimming pool, a small commercial space and the premises of two companies with electricity generated by the sun, according to the Zeleni Hrastnik Cooperative.

Picture 50: School in Hrastnik, source: https://www.caszazemljo.si/zelena-energija/soncna-sola-hrastnik.html

The electricity generated by the Hrastnik School solar power plant is net metered and deducted from the energy consumed by the customers of the solar power plant. Over the first 13 years, the total cost of their electricity consumption will be reduced by around 30%, and after the loan is paid, by around 65%, they will only have to cover the maintenance and management costs. Independence from market fluctuations was also a key factor in their decision.

The investment was worth approximately EUR 235 000. The financing method involved an initial contribution of €150 per kW of capacity from the customers involved, which covered 20% of the investment. A further 20% was co-financed by the Ministry of Infrastructure, under a call for tenders for grants for solar power plants, and the remaining 60% was covered by a loan to Zadruga Zeleni Hrastnik (cooperative group) by Eco Fund.

The customer is connected according to their own electricity needs, so that by leasing a share of the solar power plant it covers their annual electricity consumption. As an example, a household that consumes 170

kWh of electricity per month: Since the annual electricity production of a solar power plant is about 1000 kWh per 1 kW of capacity, this means that this household would need to lease 2 kW of solar power plant capacity to cover its annual needs. Their initial investment was therefore €300 (€150 x 2 kW). The lifetime of such a plant is expected to be 25-30 years.

The project, which combines solidarity-based community resource management and environmental sustainability, was led by the Zeleni Hrastnik Energy Cooperative, established in 2022, with the support of the Municipality of Hrastnik and the environmental organisation Focus. Technical know-how was contributed by Kisik, which also carried out the installation of photovoltaic panels on the roof of the Hrastnik primary school. The financial structure of the project is as follows: one fifth was contributed by the cooperators with initial inputs, one fifth was covered by a grant from the Ministry for the Promotion of Solarisation and the remainder by a loan from the Eco Fund.

SWOT ANALYSIS	
Strengths	**Weaknesses**
▪ A lot of interest for joining from people. ▪ Cooperative model means all users are also co-owners of the power station. ▪ Independence from market price fluctuations.	▪ Currently, only houses that are connected to the school's transmitter station can be included in the solar plant. ▪ The solar plant is facing a possibility of overwhelming due to big interest to join the system.
Opportunities / Possibilities	**Threats / Barriers**
▪ Subsidy funds by Eco Fund or Borzen to supplement the loan to Zadruga Zeleni Hrastnik. ▪ Exapanding the capacity of the solar plant beyond school's transmitter station. ▪ To promote the concept of community-owned, self-sustaining solar power plant.	▪ Lack of qualified leaders and managers for projects like these. ▪ Issues with communication with the local community.

No. 50: Energy renovation of the Home for seniors Jesenice, SLOVENIA

FINANCIAL DATA

Type of financing, year	Energy Performance Contracting (EPC), 2022
Financier	Municipality of Kranj, Petrol d.d.
Specifics	PPP between municipality and private company; public source: Operational Programme for Cohesion Policy Funding (OP-EKP 2014–2020)
Beneficiary	Home for Seniors Jesenice
Link	https://www.gov.si/novice/2022-02-04-evropska-sredstva-za-energetsko-prenovo-doma-upokojencev-dr-franceta-bergelja-jesenice/

DESCRIPTION and PHOTO

The project includes renovation of buildings B, C and D of the Dr. Franck Bergelj Jesenice Retirement Home, which cover an area of 6612.50 square metres. The financing model used here was EPC provided by Petrol. Within the scope of the concessioned activity, Petrol ensured the implementation of energy measures to improve energy efficiency in facilities and contractually guaranteed energy savings. With EPC, he also took over the investment risk and the availability risk. The energy renovation comprised the construction of a façade, replacement of windows and doors, thermal insulation of the roof, installation of balcony railings, replacement of roofing, installation of thermal insulation of the external walls inside (Building B), modification of the control equipment in the district heating substation, earthing of the lightning conductor, renovation of the lighting and several other energy upgrades.

Picture 51: Retirement home in Kranj, source: https://www.facebook.com/DomUpokojencevdrFrancetaBergeljaJesenice/

The energy renovation of the Dr Franck Bergel Jesenice Retirement Home increased the efficiency of energy use and consequently reduce operating costs. The project was worth €1.4 million and the Cohesion Fund has contributed €550,000. The renovation was completed in 2023.

SWOT ANALYSIS

Strengths	Weaknesses
▪ A wide range of renovation measures and additional functional improvements. ▪ Recent example of the use of this financial model.	▪ 15-year long concession contract with the same energy provider (Petrol).

Opportunities / Possibilities	Threats / Barriers
▪ Promotion of investment concept. ▪ Obtaining information (positive and negative), learning from experiences, introducing new companies to this financial model.	▪ Improper use and behaviour of occupants can negatively affect the expected results. ▪ Installation of thermal insulation on inner side of the external walls could cause more intense thermal bridges. ▪ Lack of companies with proper competences for such a large project.

5.3 List of best practices of financial models of sustainable building renovation

In this chapter, 50 examples of good practices - buildings or other built structures that were renovated using different financial models and sources of finance - are listed in a table (Table 1). The table indicates whether the case is from the public or private sector and which type of funding was used. It can be observed that only 20% of here presented cases are from private sector, the rest come from the public sector. In addition, more than 40% of the collected examples of used financial mechanisms are EPCs.

More analysis and potential will be part of the next iteration of the report.

Table 1: Best practices of sustainable renovations from Austria, Hungary and Slovenia.

No	Best practice name	Country	Public/ Private	Type of funding
1	**Apartment block Markartstraße Linz**	Austria	**Private**	Reserves, funding & subsidised housing loan, 2006
2	**Residential complex "Friedrich-Inhauser-Straße", Salzburg – Zero Carbon Refurbishment "Wir InHAUSer"**	Austria	**Private**	Housing Subsidy Salzburg
3	**Liebenauer Hauptstraße – Graz**	Austria	**Private**	Reserves, funding & subsidised housing loan
4	**Smart Block Geblergasse – refurbishment & district heating and cooling pilot project – Vienna**	Austria	**Private**	Subsidy & ESCO
5	**KA 7 Kaiserstrasse - Innovative refurbishment of a listed Gründerzeit building with interior insulation - Vienna**	Austria	**Private**	Subsidies (2013)
6	**"Gründerzeithaus" Kauergasse 2, Vienna**	Austria	**Private**	Funding demonstration project
7	**Out of gas' showcase project Zwölfergasse 21- Vienna**	Austria	**Private**	Subsidies, Erste Green Housing Loan
8	**Smarter Together - Hauffgasse 37 – 47, Vienna**	Austria	**Private**	Reserves, Subsidies
9	**Landespflegezentrum Bad Radkersburg - Carinthia**	Austria	Public	ESCO
10	**Schoolcenter Vorchdorf – Upper Austria**	Austria	Public	ESCO
11	**School Campus Hittisau**	Austria	Public	Special Municipal Loan
12	**Kindergarten Bad Eisenkappel - Vellach**	Austria	Public	Mix of different Fundings
13	**Volksschule Semirach - Model Renovation (Styria)**	Austria	Public	Subsidies and transfers, 2020
14	**Rathaus Mondsee - Mustersanierung**	Austria	Public	Model Renovation, Transfers (2022)
15	**Künstlergasse 14-16 – Puba Foundation (Vienna)**	Austria	**Private**	Private capital & Subsidies
16	**Bludenz- Model Renovation (Vorarlberg)**	Austria	**Private**	Subsidies

17	**Multi-apartment building at Hamvas Béla street 10-12, Szentendre**	Hungary	Public/ Private	PIMES CONCERTO project (flat rate) + ZBR National Grant + Own contribution + ESCO type financing
18	**Multi-apartment building at Kassai u. 8-16., Budapest**	Hungary	**Private**	Subsidized loan
19	**"Faluhaz project" (Village Block)**	Hungary	**Private**	Grant, preferential loan, private financing.
20	**Multi-apartment building at Pázsitos sétány 1-3, Budapest**	Hungary	**Private**	Private financing
21	**Implementation of smart cost-sharing systems in a condominium, Budapest**	Hungary	**Private**	Subsidy and private financing
22	**Multi-apartment building at Budapest, 1068 Benczúr street 43.**	Hungary	**Private**	Private financing
23	**Municipal multi-apartment building in Szeged**	Hungary	Public	Private financing
24	**Single-family house in Gödöllő**	Hungary	**Private**	Grant, preferential loan, private financing
25	**Renovation of single-family house in Tatabánya**	Hungary	**Private**	Preferential loan
26	**Energy renovation in Tahitótfalu**	Hungary	**Private**	Non-refundable grant and own resources
27	**Single-family house refurbishment in Budaörs**	Hungary	**Private**	Private financing
28	**Municipality office building renovation VSZ Zrt., in Szentendre**	Hungary	Public	Grant, ESCO, Municipal investment
29	**Püspökmajor Kindergarten, Szentendre**	Hungary	Public	Grant, Municipal investment
30	**Decarbonized Mórahalom**	Hungary	Public	Subsidy, Municipal investment
31	**"Autumn Light" Home for the Elderly in Alsómocsolád**	Hungary	Public	EU Grant (KEOP), Municipal investment
32	**Energetic modernization of Tarján Bilingual Primary School**	Hungary	Public	Subsidy, Municipal investment
33	**Retrofitting of Zahony Municipal Buildings for Renewable Energy Use**	Hungary	Public	Subsidy
34	**Energy efficiency measures in Municipality of Kranj**	Slovenia	Public	Energy Performance Contracting (EPC)
35	**Energy renovation in Municipality of Ljubljana**	Slovenia	Public	Energy Performance Contracting (EPC)
36	**Energy renovation of Ministry of justice in Celje, Murska Sobota and Slovenj Gradec**	Slovenia	Public	Energy Performance Contracting (EPC)
37	**Renovation of boiler house in Deteljica housing estate, Tržič**	Slovenia	**Private**	Energy Performance Contracting (EPC)
38	**Energy renovation of buildings in Municipality of Maribor**	Slovenia	Public	Energy Performance Contracting (EPC)
39	**Energy renovation, Kranj**	Slovenia	**Private**	Housing savings fund, deffered payment of investment
40	**Energy renovation of public buildings, Novo mesto**	Slovenia	Public	Energy Performance Contracting (EPC)
41	**Energy renovation of boiler room in OŠ Komenda**	Slovenia	Public	Energy Performance Contracting (EPC)

42	**Installation of a solar power plant on the noise barrier of the expressway at Bazara**	Slovenia	Public	Slovenian-Swiss cooperation programme to reduce economic and social disparities in the enlarged European Union
43	**Energy renovation of municipal administrative building and OŠ Dobrovo, Brda**	Slovenia	Public	Slovenian-Swiss cooperation programme to reduce economic and social disparities in the enlarged European Union
44	**District heating for educational facilities Ivančna Gorica**	Slovenia	Public	Energy Performance Contracting (EPC)
45	**Energy renovation of School centre, Nova Gorica**	Slovenia	Public	Energy Performance Contracting (EPC)
46	**PV panels installation on multi-apartment building, Jesenice**	Slovenia	**Private**	Energy Performance Contracting (EPC)
47	**Energy renovation of Secondary school for economic, service and construction (School centre Kranj) - Building B, Kranj**	Slovenia	Public	Energy Performance Contracting (EPC)
48	**Energy renovation of Student dormitory Vič, Ljubljana**	Slovenia	Public	Energy Performance Contracting (EPC)
49	**The first cooperative community solar power plant, Hrastnik**	Slovenia	**Private**	Initial investment by owners, Ministry for Infrastructure and loan by Eco Fund
50	**Energy renovation of the Home for seniors Jesenice**	Slovenia	Public	Energy Performance Contracting (EPC) European cohesion fund financing and state funding

6 CONCLUDING REMARKS

The present study is compilation of best practices found in the use of various financial mechanisms for sustainable building renovations from three partner countries, Austria, Hungary, and Slovenia. It contributes to the understanding of the past and current uses of models, procedures and processes of financing the renovation of buildings or building complexes, both in the private and the public sectors. The study was prepared as part of EU granted project **LIFE22-CET-RENOINVEST - Roundtables enhancing smart investments in sustainable renovation of buildings**.

The research showed that renovation cases where the analysis and overall satisfaction demonstrate integrity are rare. It also revealed that investment in renovations is easier and more widespread in public buildings, since private renovations most often require investors own savings or/and investment that is subsidised by a loan. Also, public investments in renovation are usually carried out on larger buildings or in a combination of a larger number of buildings. The fact that they are public, and their size may be the reason that they are slightly more exposed to the public and more information can be obtained about them. In the private sector, shared ownership can also be an issue as it is more difficult to agree on a joint investment.

The results of the study show that in **Austria** there is diversity in subsidies and in ESCO collaborations, partially due to many different and fragmented funding schemes and options available. This presents particular advantages and disadvantages. Different schemes and funding options were shown to be combined in best practices above, with cases of good social support in non-profit and public buildings. However, through SWOT analyses it was highlighted that most large-scale (public) renovations faced a lack of funding or dependency on future projects or schemes. Like in other two countries, high costs of renovation also discouraged the users and investors from starting or continuing the energy efficiency measures.

Private renovations were in the minority of renovation cases we compiled, with renovations of public buildings with different forms of municipal, national or European funding dominated. On the other hand, similar to Slovenia, Austrian best practices also lack promotion across country. In the case of the public buildings in **Hungary** most of the energy efficiency refurbishments described were financed by non-refundable grants, i.e. subsidies (70-100 %), or by a combination of grants and the own contribution of the municipality in question (50-50 %). The study revealed that for municipalities grants are the only opportunity to implement investments in refurbishments or renewables, however they have to be able to prepare the tender application. Based on experiences with special very large example of PIMES CONCERTO and Staccato project financing, and financing from government´s grant programmes and own contributions of the municipality/homeowners, and to some extent ESCO it should be emphasized that careful planning, preparation and coordination is a must. The renovations of Hungarian single-family homes are financed by the combination of grants and own contributions, by preferential loans and own contributions or by own resources only. There are more possibilities for financing renovations in the case of multi-family buildings. However, it has to be emphasized, that none of grant programmes and facilities is long-standing, and there is a lot of administrative burden connected to them.

In **Slovenia** the two main paths to fund an energy renovation from combined sources were distinguished: energy performance contracting (EPCs) and funding schemes of European Union. The analysis of the cases in general showed that in Slovenia there is insufficient emphasis on the promotion of successful financial solutions. It was found that knowledge and findings are not transferred enough to the educational process (or not at all) and that confidence in financial models does not increase over

the years of use. Additionally, on the basis of the presented examples, it can be pointed out that in Slovenia there are certain specific legal, formal and procedural obstacles that should be eliminated in order to make the implementation of financial solutions easier and, above all, faster, especially in the private building sector.

To conclude, the examples of good practices collected in this report will be helpful in discussions at national thematic working group events and on national platforms. The collection will also be an opportunity for the three countries, Austria, Hungary and Slovenia, to learn from each other.

The detection of examples of good practices will continue during the project through other activities such as conversations with stakeholders, connecting with other projects, with foreign stakeholders, etc. The cases found will be analysed and placed on the list of existing cases. On this basis, a new selection will be made in the last part of the project and a new planned report (Deliverable D2.3) will be prepared - a refreshed catalogue of 50 examples of good practices.

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