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Best Practice Handbook

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Introduction

The level of development and degree of exploitation of renewable energy sources varies largely between the Central Europe regions. In the EU currently about a fifth of the population lives in rural areas and about one- third in transition regions. Globally seen there will be a further shifting towards urban areas. On the other hand, it is preliminary rural areas, where the main potentials lie for generating renewable energy. With the RURES project we are focusing on a sustainable regional development in rural regions and taking into account the energy production and consumption side. By exchange of experiences and capacity building between the project partner regions especially the less developed regions in Medjimurje County (Croatia); Palecznica (Poland); Pomurska Region (Slovenia); Zala County (Hungary) and Ústí Region (Czech Republic) can positively be supported to fight their main challenges. These can be found in a lack of financial resources for energy efficiency and renewable energy system investments, low confidence in new technologies and solutions for energy efficiency and renewable energy system due to less experiences and visible best practices and high degree and dependency on fossil energy, this causes economic and ecological problems. With RURES activities the gap between more or less developed regions can be reduced by transnational collaboration, sustainable low-carbon energy planning strategies and policies will lead towards an efficient use of Europe`s territory and resources is a key element of cohesion Territorial Agenda 2020 I. (13) as key element for cohesion and II. (22) regional competitiveness is strengthened due to increased energy efficiency and renewable energy system and energy autonomy. The Europe 2020 targets on climate change and energy towards 20 % of energy consumption from renewables and increasing energy efficiency by 20 % by 2020 can only be reached when all member countries foster the energy transition process, the project Regions and Countries are mostly facing similar problems for finding new ways in energy policy implementation.

The objective of this handbook is to provide information and practical advices which will inspire relevant actors in the regions to work further on their energy efficiency and renewable energy systems. Readers can get acquainted with the possibilities of their region and beyond. They will get to know what kind of projects have been implemented in the partner regions and can learn or even realize similar investments and developments.

1. Renovation of buildings, energy saving investment

1.1. Comprehensive thermal retrofitting of public facilities in the Municipality of Karczew

Brief introduction	Sector: Energy efficient buildings	
Detailed description	Localization	Municipality of Karczew
	Concept and background	Karczew (approx. 15 900 inhabitants) is a semi-urban municipality located in the Mazowieckie Voivodeship. In 2011 the Mayor of Karczew established within municipal structures a special team responsible for carrying out investments in cooperation with private partners. Then, two important documents were developed: an „Analysis of the organisational structure and planned investments to be implemented using PPP formula in the municipality of Karczew“ and a „System and process of implementing an investment within public-private partnership in the municipality of Karczew“. In November 2011 the municipality underwent a verification process conducted by TUV Rheinland (international company specialising in certification) and received a certificate confirming that it is ready to implement projects using PPP formula. The procedure of selection of a private partner to be involved in the thermal retrofitting project lasted from February till the end of 2012. In January 2013 the Mayor of Karczew signed on behalf of the municipality a contract with Siemens Sp. z o.o. company concerning thermal retrofitting of 10 public utility buildings. Karczew municipality has 13 public utility buildings (including administrative buildings, educational, sport and culture buildings). Primary heating source of these buildings are natural gas boilers and district heating. Energy consumption of public buildings is very high leading to high operational costs as well as greenhouse gas emissions resulting from fossil fuels use. Implementation of the project will lead to a reduction of operational costs and GHG emission reduction.
	Timeframes	2013

Detailed description	Aims and activities	The aim of the project entitled „Comprehensive thermal retrofitting of Karczew's public utility buildings using PPP formula" was to reduce heat and electricity consumption, enhance buildings' aesthetics and improve energy management using environmentally friendly solutions. At first the municipality planned modernisation of 11 buildings and this number was included in the announcement. Then, one building was removed from the list during competitive dialogue procedure due to the low economic profitability of the investment. The contract with the private partner was signed for 15 years: 1 year for the construction works (thermal retrofitting process) + 14 years for the maintenance of the retrofitted buildings (servicing, repairs, removal of defects and faults, replacement of damaged or used elements, etc.). The construction phase was completed on 31.12.2013 r. Thermal retrofitting and accompanying works were conducted in 9 educational facilities and one health center located in the town of Sobiekursk. They included thermal insulation of external walls and roofs, installation of cladding, replacement of windows and doors, replacement of the guttering and the lightning protection installations, and modernisation of the roofing. Modernisation of the heating systems in respective buildings consisted in the change of the heating source from coal-based to natural gas based or from electrical heating to district heating. Old boilers were replaced and new radiators with thermostatic valves were installed. In one of the educational facilities also the electrical installation was replaced. The buildings were equipped with room control systems and energy consumption monitoring systems. Moreover, the project foreseen replacement of old lighting fittings with the new, energy efficient ones, reconstruction of the land around the buildings and construction of drainage systems.
	Barriers and problems occurred	No problems in the implementation of the investment.
	Main results	10 buildings were retrofitted, including schools, kindergartens and a health centre. The most important results of conducted thermal retrofitting works concern guaranteed energy savings: 56% savings on heating and 20,9% savings on electricity. Verification of achieved savings is done each year, after the end of the heating season. The first verification was made for the heating season 2014/2015. Relevant report was prepared by the private partner on the basis of the meter readings and the invoices provided by respective energy suppliers. The savings achieved in 2014 were following: 57,68% savings in case of heating and 19,87% savings in case of electricity. Moreover, the investment resulted in improved functionality and aesthetics of the 10 public utility buildings.

Financing scheme	The value of the contract signed between the municipality of Karczew and the contractor company - amounted to 11 518 756 PLN (approx. 2 678 800 EUR). To cover part of the costs the municipality received co-financing from the National Fund for Environmental Protection and Water Management, granted within the Green Investment Scheme (GIS) and coming to 1 323 621 PLN (approx. 307 800 EUR). Capital repayment to the contractor will be done over a 14 -year period.
Replication	This type of investment is generally prevalent in Poland.
Contact details	Anna Sikora Department for Investments and Fundraising City Hall in Karczew 28 Warszawska str., 05-480 Karczew, Poland e-mail: a.sikora@karczew.pl um@karczew.pl phone: +48 22 780-65-16, ext. 107

Photos: City Hall in Karczew


Zespół Szkolno - Przedszkolny
w Sobiekursku
Jerzy
Kukuczka

1.2. Complex thermal retrofitting of educational buildings in Zgierz

Brief introduction	The implementation of the project involves thermal retrofitting of public buildings located in the city of Zgierz in the form of public-private partnership.	
Detailed description	Localization	Zgierz, Poland
	Concept and background	The scope of the project includes implementation of thermal insulation and modernization including renovation works in 24 educational buildings located in the area of the City of Zgierz. Energy consumption of educational buildings is very high leading to high operational costs as well as greenhouse gas emissions resulting from fossil fuels use. Implementation of the project will lead to a reduction of operational costs and GHG emission reduction. The direct recipient of the project is the City of Zgierz. The indirect beneficiaries of the project will be people using the facilities, while the final recipients of the project will be the inhabitants of Zgierz and the surrounding area.
	Timeframes	06. 2017. – 08. 2018.
	Aims and activities	The goal of the project is to increase the energy efficiency of 24 educational buildings (schools) in Zgierz. The scope of works include: • Insulation of walls, roofs; • Implementation of energy monitoring system (EMS) • Modernization of internal central heating installations; • Modernization of electric and lighting installations (including LED lights); • Modernization of windows and doors (replacement with energy efficient); Additionally, there will be other improvements in the buildings structure and infrastructure made (including swimming pool modernization, kitchens modernization, renovation of toilets).
	Barriers and problems occurred	In the case of preparing a hybrid PPP project, attention should be paid to the project team and advisors, in the case of the procedure of private partner selection and apply for EU funds, among others the order of procedures in relation to the PPP contract/contract for co-financing the project, it is worth paying attention to the way of documenting the expenses incurred by the private partner.

Detailed description	Main results	The project is underway, so no final results can be described so far. The proposed activities, however, contribute to the rationalization of the use and production of energy in the buildings, which will help to reduce energy consumption and emission of air pollutants and greenhouse gas emissions. The project will lead to significant savings in operational costs, and on the other hand - will raise the aesthetics of buildings, which will be renovated on this occasion. According to energy audits, the average estimated energy saving of buildings may reach 60%.
Financing scheme		The project is implemented in the model of „Design - Build - Finish - Operate“. In this model, the project is implemented based on a PPP contract, which includes design, construction, financing and operation of investments. Unlike the other models, in this case, capital expenditures, which are refundable from EU funds, are borne by the private partner. Total value of the project: 52 730 774,67 PLN (ca. 12,262,970 EUR) Co-financing (84,58 %): 35 260 265,04 zł (ca. 8,200,061 EUR) PPP agreement: 56 411 000,00 zł (ca. 13,118,837 EUR) Other costs (management, supervision etc.) are covered from the municipal budget. The project is a hybrid project co-financed by the European Union from the European Regional Development Fund under the Integrated Territorial Investment Facility of the Regional Operational Program of the Lodz Region for the years 2014-2020.
Detailed description		This project can be implemented in other municipalities with educational buildings. It is important to be well prepared for the development of the public-private partnership.
Detailed description		Bogusława Forfecka Head of the Investment and Development Department of City of Zgierz Tel.: 42 714 32 27 Ewa Lefik – Babiasz Deputy manager: Investment and External Funding Unit Tel.: 42 714 31 12

Photos by: Łukasz Sobieralski


Zgierz

1.3. Reconstruction and Non-Eneregy Extension of Kindergarten at the Elementary School Tišina – Phase 2

Brief introduction		The manufacturer of prefabricated passive and low-energy houses Lumar IG has set up a low-energy kindergarten in cooperation with the company SGP Pomgrad in Tišina. The kindergarten, which is actually an extension of the Elementary School of Silence, extends to 670 square meters, is built with a construction system for passive houses and in less than a year is the second low-energy kindergarten that was put into use by the said company.
Detailed description	Localization	Municipality Tišina, Slovenia
	Concept and background	The low-energy kindergarten in Tišina, architecturally designed as a four-part ground-floor building with an elongated longitudinal floor plan with a length of 59 meters and a maximum width of 16.8 meters, is classified as a low-energy facility with a specific heat consumption of heating less than 25 kWh/m^2. The concept of an energy-efficient thermal envelope complements the green roof in terms of sustainable construction. The kindergarten shares the heating system with the school, the heat for the sanitary water will be provided by the heat pump. Four children‘s playroom for different ages with necessary auxiliary facilities, toilets and wardrobes, and a common central space, are connected with the terraces of the surrounding area. The new low-energy kindergarten is one of the most important acquisitions in the recent period for the municipality of Tišina. The construction of the kindergarten was partly financed by the European Union, from the European Regional Development Fund. Lumar has already established the first kindergarten in passive technology in 2008 in Posavec near Radovljica, and has so far built about 2600 square meters of kindergartens in this technology, which corresponds to about 17 independent houses.
	Timeframes	Start of the operation (decision on the approval of EU funds): 11.08.2009 End of operation: 30.09.2012
	Aims and activities	The purpose of the operation was to build a low energy kindergarten at the primary school of Tišina, thus ensuring suitable facilities for children and employees, with an emphasis on ecological relevance, great energy savings and positive impacts on human health and the environment. The building is mostly built and natural materials (wood) under a low energy standard.
	Barriers and problems occurred	The problem was because the previous area of 210 m2 of an old kindergarten (for 3 sections) meant a space distress for children and employees. Needs and desires have been known for a long time and they were all aware that such a large financial investment alone will not be able to. Finding a good moment was needed and getting as many foreign funding as possible. Therefore, in 2009 and 2010, the project documentation was actively prepared and the 2010 EU Call for Proposals was all ready to apply for a European Call for the European Regional Development Fund. In 2009 and 2011, some additional funds from the state budget were also obtained for the project.

Detailed description	Main results	By building (and partially reconstructing an existing building) the following objectives of the operation were achieved: • Increasing the spatial capacity of the entire kindergarten from 4 to 5 departments (the section of the oldest group that temporarily went to the primary school moved to kindergarten) • Significant increase in the premises (surface capacities) of the kindergarten from the existing 211.20 m^2 to 732.30 m^2 of net surfaces, thus achieving suitable spatial conditions for the needs of kindergarten, • Improvement of the standard and functionality of the premises, harmonized with the normative areas for the needs of the kindergarten (old kindergarten provides only about 46% of the necessary normative areas for the needs of the kindergarten) • Together with the private catholic kindergarten, cover the current and future needs for child care in the area of the Municipality of Tišina together with the private catholic kindergarten as well as the inclusion of Roma children in kindergarten, • Building an energy-efficient building with a low energy or passive standard, which with its architectural design creates for children and employees a pleasant and • Healthy environment.
Financing scheme		The total cost of the operation (2010,2011,2012): 1,259,493 € of which 2010: 1,400 € of which 2011: 1,098,469 € of which 2012: 159.623 € Amount of public finances: EU funds European Regional Development Fund „Development of Regions: 1,004,000 € (79.9%) State budget: 82,753 € (6.6%) Funds beneficiaries - Municipality of Tišina: 172,740 € (13.7%)
Replication		This good practice has a big potential to be implemented in other regions.
Contact details		MUNICIPALITY OF TIŠINA Web page: www.tisina.si E-mail: obcina@tisina.si Phone: +386 2 539 17 10

1.4. Full Energy Renovation of the Public Objects in the Municipality of Postojna on the Model of Energy Contracting

Brief introduction	The main purpose of the investment project was the implementation of the necessary measures for comprehensive energy renovation (investment measures) and the establishment of efficient energy management (organizational measures) in 14 public buildings owned by the Postojna Municipality in order to functionally improve and increase energy efficiency, reduce costs energy and maintenance, respectively. the management of buildings and the reduction of greenhouse gas emissions and dust particles.	
Detailed description	Localization	Municipality of Postojna
	Concept and background	The main objective of the project‘s investment were to complete the energy supply of 14 public buildings owned by the Postojna Municipality, with the aim of reducing energy consumption and consequently reducing the current operating costs in the public facilities in the planned period and with the envisaged financial resources. This has also improved the working conditions for employees, pupils, children and other users of facilities.
	Timeframes	Start of operation June 2016 Handover of works carried out purpose (management): May 2018 Completion of the project (financial closure operation): June 2018
	Aims and activities	The overall objectives of the investment project are to provide a comprehensive energy renovation of 14 public buildings; the costs of comprehensive energy recovery are covered from the savings that will be achieved after the implementation of the project; improve the energy efficiency of buildings, reduce energy consumption and reduce energy costs; to reduce the costs of heat and electricity, as well as on-going and investment maintenance; reduce carbon dioxide emissions from energy use and thereby reduce the negative impacts on the environment in the city; improve the management and maintenance of energy systems in a way that improves energy efficiency with reduced inputs; ensure the smooth functioning of heating and other energy systems, and thus the thermal comfort in the heating season and optimize the operation of cooling systems; improve working and living conditions for the users of these buildings (kindergarten children, schoolchildren, young people, adults, employees); and the further implementation of the project of energy renovation of public buildings without the indebtedness of the municipality. Through the implementation of the project, the Municipality of Postojna will contribute to the achievement of strategic development goals at the municipal level, as well as at the level of the region, the state and the EU.

Detailed description	Barriers and problems occurred	By signing a public-private partnership contract the option of choosing the best energy supplier at a given moment is withdrawn (due to the signing of the contract for 15 years). During the duration of the contract (15 years), the municipality is limited. it must first agree with the PPP provider for each intervention.
	Main results	The energy efficiency of the facilities has improved. In the buildings there is better thermal and consequently living comfort. There are no more degrees of difference in heat between individual rooms. Appropriate personnel structure of experts with the necessary knowledge to manage and maintain equipment. Funds remain available for other projects of the Postojna Municipality. In the case of non-disposition of budget funds, there is no need to borrow the municipality for the implementation of the project. In the case of PPP, the investment project does not burden the credit potential of the Postojna Municipality. Lower heating costs (saving on heating costs) and lower costs of electricity (saving on electricity costs). Increased engagement of the private partner to achieve the anticipated savings. Savings on maintenance, management and intervention costs and savings on municipal insurance costs. Rapidly executed comprehensive energy restoration of all facilities under consideration. The warranty over the installed equipment lasts for the duration of the contract (15 years). The private partner carries most of the risks, especially the especially the risks of achieving savings.
Financing scheme		Net value (net of VAT): 1,899,064.82 EUR Gross value (including VAT): 2,316,859.08 EUR Eligible costs: 1,715,251.24 EUR Funds of the Municipality of Postojna: 280,785.44 EUR EU and RS public resources (MIZ) - Cohesion EU Fund: 686,100,00 EUR Private partner: 1,004,324.23 EUR Informative reimbursable VAT of private partner 345,648.91 EUR
Replication		This good practice has a big potential to be implemented in other regions.
Contact details		MUNICIPALITY OF POSTOJNA Web page: www.postojna.si E-mail: obcina@postojna.si Phone: +386 5 728 07 00


zdravstveni dom

1.5. Energetically Economical Kindergarten Manka Golarja in Gornja Radgona

Brief introduction		The main purpose of the project was to improve the energy efficieny of two day care units of Manka Golarja in Gornja Radgona with the objective of environmental preservation and reduction in emissions. Renovation of the day care units for energy efficiency is a pioneer project in Slovenia in the field of energy and ecological renovation of public buildings. The project, therefore, needed new knowledge and a high quality approach. The renovation brought a passive standard for buildings (energy requirement lower than 15kWh/m^2). The renovation also took into account the principles of biological construction as automatic and natural technologies and materials were used. After the renovation, the day care centre uses half the energy than before. The renovation is, therefore, an example of good practice as the centre became one of the most energy efficient buildings in Slovenia. As the energy efficient state of day care centres in Slovenia is poor, this example could also motivate other municipalities to successfully renovate public buildings.
Detailed description	Localization	Municipality of Gornja Radgona, Slovenia
	Concept and background	In 2005, the program document "Energy concept of the municipality of Gornja Radgona" was adopted, containing proposals for measures to increase the share of the use of renewable energy sources and efficient use of energy. In accordance with this document, a decision was made for the energy renovation of two buildings of the Kindergarten Manka Golar Gornja Radgona to a passive standard. The facts that influenced this decision: • The first kindergarten unit was built in 1976 and had no thermal insulation, • The second unit was build in 1984 and had a thermal insulation of minimum thickness, • Building furniture in both units has been no longer in line with modern energy efficiency requirements, • The firs unit was still covered with asbestos roofing.
	Timeframes	Start date: 1.1.2008 Duration: 2009 finalization of the construction (end date: October 2009)
	Aims and activities	The aim was to achieve passive standard and stimulate the use of renewable resources and energy efficient use to reduce the pollution of the environment. Consecutively costs also decrease and living quality improves both for children and for the employed persons. In September 2008 the first building was opened. Renovation: only the old walls and the floor were left from the old building. The walls got 30 cm of thermal isolation. The ceiling has been isolated with 40 cm of cellulose flakes. The renovation included all sorts of sanitations (roof, windows, floors, frontage, installations), new heat pump, ventilation system with recuperations), new heat pump, ventilation system with recuperation, set up of photovoltaic collectors. The second building was opened in October 2009.

Detailed description	Barriers and problems occurred	Development agency Gornja Radgona (PORA) also participated in the project - they pointed out in particular, too long an overview of the report of the project results by the responsible ministry of the Republic of Slovenia.
	Main results	The kindergarten building has been renovated into a passive house. The project has made use of expert results from the Institute of building which made an energy survey and prepared the case study for both buildings. The renovation consisted of the sanitation of roof, windows, floor and frontage, renovation of installations, updating ventilation system (recuperation), installing sun collectors for hot water, renovation of water supply and electric systems. Windows were enlarged and air impermeability was achieved. The effects of all these measures are energy savings, better lighting and ventilation in the rooms. About 2000 m^2 of internal surfaces have been restore, all outdoor surroundings including sanitary, delivery and parking areas.
Financing scheme		Total project cost: 3,556,400 EUR (from the municipal budget) Grant amount from the Norwegian Financial Mechanism: 672,466 EUR The municipality Gornja Radgona was the investor and assured three quarters of total for renovation, the remaining part was covered by the Norway Grant. The institute for buildings prepared an expert basis, work was carried out by the company SGP Pomgrad.
Replication		Transferability of project is very high. Every kindergarten could be renovated in the passive standard way.
Contact details		Municipality of Gornja Radgona Web page: https://www.gor-radgona.si/ E-mail: tajnistvo.zupana@gor-radgona.si Phone: +386 (0)2 564 38 22

1.6. Energy renovation of educational institutions of the municipality of Puconci

Brief introduction		Through the project „Energy renovation of educational institutions of the Municipality of Puconci“, the Municipality of Puconci successfully participated in the tender „Co-financing the operation for the energy renovation of buildings owned by local communities“ in the framework of the Operational Program for the Development of Environmental and Transport Infrastructure for the period 2007-2013, 6. development priority „Sustainable use of energy“ 1. Priority directions „Energy renovation of public buildings“. With this project the municipality of Puconci decided to restore the (5) facilities under the auspices of the primary school Puconci, this is the central primary school Puconci, primary school Mackovci and Bodonci with kindergartens and kindergarten Puconci and Brezovci. All buildings totaling 6.361,00 m^2 of heated areas had an average heat consumption of 721.16 MWh / year and 207.38 MWh / year of electricity in the last three years before the submission of the application.
Detailed description	**Localization**	Municipality of Pocunci
	Concept and background	The long-term objective of the operation was to improve the energy efficiency of buildings, reduce energy consumption and ensure efficient use of energy. The overall objectives of the investment are the preservation of the environment, with the mentioned interventions to stimulate ecological awareness and create a supportive environment for the highest possible ecological awareness. <u>The main reasons for the renovation were in:</u> • By pursuing the goal of increasing energy savings and efficiency, and consequently reducing costs, • Reduction of greenhouse emissions and environmental pollution, • Improving or increasing the satisfaction of all employees and all those involved in the educational process, • Improving the well-being of children, pupils and employees in selected schools and kindergartens.
	Timeframes	The entire investment started in July 2013 was completed in May 2015, which means that it is physically and financially completed.
	Aims and activities	The goal of energy renovation was: • efficient use of energy, • reducing energy consumption for heating and domestic hot water, • reducing energy costs, • replacement of fossil fuels with renewable energy sources, • reduction of emissions in the atmosphere, • preservation of the environment, • improvement or increasing the satisfaction of all employees and all those involved in the educational process, • improving the well-being of children, pupils and employees in selected schools and kindergartens, • ecological awareness.

Detailed description	Aims and activities	Actually implemented measures: Primary school Puconci, associated Primary school Bodonci and associated Primary school Mackovci: • envelope of the building, • change the furniture of the building, • building the boiler room - wood biomass, with ventilation. Kindergarten Puconci in Brezovci: • envelope of the building, • change the furniture of the building, • building the boiler room - heat pump, with ventilation.
	Barriers and problems occurred	For three facilities, the realized value was higher than planned, while in the case of two it was smaller. The differences occurred mainly in the execution of works - most of them at the Primary school Puconci, which the constructor could not foresee, so there were additional works, including amendments and changes to the project documentation, on the basis of which the works could be carried out. At the request of the client, the constructor also added items that were not eligible for the cost, but they were carried out within the scope of energy renovation, which will not affect the final indicators of savings. Higher costs were also incurred in the preparation of project documentation and expanded energy audits, as well as for expert supervision, with which the contract was concluded on the percentage of works carried out. The reason for the increased realized values was also in the implementation of the public tender in the selection of the most favorable provider, where the open procedure was carried out in the phase 1 of the Public Procurement Act (hereinafter: ZJN-2) where they performed the open procedure for the measure – the renovation of boiler rooms, which included hardware installation work, was run by only one provider, but the bid value exceeded twice the estimated value. In the second phase, they approached to more efficiently implementation of the public tender, as they carried out the negotiated procedure. During the implementation of the operation, the VAT rate was raised, which increased the prices on the market, as well as the investment.
Detailed description	Main results	The Municipality of Puconci has committed itself with the project to achieve the following indicators within two years after the completion of the operation: • predicted heat savings of 439.55 MWh / year, • the envisaged production of renewable energy sources (RES) is 281.5 MWh / year. By monitoring and modernizing the boiler rooms at all facilities, they will monitor the energy consumption that will be stored at the central school of the primary school Puconci. As the operation was completed in May 2015, it will be only now or in the coming years to see energy savings. In addition, they want to update the system by remotely reading and transmitting to the central computer of the Primary School Puconci and so will have a complete overview of energy consumption.

Financing scheme	The operation was partly financed by the European union from the Cohesion Fund and the Ministry for infrastructure and spatial planning. Total for the entire realization of the operation was realized - 1,469,007.49 EUR, VAT included. Financing overview from different sources: EU Cohesion Fund (870,984.04 EUR) Slovenian participation (153,703.13 EUR) Own share of the Municipality (444,320.32 EUR)
Replication	Transferability of project is very high. In principle, there are no general regional obstacles to implementation in ther regions.
Contact details	Municipality of Puconci Web page: www.puconci.si E-mail: obcina.puconci@puconci.si Phone: ++386 (0)2 545 91 00

1.7. Energy-related refurbishment of schools in Montenegro

Brief introduction	The Energy Efficiency Act passed in 2010 requires all of the government ministries to implement energy-saving programmes, and the Education Ministry is leading the way with plans for the energy-related refurbishment of the 233 schools and nurseries for the country‘s approximately 120,000 children and young people. The country, which borders the Mediterranean Sea, is receiving assistance in this regard from the German federal government. The main goal of this practice is to raise public awareness of energy conservation by presenting real-world examples of highly energy-efficient retrofit projects of school buildings that will lead the way to carbon-free approaches, while ensuring high performance indoor environments.	
Detailed description	**Localization**	Montenegro
	Concept and background	Some school buildings across Montenegro are as much as 90 years old, and very few have been renovated in the last 20 years. Many were built with no consideration to the climatic conditions in Montenegro. There are cases where heating has not been installed or does not work, roofs are leaky and buildings are dilapidated. In some there is mould in the showers, toilets and sports halls. All in all not the ideal conditions for learning. The energy costs for the buildings are also a great deal higher than in other Central European countries. This all has led to the need for energy refurbishment of public buildings in particular (schools and nurseries) in order to increase their energy efficiency.
	Timeframes	2015 – 2016
	Aims and activities	1. Design, demonstration, and evaluation of highly energy efficient retrofitting measures for schools in Montenegro 2. Development of guidelines and tools, building upon existing knowledge and tools, that are applicable throughout the EU countries 3. Dissemination of results, guidelines, and tools, including training activities
	Barriers and problems occurred	During project implementation, investors had to overcome many obstacles in order to succeed. Some of them are listed below: lack of knowledge and experience of many stakeholders on the building level as well as on decision-making level; lack of competence in the public sector is considered as a problem for bigger energy renovation projects, as the total and long-term picture of the energy supply system is not often understood, uncertainties regarding economic aspects could result in insufficient funding.

Detailed description	Main results	At the end of 2015, Montenegro carried out the energy related refurbishment of 21 school buildings. The energy-related refurbishment allowed schools to reduce their energy consumption by at least 20%. The measures are improving the learning conditions for pupils, and therefore their achievement. The eradication of mould reduces the health risks for both pupils and teachers. With the energy-related refurbishment of its public buildings, Montenegro is contributing to global climate protection and its own sustainable development. The investment has a positive effect on employment and incomes because it benefits local construction companies and energy auditors.
Financing scheme		KfW is providing funds totalling EUR 13.5 million for the first phase of the project. The successful programme is being continued past 2015. For the second phase, the German federal government promised investment amounting to EUR 20 million and EUR 2 million grants for consulting services. The Montenegrin Ministry of Finance is the recipient and borrower of the funds provided by KfW, but responsibility for the public sector energy efficiency programme lies with the Ministry of Economy. With this soft loan scheme the upfront costs for the building owner are reduced so the loan has given in attractive low interest rate and duration (1 and 2 % for 10 to 30 years).
Replication		This practice could be implemented in other regions, especially in less developed countries where energy-related refurbishment would bring large energy savings. This is appealing to KfW since it can help overcome the financial and economic crisis such countries. Experience from other countries shows that government energy efficiency programmes often trigger further investment at the municipal level and in the private sector.
Contact details		KfW Group, KfW Development Bank – The Kreditanstalt für Wiederaufbau (KfW) is based in Frankfurt and was created under public law in 1948. It both promotes local economies and acts as one of the most significant investors in international development. Palmengartenstrasse 5-9 60325 Frankfurt am Main, Germany Phone +38 220 22 81 70 Fax: +38 220 22 82 40 KfW Office Podgorica Dzordza Vasingtona 23 81000 Podgorica Montenegro kfw.podgorica@kfw.de Ministry of Finance Montenegro - is the ministry in the Government of Montenegro which is in charge of the nation‘s finances. The ministry was established in 1879 as a ministry of the Principality of Montenegro. It was abolished in late 1922, but restored 23 years later, in 1945. Darko Radunović Minister of Finance Phone: +382 20 242-835 E-mail: mf@mif.gov.me Fax: +382 20 224-450 Address: Stanka Dragojevica 2, 81000 Podgorica

1.8. Building retrofit for the University of Applied Sciences – Munich

Brief introduction	This project constitutes an innovative forfaiting structure for financing energy efficiency measures in a public building, with a focus on low-carbon solutions, which will improve the learning environment for students as well as staff. The project includes installations of combined heat and power plant, installation of energy efficient lighting, optimization of heating and building management.	
Detailed description	Localization	Munich, Germany
	Concept and background	To cope with climate change energy sustainability is considered the key target EU Countries set to achieve by 2020. Existing energy users such as building stock require huge efforts to be aligned to this goal. This is the case of the University of Applied Sciences - Munich since it was built in 1971. Since the indoor air quality performance of the building is bad it was necessary to improve it using sustainable methods and materials. The Johnsons Control (ESCO) and the university agreed to energy efficiency measures comprising the optimisation of the heating, lighting, metering, building management and pumping, as well as the installation of a 49.5 kW combined heat and power (CHP) plant.
	Timeframes	2012-2013
	Aims and activities	The project has three main activities: design, demonstration, and evaluation of energy efficient refurbishment measures for University of Applied Sciences (that will lead the way to carbon-free approaches, while ensuring high performance of indoor environments), development of guidelines and tools, building upon existing knowledge and tools, that are applicable and dissemination of results, guidelines, and tools, including training activities for all University users in order to raise their awareness of energy conservation. Main barrier for the project implementation was that University has complex decision-making structure. Energy management was controlled centrally by the Estates department which didn`t involve dedicated energy management staff.
	Barriers and problems occurred	One of the main problems to be solved is how to prevent car sharing parking spots to be used by unauthorised vehicles to stimulate behaviour change and foster a culture of sustainable mobility. Citizens will need to be made aware of the service, as well.
	Main results	The project resulted with reduction of CO_2 emissions 88t p.a. approximately 11.6% compared to baseline and energy savings € 118,860 p.a. (41.7%). This is the second project with the innovative forfeiting structure and represents a role model for further energy efficiency investments in schools, universities etc. Through the project were implemented EE measures including a CHP plant (decentralized energy production).

Financing scheme	The University of Applied Sciences Munich and the energy service company (ESCO) Johnson Controls entered into an energy performance contract (EPC) for both of the buildings on the university's campus in Munich-Pasing, with a total EPC volume of €1.1 million In this financing scheme University acts like employer and hires Johnsons Control to implement EE and RES measures acc. to their energy performance contract and pays Johnson Control receivables/energy savings per annum which they have guaranteed the university for a contract period. Johnson Control and EEEF closed forfaiting agreement (purchase of 70% of energy savings). Johnson Control according to agreement then forwards sold part of energy savings to EEEF.
Replica-tion	This project serves as a model for further energy efficiency investments in educational facilities such as universities, schools and kindergartens. It could be implemented in other regions, especially where it could bring more energy savings. It is also necessary that energy management isn`t controlled centrally by the Estates department.
Contact details	University of Applied Sciences Munich – is the second-largest University of Applied Sciences in Germany. It was founded in 1971 and is the largest university of applied sciences in Bavaria, with approximately 17,500 students, 475 professors, 750 lecturers and 745 non-academic staff. Lothstr. 34 80335 Munich Tel. +49 (0) 89 1265-1121 Germany Johnsons Controls - is a global diversified technology and multi industrial leader serving a wide range of customers in more than 150 countries. 5757 N. Green Bay Ave. P.O. Box 591 Milwaukee, WI 53201


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1.9. Energy Savings in the Agricultural and Forestry school Frýdek – Místek

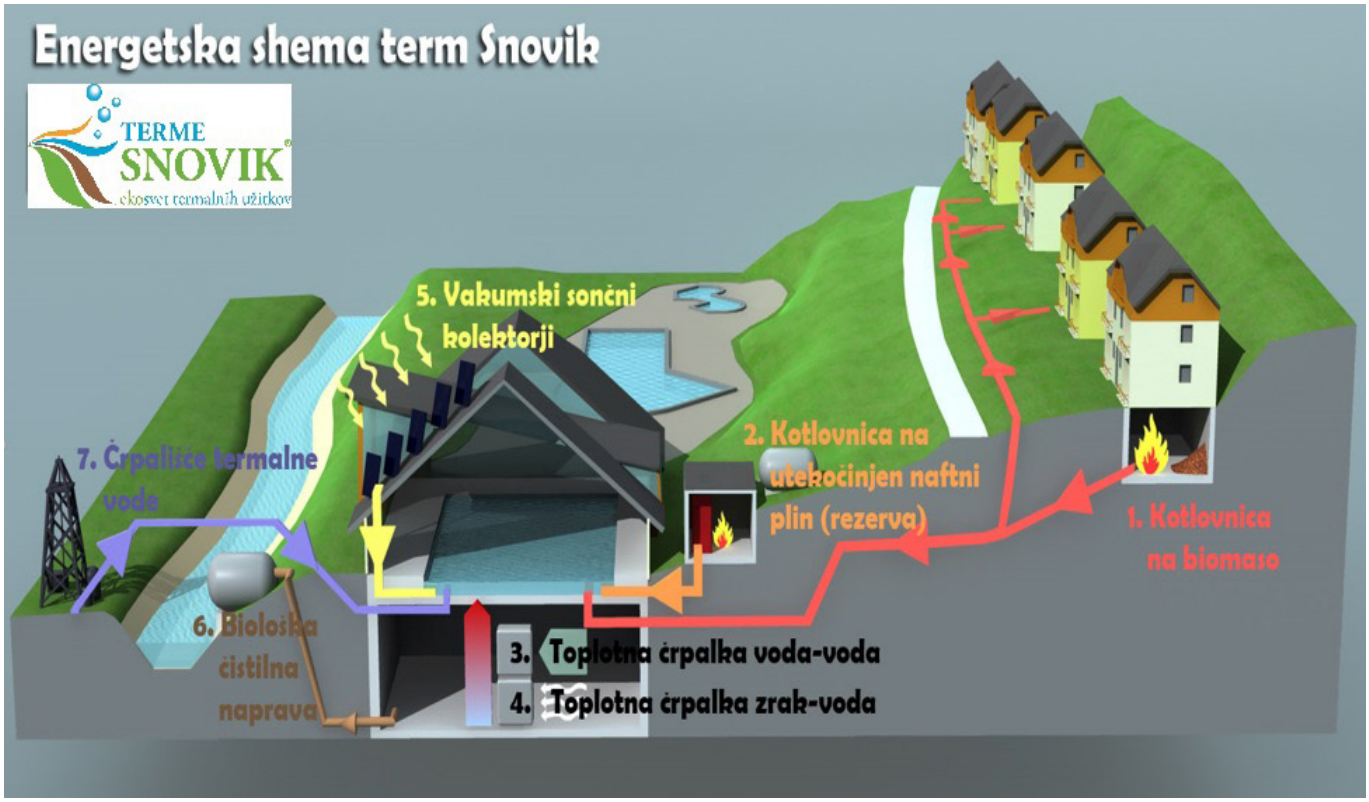
Brief introduction	The project is aimed at reducing the energy consumption for heating. Reducing CO_2 and other pollutants into the air and reduce the consumption of primary fossil fuels.	
Detailed description	Localization	Lískovecká 2089, 738 01 Frýdek-Místek, CZ
	Concept and background	Supporting the project to reduce the consumption of primary fossil fuels and increase the use of renewable energy sources.
	Timeframes	28/07/2010 – 26/09/2011
	Aims and activities	The improvement of the thermal and technical properties of the school facility.
	Barriers and problems occurred	Slight technical problems with insulation (walls inequality, the inability to use standard anchoring equipment). Slightly problematic communication with building supervision from the perspective of the investor.
	Main results	The thermal insulation of a school building, reducing heat consumption and replacing an obsolete heat source for an environmentally friendly alternative.
Financing scheme	The total project cost was CZK 19,755,393, the project was co-financed from three sources - the EU funds 9,423,513 CZK, the state budget (The Ministry of the Environment) CZK 554,324 and The Moravian-Silesian region CZK 9,777,555. The project was funded from the Operational Program Environment, Priority Axis 3 - Sustainable Use of Energy Sources, Areas of Intervention 3.1 The construction of new facilities and the modernisation of the existing facilities with the aim to increase the use of renewable energy sources for heat generation, electric energy generation and for combined heat and electric energy generation and 3.2 Realisation of energy savings and the use of waste heat.	
Replication	This good practice can be applied to any administrative building (public or private sector) in any region. The condition is that the buildings have not undergone reconstruction/thermal insulation and use the aged local energy source.	
Contact details	Project Manager Ing. Milan Rostek tel: +420 595 622 748 e-mail: milan.rostek@msk.cz	

1.10. Environment-friendly and energy-efficient Snovik Thermal SPA

Brief introduction	The project represents the successful implementation of a long-held goal: exploitation of the curative thermal waters discovered at Snovik decades ago. To date the project has created about 30 new jobs directly and over 50 indirectly. The spa center (pools and apartments) are built in an energy efficient way. The larger part of energy requirements is covered with local resources - geothermal, solar energy and biomass. The Snovik thermal spa, the closest to the capital Ljubljana, which can already take pride in a number of distinguished awards, in particular for its eco-friendly approach. The spa has been given an award as a top energy-saving company, the EU award for eco-friendly tourist accommodation, and also an award from CIPRA, the International Commission for the Protection of the Alps, for achievements in the protection of the environment.	
Detailed description	**Localization**	Municipality of Kamnik, Slovenia (western Slovenia). SPA SNOVIK is the highest altitude spa in Slovenia. They are locatedin Tuhinjska Valley, near Kamnik. Only an hour‘s drive from Ljubljana, Celje and Kranj and you will find yourself in the unspoiled nature of Snovik.
	Concept and background	Since its foundation, Terme Snovik has been pursuing energy efficiency goals, the use of more environmentally friendly technologies and local renewable energy sources. Their integral approach is important at all the levels of action and tracking the vision of the leading Slovenian ecological terms. They build their visibility on the trademark ECO world of thermal pleasure based on the richness of the natural environment surrounding them, and on healthy lifestyle. For a system of environmental management they have obtained ISO 14001:2004 and with this they have take commitment in their actions to use processes, work techniques, materials, products and energies, that will contribute to reducing and managing adverse impacts on environment. They also obtained the ISO 9001 standard for the management system quality and the EU Ecolabel (environmental daisy) for more environmentally friendly tourist accommodation.
	Timeframes	Project start date: 2001-01-01 Project end date: 2012
	Aims and activities	For the planning and construction of the thermal spa they made use of the latest technologies for energy-efficient and environment-friendly solutions. Only high-grade materials with the appropriate certification were employed. The construction itself was handled in stages to facilitate the implementation of the various measures targeted at energy efficiency and allow verification of the results with thermographic imaging. At the start of the works, a biological waste water treatment plant was installed and a boiler room for liquid gas was built. Liquid gas is now used as the primary energy source and also serves as a reserve to meet peak demand. When further facilities were added (swimming pool, restaurant, sauna, therapy centre), evacuated tube collectors and two heat pumps (water-water and air-water) were installed, and in the last phase of construction a biomass heating plant was also built. The apartment buildings are operated on the intelligent room/house principle.

Detailed description	Barriers and problems occurred	Financing strategy: Due to the intensive construction of the apartment complex, there were occasional problems with the provision of sufficient financial resources. The cause of the situation was in too slow of provision of sufficient financial resources through recapitalization and poor provision of own funds from operations. The situation was partially displaced with additional debt owed, and partly with the accelerated dynamics of obtaining grants.
	Main results	The measures taken have had direct ecological results (significant reductions in air and water pollution, etc.) and indirect financial results (lower running costs). This has led to certification pursuant to ISO 9001 and ISO 14001 and the EU's Eco-label scheme (Flower). The latter is also a valuable marketing tool to promote this new spa, which is the highest thermal spa in the Kamnisko-Savinjske Alps. This means Snovik Thermal Spa can be presented as an example of good practice on a variety of platforms. They are successfully marketing their seminar facilities by presenting the advantages of renewable energy in theory and practice to both expert and lay audiences, and a number of workshops have been held on the subject. They also organise open days to show visitors heat pumps, evacuated tube collectors,the biomass heating plant, the small hydropower plant and the biological water treatment plant. In 2007 the use of renewable energy permitted heating costs to be reduced by 28 % while the total turnover increased by 36 %, and they have succeeded in reducing CO_2 emissions by approx. 305 tons per year. Impacts on adaptation: The use of biomass represents a positive impact since forests in Slovenia are managed in a sustainable way. With energy saving measures and the use of renewable energy Snovik is adapting to climate change consequences by constantly reducing non renewable energy sources. With the adaptation they also avoid raising prices of non-renewable energy sources. Impacts on environment: All the measures taken have a positive impact on the environment. What is also an added value is the number of visitors, which can indirectly learn about it and are encouraged for energy saving and environmental friendly measures. Before the new spa was built the water left into the stream had a temperature of 32 °C, after the construction only 12 °C. Also the water from the biological water treatment plant was never polluting the stream more than allowed. Impacts on society: The municipality is also included in the project, indirectly many touristic and business stakeholders are included. They are building networks and spreading the knowledge and experiences among partners and in this way encouraging them to a better environment and quality of living. With their striving for good environment they are also encouraging inhabitants to manage their forests and pastures and this biomass material than can be used in the thermal spa for heat production. The Thermal spa has created around 30 new jobs and also around 50 jobs indirectly.

Detailed description	Main results	Impacts on economy: With the realization of the project the result was over a million of visitors in the spa and over 50.000 overnight stays in apartments in the past 6 years. They have assured ca 30 new jobs and also over 50 indirect jobs. Profit was invested in the further development of the company and the company has made itself valued on the local, national and worldwide touristic field. With this project many common economic affects are achieved.
Financing scheme		Investment of Terme SNOVIK were carried out in stages as well as the obtained grants: Construction of a new apartment complex with 426 beds. The investment - the construction of apartments and the capacity to generate electricity from renewable sources, the renovation of the road, the acquisition of new pumps and the water supply - totaled SIT 1.6 billion. Of these, Terme SNOVIK have received 35 percent or 432 million SIT (1.800.000 EUR, 2003) through the tender of the European Regional Development Fund, while 25 percent was contributed by the state. In March 2007, a biomass boiler plant started to operate in the apartment complex, which means that the use of fossil fuels will be fully carried out and replaced with more environmentally friendly renewable energy. The construction of the boiler plant was partly financed by the European Agricultural Guidance and Guarantee Fund (EAGGF) and the Agency for Agricultural Markets and Rural Development (AKTRP). Improvements in Terme SNOVIK in 2012 in the field of pool work: part of the renovation was funded by the European funds through the call for the efficient use of electricity UREE1. The project involved renovation and optimization of systems in other areas of electrical engineering. In addition to the new central control system, the complete automation of the filter regeneration procedures and other systems was carried out, which were subordinate to manual management by then. Due to the comprehensive approach to renovation, the effect of the all-round advantages of the new system is even more visible.
Replication		All the measures and technical solutions are transferable in every environment if they realize the condition that all potential beneficiaries have a certain level of awareness and are willing to get new knowledge on the field. The topic is very actual and there is always an interest from different investors to see their work. There is not only interest in the field of tourism, but also other fields. Energy measures such as in Terme Snovik can be implemented in other tourist resorts as well.
Contact details		Terme Snovik - Kamnik d.o.o. Web page: http://terme-snovik.si/ E-mail: info@terme-snovik.si Phone: ++386 (0)1 83 44 100


Energetska shema term Snovik
TERME SNOVIK
ekosvet termalnih užitkov
5. Vakumski sončni kolektorji
7. Črpališče termalne vode
2. Kotlovnica na utekočinjen naftni plin (rezerva)
1. Kotlovnica na biomaso
6. Biološka čistilna naprava
3. Toplotna črpalka voda-voda
4. Toplotna črpalka zrak-voda

1.11. Renovation of multi-apartment buildings in Estonia

Brief introduction	The project`s main concern is energy refurbishment of a low income building blocks with multi-family buildings in the wider area of Estonia. It was initiated from Estonian Government in order to set up a support system for the renovation of the low quality and low energy efficiency apartment buildings. The rationale was to be found in the fact that, at that time, the Estonian building stock accounted for up to 50% of the total national final energy consumption, significantly above the average of 37,5% across all EU countries, that around 60% of the Estonians were living in apartment buildings built primarily between 1961 and 1990 and that energy efficiency and indoor climate were especially in need of improvement.	
Detailed description	Localization	Estonia
	Concept and background	In Estonia there are a total of approximately 27,000 apartment buildings, and approximately 90% of all apartment buildings were built before 1990. The majority of those buildings have same typical problems: high energy consumption levels, insufficient ventilation, uneven indoor temperatures, and insufficient thermal comfort levels. Therefore, a pretty extensive or 'deep' level of renovation is required. Any large-scale and systematic renovation process for apartment buildings in Estonia is complicated due to the fact that a total of 82% of dwellings are privately owned. Apartment buildings are generally managed by apartment associations which mean that all of the apartment owners in each building must agree on the volume of any renovation work and also on the budget for such work.
	Timeframes	2010 – 2014
	Aims and activities	The aims of the project are: quality check of EPC recommendations, making decisions on the refurbishment actions and priorities based on the EPC recommendations, achieve energy saving in primary energy consumption of ~60% by improving the envelope performance, quality control of products, certification of implemented technologies and products implemented, increasing awareness of inhabitants of the local and wider society on the benefits of energy renovation and the importance of quality standards. Some of activities were: implementation of energy audits; conducting measurements of indoor conditions and envelope surface temperature, before renovation; issuing Energy Performance Certificates; launching call for Tenders and selection of sponsor companies, preparation of technical specifications documents, etc.
	Barriers and problems occurred	The main challenge for the building associations was reaching an agreement among the majority of owners to take advantage of the financial instrument – an experience shared by many associations of apartment blocks in Estonia. Preparation with an apartment association in regard to renovation work takes time - up to two years - and there is no direct way in which apartment associations can be guided when it comes to renovation work (this can only be managed through raising awareness and though good example).

Detailed description	Main results	During the period 2010-2014, a total of 663 apartment buildings underwent renovation work in Estonia. Average energy savings for each apartment building were at 43%, and the total annual energy saving was approximately 60 GWh. The project resulted in an energy efficiency improvement of 63% - resulting in a shorter repayment time than initially expected. The association underlines that other improvements included a better living environment, better temperature in apartments and an increased market value for the entire block of apartments.
Financing scheme		KredEx, as public financing institution, was the holding fund manager of the renovation scheme, receiving €17.74 million of ERDF funds and attracting another €48.97 million from public sources for the same purpose. Two banks distributed the funds to apartment associations who could rely on KredEx for technical assistance as well as help with energy audit grants, or guarantees covering their 15% share of renovation costs. The total of investment in relation to apartment associations and the grant scheme amounted to €151 million, of which €38million took the form of grants. In addition to the renovation grant, there was also renovation loan with low interest rate and long repayment period. Renovation loan was financed by European Structural Funds. In this project, through a combination of loans, technical assistance and grants, associations of apartment owners received guidance and financial assistance throughout the documentation and implementation process of their energy efficiency renovations.
Replication		The execution of the renovation work grant schemes in Estonia has shown that extensive integrated renovation is possible in situation in which buildings are managed by apartment associations and apartment owners have to agree on the extent of any renovation work and also on the budget for the project. The good practice could be implemented in other regions where new innovative solutions can be implemented and apartment owners are willing to invest in order to renovate their apartment and building and where financial support keeps the cost of renovation work to an acceptable level.
Contact details		KredEx Revolving Fund/KredEx Fund - a revolving energy efficiency fund founded in 2009, is part of the KredEx Foundation, a government owned non-profit provider of financial services established in 2001 by the Estonian Ministry of Economic Affairs and Communications (MoEAC). Mr Andrus Treier - Chief Executive Estonian Credit and Export Guarantee Fund (Kredex) Pärnu mnt 67b, 10134 Tallinn Estland Phone: +372 6 819 950 E-Mail: andrus.treier@kredex.ee Website: http://www.kredex.ee

2. Use of renewable energy

2.1. Construction and operation of a wind turbine within the Energy Concept for Energy Autonomy until 2050 in Zschadraß, Saxonia, Germany

Brief introduction	Since October 2009 the municipality Zschadraß operates one of the largest wind turbines in the region through the civic association „Rural Life“ and the Foundation „Ecological-Social Foundation Zschadraß“. But the Saxon municipality does not just invest in wind power. Nearly all public buildings such as the school, the fire station or the municipal administration have photovoltaic systems. This allows the municipality a financial scope. For example, this money will be used to fund ecological projects for children, to help children of low-income parents, to organize summer camps or to offer a community car service.	
Detailed description	Localization	Municipality Zschadraß (3300 inhabitants), Saxonia, Germany – Cities Triangle Leipzig, Chemnitz, Dresden
	Concept and background	The idea of a sustainable energy supply based on renewable energies existed since the year 2000. Not only ecological questions were decisive for rethinking. The community had to save and was forced to tap new sources of income, because an increase in tax revenues through new trades was not expected in the structurally weak municipality. Therefore, the municipality proposed to the 3300 inhabitants an energy concept that should make the municipality energy-autonomous by the year 2050. The energy concept envisages that the demand for electricity, heat and fuels on site will be gained with the help of solar, wind and bioenergy. This is intended to reduce energy costs in the long term and generate revenue from local energy production.
	Timeframes	Commissioning of the wind turbine in October 2009 Break-even-point after ca. 15 years (2014/15)
	Aims and activities	Aims: • Securing the future • Taking responsibility for futre generations • Savings in municipality budget • Boosting the municipalities own added value Activities: • Development of the energy concept • Construction and operation of a wind turbine
	Barriers and problems occurred	A barrier which occurred but could be solved is the necessary persuasion to the population. After first successes became visible, even individual inhabitants began to invest in renewable energy independently and at their own expense, for example, by equipping their own houses and or companies with solar energy systems.
	Main results	• Successful Construction and operation of a wind turbine • Profit and reinvestment in social policy after break-even-point • Important step towards the goal of energy autonomy until 2050.

Financing scheme	Municipalities themselves are not allowed to generate profits from renewable energy plants. Therefore, there are municipal utilities in many cities and municipalities, which in turn belong to the municipality. In this way, municipalities can take care of their citizens' energy supply and use the profits to finance other public tasks, such as childcare. It is similar in Zschadraß. Since the establishment of a municipal utility for the 3300-inhabitant community is not economical for personal and financial reasons, the municipality has outsourced the energy production in a civic association and a foundation. The green electricity is fed into the German electricity grid and remunerated by the Renewable Energy Sources Act. The investment is around 3.2 million euros. The municipality carries about 20 percent of the investment through a civic association and a foundation. The remaining investment is taken over by a private operator from the village. The municipality has to use the proceeds from the wind turbine to pay off the loans. But after about 15 years, the municipality will have paid off the loan and generate revenue from the wind turbine. This income should then come back to the municipality benefit and be invested in social policy, for example in free school lunches for children from low-income families.
Replication	In principle, there are no general regional obstacles to implementation in other regions recognizable. Nevertheless, national legal framework and the participation of the population are crucial.
Contact details	Municipailty Zschadraß Tel.: 034381 83100 Mayor Matthias Schmiedel Civic Association „Ländliches Leben“ (Rural Live) Foundation „Ökologisch-Soziale Stiftung Zschadraß“ (Ecological-Social Foundation Zschadraß)

2.2. Biogas plant with the capacity of 0,2 MW at the wastewater treatment plant in Siemiatycze

Brief introduction	Sector: Biogas use	
Detailed description	Localization	Siemiatycze, Poland
	Concept and background	Local authorities care deeply about environmental protection and engage in different environmental initiatives. One of them was construction of the biogas plant at the municipal wastewater treatment plant, which was done within the project entitled „Efficient disposal of sewage sludge through its use for the purpose of electricity and heat co-generation“. The project was initiated by the municipal company named Przeds b orstwo Komunaln Spółka z o.o., which wanted to solve the problem of high energy consumption in the waste treatment facility modernised several years before. Investments in renewable energy sources are still rare in the Podlaskie Voivodeship. The one done by Siematycze is the first investment of this kind implemented in the whole district. Except for increasing renewable energy generation, it also helped to solve the problem of offensive odours from the sewage sludge. The sludge was stored before in open tanks and - as a result - all related gaseous pollutants were emitted to the environment.
	Timeframes	2013-2015
	Aims and activities	New installation ensures proper management of sewage sludge produced during wastewater treatment. Both surplus activated sludge and primary sludge are subjected to the anaerobic fermentation process, which was introduced in the sludge handling system. Before being directed to the process, surplus activated sludge (from secondary sedimentation tanks) is thickened and dehydrated. The outcome of the anaerobic fermentation is biogas, which is then stored in a special tank and - through the condensate dehydration system and biogas desulphurisation system - transported to the low-pressure tank. Then, through the pressure pump, biogas is transferred from the tank to the energy cogeneration unit, where heat and electricity are produced. Heat is used to maintain process temperatures in digester chambers at adequate levels, while electricity is used for the wastewater treatment plant‘s own purposes. Each chamber is equipped with heat circulation system and double impeller agitators, which ensure complete sludge mixing.

Detailed description	Barriers and problems occurred	No problems in the implementation of the investment.
	Main results	The main aim of the investment was to ensure proper and efficient management of sewage sludge by using it to generate heat and electricity satisfying part of plant's own demand. As a result the plant managed to halve its electricity costs related with powering process equipment. Average monthly savings on energy bills reach nearly 20 000 PLN (approx. 4 600 EUR). The company managing the plant also gains profit from selling certificates of origin of electricity from promoted sources (so called „green certificates"). These additional financial re- sources cover part of the plant's exploitation costs. Except for economic benefits, implementation of the project also brought social ones. It improved comfort of life of Siemiatycze's citizens as it contributed to the liquidation of bothersome odours. Air pollution was eliminated thanks to the controlled fermentation of sewage sludge. Moreover, introduction of the fermentation process resulted in decreasing sludge volume by even 30% and increasing sanitary safety of digested sludge making it usable for agricultural purposes. After degasification and mechanical dehydration, the sludge is subjected to the process of hygenisation and can be used as a natural fertiliser. Preparation of the sludge for further treatment (drying, combustion) according to global trends opened way for future investments planned by the municipal company, i.e. construction of a drying and combustion unit. Environmental benefits related with the investment consist in using renewable energy source (biogas) to generate heat and electricity, thus allowing to reduce fossil fuels consumption.
Financing scheme		The total value of the project came to approx. 12 Mio PLN (approx. 2.8 Mio EUR). Out of this amount almost 7.5 Mio PLN (approx. 1.7 Mio EUR) was granted from the Regional Operational Programme for the Podlaskie Voivodeship for 2007-2013 and further 2.5 Mio PLN (approx. 0.6 Mio EUR) came from a loan from the Voivodeship Fund for Environmental Prot ct on and Wat r Manag m nt n B ałystok. Th proj ct also foreseen the purchase of the installation for dehydration of the digested sludge, which cost approx. 2 Mio PLN (approx. 0.5 Mio EUR) and was also co-financed from the ROP (with the 85% co- financing rate).
Replication		This type of investment is generally prevalent in Poland.
Contact details		Przedsiebiorstwo Komunalne Spolka z. o. o. in Siemiatyze e-mail: sekretariat@pksiemiatycze.pl phone: +48 85 655 25 77 Waterworks and Sewage Utility Romaniuk Dariusz - biogas plant operator e-mail: d.romaniuk@pksiemiatycze.pl phone: +48 85 655 27 23

2.3. Installation of RES systems in public utility buildings and private households in Niepołomice

Brief introduction	Sector: PV, solar heat, heat pumps	
Detailed description	Localization	Niepołomice, Poland
	Concept and background	Niepołomice is a town of 26,000 inhabitants in the southern part of Poland, in the Małopolskie Voivodeship. Since 2011 Niepołomice is implementing its Sustainable Energy Action Plan, with a CO_2 reduction goal of 25% by 2020 (compared to the 2008 year baseline). One of the actions foreseen in the SEAP is the increase of RES systems installed on the territory of the municipality. Consumption of energy in buildings (public, residential) is the main driver of GHG emissions of the commune, so the development of dispersed RES installed on buildings has a high potential for the GHG emission reduction. Apart from GHG emissions energy consumption in buildings also causes a serious problem with air pollution (from the utilization of fossil fuels for heating). In 2012 the Niepołomice municipality became a leader of the project „Installation of renewable energy systems in public utility buildings and private households in the municipalities of Niepołomice, Wieliczka, Skawina, Miechów, Myślenice and Zabierzów“, which applied for co-funding from the Swiss-Polish Cooperation Programme. A decision on the implementation of project activities was based on the need for diversifying energy sources used, increasing renewable energy production, reducing low-stack emissions and protecting natural ecosystems.
	Timeframes	2012. – 2017.

Detailed description	Aims and activities	The overall objective of the project was to improve air quality by emission reduction from the building of 6 neighbouring municipalities: Niepołomice, Wieliczka, Skawina, Miechów, Myślenice and Zabierzów (the two latter joined the project in 2015). The project also aimed at improvement of health conditions and quality of life of their citizens. The core of the project was the installation of RES systems in public utility buildings and private households, accompanied by educational & information campaign addressed to the citizens. Implementation of the project started on the 24th of January 2012 with the signature of an agreement between the project coordinator (municipality of Niepołomice) and the Implementing Authority of European Programmes. Another important step was the signature of an agreement between the coordinator and the Info Solutions company responsible for supervising project implementation, which took place on the 5th of December 2012. Then, an open tender for the RES installer was announced and on the 4th of October 2013 relevant agreement was made with the selected consortium. First solar systems were installed on private residential buildings in December 2013. Installation of the systems has been completed in 2016. The project has foreseen three types of solar thermal installations that could be installed in private households: type A (for three people) with 2 solar thermal collectors and 250-liter hot water storage tank (household‘s contribution = 4 020 PLN = approx. 935 EUR); type B (for three to five people) with 3 solar thermal collectors and 300-liter hot water storage tank (household‘s contribution = 4 660 PLN = approx. 1 084 EUR) and type C (for more than five people) with 4 solar thermal collectors and 500-liter hot water storage tank (household‘s contribution = 5 730 PLN = approx. 1 333 EUR) . An additional part of the project, implemented in 2016-2017 was a thermal refurbishment of 13 public building in Niepołomice. This part of the project hasn‘t been foreseen in the project proposal but was a result of the surplus amount of funding resources available (due to positive currency exchange rate change). Project leader negotiated with the funding authority and agreed in an annexe to the project agreement inclusion of thermal refurbishment within the project.
	Barriers and problems occurred	The investor did not encounter any obstacles during the implementation of the investment.

	Main results	The investment included installation of 615 solar thermal systems (with the total surface of 4 280 m^2) in private buildings, installation of 3 solar thermal systems (with the total surface of 46,4 m^2) in sports facilities and installation of heat pumps with the capacity of 90 kW and 204 kW. The first building in Niepołomice, which was equipped with the heat pump (with seven 180-meter wells), was the Administration Centre. The wells were made in the parking area. The 2nd building was the indoor swimming pool in Niepołomice, where 3 heat pumps were installed (with 19 wells of 3 135 m in total) and are operating in a cascade system. The building was also equipped with PV panels, which were mounted on the roof, southern façade and part of the western façade. The PV plant has the surface of 1 020 m^2 and the peak capacity of 166.6 kWp. Generated electricity is used to cover building's own demand and is not supplied to the grid. The plant is integrated with the monitoring system, which allows real-time observation of renewable electricity production and related CO_2 emission reduction. Special display monitor - placed in the swimming pool's main hall - shows installation's current output, amount of electricity generated during the day and daily gain in PLN recalculated into monthly, yearly and total values. The monitor also displays a daily reduction of CO_2 emissions. Open access to the monitoring results is important for raising energy awareness of the local community. In the period from the 1st of November 2015 till the 21st of March 2016, the installation generated 20.44 MWh of electricity, contributing to the reduction of CO_2 emissions by 11.18 Mg CO_2. Such a hybrid solution (integration of PV modules with heat pumps) allows reducing energy costs and low-stack emissions significantly. Complex thermal retrofitting of 13 public buildings resulted in savings of 5431 GJ/year of energy and the reduction of CO_2 emissions of 937,79 tones of CO_2 equivalent. The retrofitting included: insulation of walls, changing windows and doors, modernization of internal heating installations, modernization of internal lighting. It also included installation of 10 kWp solar power plant on each building and energy monitoring system. An important project result is the increase of citizens' energy awareness, which should lead to the wider use of environmentally friendly technologies, including the ones used for supplying both private and public buildings with renewable energy. Thanks to the installation of solar thermal collectors, PV panels and heat pumps in a large number of buildings, the project significantly contributed to the reduction of low-stack emissions (through the reduction of fossil fuels consumption), as well as to lowering energy bills paid by public institutions and private households involved. It needs to be remembered that optimisation of energy and natural resources consumption influences economic growth.

Financing scheme	The total value of the project implemented in 6 municipalities amounted to 82 704 876 PLN (22 275 030 CHF = approx. 19 233 690 EUR). 64.51% of the cost (53 352 915 PLN = 14 369 621 CHF = approx. 12 407 654 EUR) was covered from Swiss funds and remaining 35.49% (29 351 961 PLN =7 905 409 CHF = approx. 6 826 036 EUR) from municipalities' and other beneficiaries' own contributions. Citizens had to cover 30% of the costs of their individual installations, while 5.49% was provided from respective municipalities budgets. In case of RES systems installed on public utility buildings, 100% of own contribution came from municipalities budgets. As a result of currency exchange rate increase (from 2.9 PLN/CHF to 3.7 PLN/CHF) the municipalities had a larger amount of funds available (in PLN) that it was foreseen in the initial phase of the project. Additional funds had been used for thermal retrofitting of public buildings following annexe to the agreement with the funding institution.
Replication	This type of investment can be replicated in other regions however there can be local differences with the legal possibility of inclusion of mixed funding sources (international, public and private).
Contact details	**Municipality of Niepołomice** e-mail: magistrat@niepolomice.eu phone: +48 12 250-94-04 Stanisław Nowacki, project coordinator e-mail: st.nowacki@gmail.com phone: +48 12 250 94 51 www.niepolomicesolary.eu

2.4. Biofuture Cross-Border Demonstration and Training Center for Energy Sustainability

Brief introduction	„Cross-border demonstration and learning center bioconstruction and bioliving – BioFuture is a project that shows the benefits of using renewable energy sources and natural cycles of substances in the environment for building and living area.	
Detailed description	Localization	It is located in Martjanci, in the municipality of Moravske Toplice in Pomurje, in the north-eastern part of Slovenia. The municipality has 6,200 inhabitants and is known for its tourism, thermal spa, viticulture and typical Prekmurje cuisine.
	Concept and background	Project start because there has been no breakthrough in the circle of designers and contractors in the field of renewable energy sources in the field of energy saving. The emergence of alternative energy use solutions in the market has had an impact on pricing in recent years, although it did not lead to a drop in price, but the price has risen. Although several users were aware of energy-saving use of energy, in practice, there was still no breakdown. It was envisaged that a crossborder energy-efficient and energy-renewable innovation and incubation competence center will be set up in Nagykanizsa (HU) Scientific and Technological Center (Tudás és Technológiai alközpont) and a pilot demonstration center has been established in Martjanci, all for the display and usefulness of the acquired data. They have established the Ecological Energy Use Partnership (Ökológikus Energia-felhasználási Partnerség (ÖEP), which has already worked in the region using measurable data among other parties. The network system required an information system and a web site. Data on timber construction and target groups in the region were prepared and the values of possible renovations of traditional buildings. Conferences were held, workshops for target groups. The publication of data was carried out in accordance with the project‘s implementation of energy use. The causes of this situation are searched on the Hungarian side of Megújuló Energia Klaszter, Magyar Pellet Klaszter, Faés Bútoripari Klaszter and on the Slovenian side of SISinergija and Bistra hiša - Smart House. The participating parties came to the conclusion that the people were acquainted with basic and wider solutions, although they could not directly address actual users and a certain market share. There was no model database in the area covering the concepts related to the acquisition and consumption of energy, so that it could be of such relevance. Existing sites played an important role, but they were not able to provide the information needed for the market, that is, for planners in combination with subscribers. A technological development and teaching base was also lacking, which could provide important guidance to expert groups of planners / traders / operators on a daily basis. Critical deficiencies were the data for planners, builders of building materials and contractors. As contracting authorities have dealt with these solutions with planning teams / traders / contractors, the experts rarely use these solutions for the efficient use of energy due to these deficiencies. If the situation does not change, I would further state the improvement of efficient energy consumption or the use of energy-saving sources.

Detailed description	Timeframes	1st September 2009 - 31st December 2012
	Aims and activities	The aim of the project „Cross-border demonstration and learning center bioconstruction and bio living - BioFuture“ is to show the benefits of using renewable energy sources and natural cycles of substances in the environment for building and living area. On this basis, experts will be trained in certain institutions and organizations in the field of renewable energy and bio-engineering.
	Barriers and problems occurred	It was planned that the project will be completed by 31 August 2012, but the duration of the project has been extended until the end of 2012.
	Main results	Establishment of an innovative joint training, technology research center in Hungary and Slovenia, which aims to spread best practices, development of economical systems, knowledge and innovation; • Breakthrough in the use of efficient and environment friendly energy in the range of the Slovenian-Hungarian state border; • Increase of the region‘s innovative capacity, research activities of complex model energy systems, making the best energy solutions in specific cases; • Establishment of an international partnership established by practice-oriented partners in the field of the use of renewable energy sources and energy efficiency, appropriate interactive communication network and a common developed and complete database, which is also a common usage; • Open to display the benefits of using renewable energy sources to the people and future users; • Promotion of education of professionals in the institutions and organizations in the field of renewable energy sources in laboratory conditions; • Qualification of combustion appliances that work with the used renewable energy sources by measuring the operating parameters, data collection relating to that or development of combustion appliances, certification of results to develop those appliances and innovations and providing assistance to new enterprises.
Financing scheme		BIOFUTURE project was approved on 7 May 2009 by the Joint Monitoring Committee of the Operational Programme Slovenia-Hungary 2007-2013 (more about programme on: http://www.sihu. eu/en/programme/european-territorial-cooperation/) with a total amount of 1,269,091.08 Euros, of which the ERDF co-financed 1,026,348.65 Euros.
Replication		This good practice has a big potential to be implemented in other regions. It is particularly important, to properly fit the case into the environment and space taking into account the specificities of certain regions / cross-border regions.
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2.5. Project »BISTRA HIŠA – SMART HOUSE« Renovation and refit works of historical building

Brief introduction	It started in 2005 in Martjanci. The old school from the 18th century was transformed into a modern, specific regional business incubator, where the headquarters of some development institutions are located. At the same time the Smart House serves as a systematic demonstration center of good practices and an advisory and learning center for efficient use of energy (EEU) and the use of renewable energy sources (RES) not only in the Pomurska region, but also throughout Slovenia and in cross-border areas.	
Detailed description	Localization	Smart House is located in Martjanci, in the municipality of Moravske Toplice in Pomurje, in the northeastern part of Slovenia. The municipality has 6,200 inhabitants and is known for its tourism, thermal spa, viticulture and typical Prekmurje cuisine.
	Concept and background	The implementation of the project has a significant impact on overcoming the existing regional barriers related to energy-sustainable development, environmental protection, public awareness, counselling and training. Energy analysis showed that the 18th century building has unsatisfactory thermal conditions. For this reason, in the renovation of the old school, was planned to ensure the quality devices for optimal energy efficiency in combination with natural materials, while also benefiting from renewable energy sources. This enabled both adaptation approaches: rational use of energy and the use of renewable energy sources. The project Smart House is an example of the old building being reconstructed with regard to monumental heritage, energy efficiency in the use of renewable natural raw materials for insulation (including passive attic). Since the building is preserved as monument and on the external side of the building there is no process allowed, therefore the appearance of building remained unchanged and walls are insulated on the inside.
	Timeframes	2005-2008

Detailed description	Aims and activities	• raising awareness of the population on the use of renewable energy sources and on measures of efficient use of energy; • general increase in the production of energy from renewable energy sources; • maximizing energy efficiency; • a significant reduction in greenhouse gas emissions promoting the use of modern approaches and natural materials for the renovation of buildings; • raising the demand for RES and EEA measures, equipment and installations in the consumer market; • providing advice to individuals and companies on RES / EE; • training of workers in the field of RES / EE equipment and installations; • creating new jobs. In order to reduce transmission loss of heat, the quality of heat protection of the building envelope must be at a very high level. • During renovation of the building were used all natural indigenous materials. Straw and clay, as two representatives of these materials are historically important construction materials, since they were used at the beginning mostly everywhere. In addition to straw and clay were for renovations also used: cane, wood, sawdust, hemp, cellulose, coconut fibre … • For wall insulation is used clayey plaster in combination with panels made of cane, which further improves thermal insulation properties of clay. Thermal construction transmittance of the walls is 0,455 W/sq. m K and is smaller then the maximum tolerable heating transfer, which amounts 0,600 W/sq. m K. • For improving insulation capacity of the roof were by reconstruction used cellulose fibers and fibrous wood panels. Thermal construction transmittance is 0,123 W/sq. m K and is smaller than the maximum tolerable heating transfer, which amounts 0,250 W/sq. m K (sloped roof over heated attic).

Detailed description	Barriers and problems occurred	The initiator of the establishment of the systematic demonstration and dissemination center of RES and ERA in Pomurje is Smart House. The lack of awareness of the population and the information gap on the efficient use of energy and energy-sustaining approaches in our rural region shows the high need to establish a center such as Smart House. For this purpose, an abandoned house was selected in 2004 - the old school in Martjanci. The 18thcentury house was actually abandoned for 10 years. It had post offices in it, but much earlier it was a public school, whose rooms were warmed up in winter with wood stoves. In addition, the house is also monumentally protected, including one of the last nesting huts on the chimney, which is very characteristic for the Pomurje region. The performed energy analysis showed that the 18th century building has unsatisfactory thermal conditions. For this reason, in the renovation of the old school, provision was made for quality devices for optimal energy efficiency in combination with natural materials, while also benefiting from renewable energy sources. This enabled both adaptation approaches: efficient use of energy and the use of renewable energy sources. • Installation problems: Since the object is monumentally protected and no operation is permitted on the outside of the building, the outer appearance of the building remained unchanged, and thus the walls were insulated from the inside. The thickness of the thermal insulation on the inside of the walls reduces the building‘s premises. Typically, such thermal insulation is also less effective, the reason are thermal bridges that occur because it can not be placed everywhere (eg, by ceilings, by internal walls, in pressures, etc.). • Use of alternative heat insulation: Various heat insulation materials from more or less natural raw materials and recycled products are available on the market. In addition to some of the environmental benefits highlighted in these products, certain weaknesses are also required in comparison with the classical materials used. Thermal insulation from cellulose, old paper, wood waste, clay, reeds, flax, straw, coconut, cork, cotton or sheep wool has on average slightly lower thermal conductivity than conventional materials. There is also no reliable data on the durability of all these materials. In some, especially organic materials, additives are needed to improve fire resistance, however, these materials do not achieve fire resistance of conventional insulating materials. As a rule, the price of alternative materials is higher than for established products.

Detailed description	Barriers and problems occurred	• An exaggeration with thermal insulation: Problems arise in unprofessional choices. Problematic is that it is exaggerated by thermal insulation, which means unnecessarily high costs. The efficiency of thermal insulation is in fact proportionate to a certain thickness, but then additional thermal insulation is no longer as effective. Example: the difference is significant if there is 5 or 10 cm of thermal insulation. If it is 30 or 35 cm, the difference is very small. But if it is 100 or 120 cm, the difference is unseen, it is completely symbolic
	Main results	By implementing the project, Bistra hiša - Smart House contributed to the fundamental national energy policies in the field of renewable energy sources and efficient energy use (and supported the implementation of the European directive on the energy performance of buildings (202/91 / EC), the Energy Declaration and the Kyoto Protocol. Energy supply of the building comes from renewable energy sources (solar thermal and photovoltaic network system and biomass) and natural materials are used for renovation. Compared to conventional buildings, the building Smart house had a significantly reduced impact on the earth's resources and atmosphere. Special emphasis is also placed on the district heating system for wood biomass - chips as a future local energy source. Consequently, the project aims at reducing or eliminating the use of fossil fuel boilers. The important impact of the project is in the cleaning of forests in the surrounding area and the incineration of less quality wood. The project represents the first pilot example of renovation of the old building heritage building with respect to the monument protection, energy efficiency in the reconstruction using natural raw materials for insulation (including passive attics) and the installation of RES devices and systems. „Old School Martjanci" will have the first example of installing a photovoltaic system in Pomurje and will also be the first example of a facility in Slovenia that has implemented most of the RES and EEU systems at one location. Upon renovation of the old building, they achieved savings of heat energy without heat inflows in the amount of 61,338 kWh, which represents a lower consumption of extra light heating oil by 4,800 liters per year. With this, they dropped 12.8 t CO_2 less into the atmosphere than previously. When constructing a remote biomass system with inclusion of adjacent buildings, they will save 19,770 liters of extra light heating oil annually, which represents 53.2 t less CO_2 emissions per year. - Reduction of resource consumption: After completing the adaptation, the Smart house achieves a low energy standard, which is reflected in improved thermal insulation of the building and reduced heat losses. Great acquisitions are also reflected in the heat energy savings of the building, which amounts to 61,338 kWh per year. • Impact on living comfort: Living comfort in poorly insulated buildings needs improvements. The cause is in cold outside walls. Due to cold exterior walls there is a great temperature difference between the surface of the walls and the air in the room. This difference should not exceed 3°C. Otherwise, „radiant asymmetry" is created by the movement of the air, which is felt by the human body as an inconvenience. In addition, in the case of cold

Financing scheme	For the reconstruction of the old school, the Smart House project obtained a favorable loan of 500,000 EUR from the EKO Fund of the Republic of Slovenia (loan - 85%, own financing - 15%). Thanks to the reconstruction, the investor managed to save up to 61,338 kWh of the thermal energy of the building by reducing the consumption of heating oil from 8,000 l to 3,200 l per year, which is 12,8 tons of CO_2 emissions less! After the adaptation, optimal energy efficiency improvements have made it possible to save about heating energy by more than 55%, which means a good financial result in the light of long-term savings.
Replication	The main proposal for other municipalities or individuals planning to rebuild or build low-energy buildings is to persuade residents (investors) and key actors to play energy-saving measures in building a decisive role. A convincing and entrepreneurial project manager, as well as strong support from local and national authorities, is needed. Local energy production from renewable sources already has and will have an even more characteristic role in local sustainable economic development in the future. It can contribute a decisive share based on an increase in the local value added chain. Therefore, the promotion and implementation of renewable energy sources in local communities is and will remain truly important. To persuade residents and key actors about the importance of energy efficiency measures and the use of renewable energy sources - this is an example of good practice, such as the Bistra House (with one-stop installations) - can play a decisive role. The project Smart House is an example of the old building being reconstructed with regard to monumental heritage, energy efficiency in the use of renewable natural raw materials for insulation (including passive attic). • Good practice can be transferred to other regions, but in case of renovation of protected buildings, the rules laid down by the Institute for the Protection of Cultural Heritage of Slovenia must be followed. • While making façade system, the European standards ETAG 004 must be adopt. It is obligatory for the façades, because the manufactures by obeying their demands demonstrates that the quality of all materials of façade system is controlled and verifiable. • According to ETAG 004, all finish layers must have a lower value of humidity than 0,5kg/sq. m, suitable for outdoor use and are hydrothermal effective, they should prevent humidification of other elements in the system and are resistant to freezing and thawing cycles.
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STOP

2.6. Project Bistra hiša – Smart House – Renovation and refit works of historical building (Geotermic – installation of Heat pump)

Brief introduction	The main Project Smart House started in 2005 in Martjanci. The old school from 18th century was transform into modern, specific regional business incubator, were the headquarters of some development institutions are located. At the same time Smart House serves as a systematic demonstration center of good practices and an advisory and learning center for rational use of energy (RUE) and use of use of renewable energy sources (RES) not only in Pomurje region, but also throughout Slovenia and in cross-border areas.	
Detailed description	Localization	Smart House is located in Martjanci in the municipality Moravske Toplice in Pomurje region, in the northeastern part of Slovenia.
	Concept and background	Energy analysis showed that the 18th century building has unsatisfactory thermal conditions. For this reason, in the renovation of the old school, was planned to ensure the quality devices for optimal energy efficiency in combination with natural materials, while also benefiting from renewable energy sources. This enabled both adaptation approaches: rational use of energy and the use of renewable energy sources.
	Timeframes	Project start date: 2005 Project end date: 2008
	Aims and activities	The goal is: • reduce resource consumption: heat pumps run compared to competitive heating systems extremely favourable, since they consume up to three times less primary energy, such as gas or oil boilers. Approximately 75% of their heating energy comes from the environment free of charge and therefore only 25 % in the form of electricity to produce 100% heating output power. Heat pumps can also be used for cooling. During the season, at elevated outdoor temperatures, the heat pump can be used for passive cooling. • reducing environmental impacts: using efficient heat pumps reduces the negative impact on the environment. Heat pumps are classified as renewable energy sources. With the heat pump system, the sun gives 75% of the energy needed to heat the buildings and prepare hot sanitary water. Solar heat is accumulated directly in the air, ground and groundwater. This ambient heat is available in practically unlimited quantities. • low operating costs: The benefits of heat pumps from traditional heating sources are, of course, the costs that we have through heating due to lower energy consumption. In general, the investment in the heat pump is reimbursed in a much shorter time than other alternative renewable heating sources (solar heating, pellets, photovoltaics...). Heat pumps do not require any maintenance and life expectancy is up to 25 years. In the summertime, they can cool rooms and thus the investment in air conditioners is out. • easy operation: When heating with heat pumps, time, care, additional work and money for the supply of other types of goods are lost. All systems offer extremely convenient and easy operation. With the entire system you can also manage remotely.

Detailed description	Barriers and problems occurred	• Construction problems: the weakness or limitation of the water-water heat pump is that we need a water source with a sufficiently strong and reliable water flow (the required minimum flow rate is 0.2 m^3/h for 1 kW of thermal power and the ground water temperature must not be lower than 7 [deg.] C.). However, it may happen that ground water (water vessels) find a different path. • The biggest obstacle to even greater use of heat pumps represents high initial investment costs compared to the other heat sources for heating system, despite the fact that furthermore the costs are lower. • Granting the irreversible funds and easier method to access then is one of the solutions. Countries that have this kind of heat pump co-financing regulated, record bigger use of such heating system. Meanwhile in Slovenia we record annual battle with bureaucracy for the irreversible funds.
	Main results	• Smart House is energetically provided with renewable energy sources. Solar energy is exploited also with greater solar collector's installation for water preparation that heats facilities and other water requirements. Water is at lower temperatures in reservoir heated with heat pump, at peak time and by increased use with district wood biomass heating. So as an additional secondary heating system we use heat pump type water-water. Brand of the heat pump is Termotechnik model VV 13/15 E1. As a heat source is used underground water trough pumping it within the evaporator of the heat pump using submersible pump. In the evaporator underground water transmits heat and cooled water for proximately 3 to 4 °C returns back. The heat pump achieves very high level of efficiency. Before purchasing and installation is necessary to check the availability of underground water and the temperature of the water. Temperature of the underground water can not be lower then 7 °C (in our case the temperature of underground water is 14 °C), required is minimum flow of 0,2 m^3/h for 1 kW of heat power (in our case, the flow is 3,4 m^3/h). Due to the higher heating number are recommended low temperature heating systems in our case the heating is in walls and floor. • Next to the heating is also carried out passive cooling system of the facility. For cooling we have a system by which the cold source (ground water) is pumped trough an intermediate heat exchanger, which cools water for cooling facilities. Cooling of facilities is carried out with help of floor and wall piping system. Such system is effectively reduced, because we can not allowed temperature water in piping system to go below + 18 ° C to avoid condensation of floor and wall surface. For calm cooling trough walls and floors are available two passive cooling stations PA SIV 6 R and PA SIV 10 R, which prevents the cooling water to drop temperature below the dew point.

Financing scheme	For the reconstruction of the old school, the Smart House project obtained a favorable loan of 500,000 EUR from the EKO Fund of the Republic of Slovenia (loan - 85%, own financing - 15%). Thanks to the reconstruction, the investor managed to save up to 61,338 kWh of the thermal energy of the building by reducing the consumption of heating oil from 8,000 l to 3,200 l per year, which is 12,8 tons of CO_2 emissions less! After the adaptation, optimal energy efficiency improvements have made it possible to save about heating energy by more than 55%, which means a good financial result in the light of long-term savings.
Replication	This good practice is easily transferred to other regions, only certain conditions must be guaranteed: • for example, the required minimum flow rate is 0,2 m^3 / h for 1 kW of thermal power and the groundwater temperature must not be lower than 7 ° C ...). • Heat pumps apply to the international standards EN 225 and EN 14511. Some submit the coefficient of performance (COP), using old standard EN 255, which takes into account heated water temperature difference of 10 K, while the standard EN 14511 takes into account the temperature difference of 5 K. Parameter difference is by this comparison of COP up to 10 %.
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2.7. Car-sharing programme for electric cars

Brief introduction		The project was initiated in order to develop car-sharing scheme which also includes electric cars and the infrastructure (i.e. charging stations, rental places, etc.) required for Bolloré's (provides the Autolib' car-sharing service for electric cars in Paris) European electric car rental concessions, which the company won via public tenders. The project consists of a full electric car-sharing service, which includes an interconnected on-street infrastructure and a supporting IT network system. The project started in Paris, providing the city with environmentally friendly electric cars with the support of the city council. After the trial period and when a track record had been established, Bolloré targeted Lyon and Bordeaux for the green initiative.
Detailed description	Localization	Paris, Lyon and Bordeaux / France
	Concept and background	Similar to many other cities, Paris, Lyon and Bordeaux are struggling with traffic congestion, a lack of parking spaces and air pollution caused by a high number of private vehicles. To reduce traffic, Bolloré wants to offer a successful car sharing service in order to increase the sustainable mobility service offer; the car occupancy rate particularly in sensitive urban areas and encourage more energy-efficient travel behaviour and decrease traffic, congestion and pollution.
	Timeframes	2013
	Aims and activities	Bolloré aims to provide reserved parking areas for car sharing, so that users of the car sharing service will easily find a parking space and will have no problem finding a vehicle. This project aims at managing and operating in an optimal way a fleet of electric car-sharing vehicles which will led to reduction in emissions, more efficient use of vehicles and publically available car sharing.
	Barriers and problems occurred	One of the main problems to be solved is how to prevent car sharing parking spots to be used by unauthorised vehicles to stimulate behaviour change and foster a culture of sustainable mobility. Citizens will need to be made aware of the service, as well.
	Main results	At the end of 2015, Bolloré had 3,944 cars and 6,493 charging stations installed across the project's three locations. Preparations for the project to expand into other cities have begun, including London (the UK) and Indianapolis (USA). This project brought reduction of CO_2 emissions of minimum 50% compared to baseline. This was the first EEEF transaction for clean urban transport in Europe. In the project participated 51 municipalities in the Paris/Île-de-France region and the project results were accessible to more than 4 out of 7 million inhabitants.

Financing scheme	The French company Bolloré, which provides car-sharing services for electric cars via Autolib'in Paris, Bluely in Lyon and Bluecub in Bordeaux, signed a bond agreement – bullet loan worth €30.0 million with the EEEF in 2013. The bond has a maturity of five years and was issued by Bolloré and purchased by the EEEF. The repayment method is bullet structure. A bullet loan is a loan that does not amortize over time and must be repaid with a single large payment (also called a balloon payment) at the end of the term of the loan. Because of this, bullet bonds may pay a relatively low rate of interest due to the issuer's interest rate exposure. A bullet loan provides the advantage of not having to immediately begin paying back the loan. This can be preferable for companies that have near-term cash flow issues. The borrower must, however, be prepared to repay the principal and interest in its entirety at the end of the term.
Replication	The successful implementation of a public electric car-sharing program in a city as crowded and spatially challenged as Paris proves that it can be implemented everywhere. If this practice would succeed anywhere it is necessary to involve cities and municipalities in funding scheme, particularly by financing the construction of stations and the securing of parking spaces.
Contact details	Bolloré - French company which provides car-sharing services for electric cars. It was founded as family business in 1822 and it holds positions in activities around three business lines: transportation and logistics, electricity storage and solutions and communications. Puteaux, France

3. Financial Support Modes

3.1. Support for building energy development using renewable energy with combined credit products

Brief introduction	The call contributes to improve the energy-saving and energy efficiency of buildings by using renewable energy sources. It provides a grant support and loan for the realization of investments. At the same time it serves to strengthen environmentally conscious economic competitiveness, reduce the amount of environmental load and primary energy used and to reduce the business incomes.	
Detailed description	Localization	The whole territory of Hungary
	Concept and background	This announcement was jointly published by the Deputy Secretary of State for Economic Development Programs and MFB Ltd. under the Economic Development and Innovation Operational Program according to the 1006/2016 (I.18.). Government Regulation on the Annual Development Allocation for Economic Development and Innovation Operational Program. Approximately 40% of the energy consumption in Hungary occurs in buildings. If our buildings are well insulated and operated in an energy-saving manner, we also create the energy-security for the generations of our children and grandchildren. We intend to raise energy-efficiency by improving the thermal properties of the buildings of enterprises (insulation, replacement of doors and windows); modernization of non-production heating, cooling and domestic hot water systems using renewable energy sources, modernization of lighting systems and renewable electricity generation. The necessity for increasing energy-efficiency and energy-saving is also confirmed by the fact that according to statistical data, domestic energy intensity is estimated to be more than three times and as measured on a parity value of unit GDP, 1.5 times higher than in developed EU Member States. This is a serious disadvantage for domestic companies in the market competition both from an environmental and economic point of view.
	Timeframes	16. 03. 2017. – 18. 03. 2019.
	Aims and activities	Supporting the building-energetic projects using renewable energy with a combined credit product is aimed at providing non-refundable subsidies and loans for small and medium-sized enterprises to invest in energy-saving and energy-efficient buildings using renewable energy sources. It also serves to strengthen environmentally conscious economic competitiveness, to reduce the amount of environmental load and primary energy used and to alleviate the burdens on business overheads.
	Barriers and problems occurred	No problems in the implementation of the investment.
	Main results	Since energy appears to be a significant item in the production costs of a business, its support has become important. The subsidy is available for most of the small and medium-sized businesses, which many have applied for.

Financing scheme	91.53 billion HUF (of which the non-refundable subsidy is 59.45 HUF billion and the loan amount is 32.08 billion HUF). Non-refundable subsidies and loans for this announcement are available with at least 10% own financial resource in a simplified procedure, one-stop-shop system. The simultaneous use of non-refundable subsidy and the loan is compulsory. In addition to non-refundable subsidies, this structure offers loans with much more favourable conditions than the market. The project to be implemented consists of non-refundable subsidies, loans and contributions, which together define the total cost. The amount of non-refundable subsidy is: minimum 3 million HUF, max. 50 million HUF. Amount of loan: min. 3 million HUF, max. 50 million HUF. The amount of non-refundable subsidy can be up to 45% of the total eligible cost.
Replication	Energy efficiency plays an increasingly important role in the renovation of buildings; this project is primarily directed at the public sector‘s attention to this fact, which supports micro, small and medium-sized businesses. The benefits of the loan, on contrary to the 100% support, is the principle of additionality represented by the EU, which should be applied to most projects. As the project winning business or even individual may invest in its own interests and make a new investment, improvement which can have the most significant impact on itself or the public.
Contact details	https://www.palyazat.gov.hu/ginop-411-844-16-megjul-energia-hasznlatval-megvalsul-pletenergetikai-fejlesztsek-tmogatsa-kombinlt-hiteltermkkel-1 http://www.mfbpont.hu/ tel.: +36 1 896 6666 e-mail: ugyfelszolgalat@mfb.hu

3.2. Residential Energy Efficiency Loan Program

Brief introduction	The aim of the supported loan program handled by the Hungarian Development Bank (MFB) is to lend money to the residents for energetic investments in more favorable conditions than the general consumer installment loans on the market. The favorable, 0% interest is made possible by the non-refundable resources given by the European Regional Development Fund. This means that unlike previous Hungarian practice (e.g. the 30-50%, fully funded program Otthon Melege) the support is in the interest of the loan and the households pay back the investment capital to the bank.	
Detailed description	**Localization**	The whole territory of Hungary
	Concept and background	The highest energy and CO_2-saving potential in Hungary is in the residential sector. A 0% interest bank loan is a good operable financing solution in several West-European countries. The system provides a possibility to mobilize the private capital of households and head the financial sources in the direction of the development of energy efficiency and use of renewable energy sources.
	Timeframes	Available from 05-2017 until the run out but not later than 31th December 2022
	Aims and activities	Activities regarding the improvement of energy sufficiency: 1. Lagging of outside walls (eligible independently); 2. Replacement or modernization resulting in energy saving of outside windows and doors (eligible independently); 3. thermal protection of buildings for the summer with shades (only with another activity that is eligible independently); 4. modernization of hot water system for heating and/or utilization: I. modernization of heat-producing systems or their replacement with modern, high-efficiency equipments (e.g. condensing boiler) (eligible independently); II. modernization or replacement of exothermal equipments (e.g. surface heating) (eligible independently); III. necessary chimney technology developments (only eligible on the terms of I.); IV. building of automated central (heat source) and local (exothermal) regulations (eligible independently); 5. modernization of recuperator, building of a VRF5 cooling system (eligible independently); 6. replacement of existing indoor and outdoor lighting system with an energy sufficient system (only with another activity that is eligible independently: I. replacement of light sources, illuminators and connectors; II. modernization of lighting systems

Detailed description	Aims and activities	Activities regarding the utilization of renewable energy: 1. solar cell system for producing hot water for utilization and/or for helping the heating system (eligible independently); 2. building of a briquet, pellet, wood chips, wood gasification boiler system to produce hot water for utilization (eligible independently); 3. installation of solar cell system to cover the building's power requirements (eligible independently); 4. heat pump systems for heating and/or cooling and/or producing hot water for utilization and/or for helping the heating system (eligible independently). Development and project management and other expert costs are eligible not independently but as part of the execution.
	Barriers and problems occurred	Since the first announcement it was modified four times, the date of the last modification is the 7th May 2018. These modifications were needed because very few people applied for the loan. According to experts the current construction is still not perfect because to match the technical expectation one must invest in combined systems (i.e. investments regarding renewable energy and energy efficiency at the same time) which exceeds the potential and/or the demand of the borrowers. The 0% bank loan is a new financing system in Hungary. As it is a long term program, we still have very few experiences regarding to the results of it. But the first year of the operation shows some risk and difficulties: • Limited potential target group, some of the household cannot afford savings (lack of self-effort) • The relationship between the contractor and the consumer is mutually dependent, the lender is not liable (if the execution does not bring the indicators, the borrower is liable alone) • The unit prices and the fees specified in the application are very low (the fees for example for the lagging of front increased with nearly 100%, while the material prices also increased with around 30-50% in last year) • The achievable energy savings are not put in HUF in the prospectus • The level of aid is low compared to the 50% state aid granted in previous years, so it is not attractive for a large proportion of the population • Due to the high VAT in Hungary (27%), the construction is not competitive with the black-market in the building and renovation sector

Detailed description	Main results	According to the MFB the households should apply for the loan because the discounted instalment payment could be lower than the energy saving achievable by the investment. These theoretical calculations should be treated with reservations since the prices of the building industry – the increasing fees and material prices – as well as the unique energy saving potential of the buildings could result in different pay-offs regarding the investment. This is why unique planning and calculation is necessary. On the other hand, we must add that energetic pay-off calculations disregard such pros of the investment like increasing in conformity, safety, environs, air quality improvement and the improvement of the real estate's market status. It is too early to say anything about the efficiency of the discounted, Residential Energy Efficiency Loan Program in the first half of 2018. If it will become a success then it will greatly contribute to the improvement of the energetic status of households and the share increase of renewables. The advantage of the supported loan construction is that with a low support rate a huge amount of private capital can be moved and directed to the sustainable energetic goals. On the other hand, from the nearly 3.3 million households that would need it, only a small amount can utilize the loan product since the target group that have access to the loan is relatively small. In the last decade the residential willingness for applying for a loan has substantially decreased. According to energetic expert organizations the too high energy expectations at buildings further decreases the opportunities to apply for the. It should be considered to make concessions in achieving the cost-optimal level, that would give way for partial investments (e.g. replacement of windows, lagging or modernization of heating alone).

Financing scheme	The Hungarian Development Bank Zrt (MFB) provides a 370 million EUR credit from EU resources as a loan without interest to support residential investments regarding energy efficiency and renewable energy sources. This credit provides resources for approximately 50.000 households. Most of the money (340 million EUR) is for people living in rural areas. The minimum amount of the loan is 1600 EUR, the maximum is 32 000 EUR for individuals and 22 000 EUR/apartment for apartment houses and housing cooperatives. The duration of the loan can be 20 years tops. Own contribution is 10%. The Loan Program does not include state support. Collateral cash at individuals: Can apply without collateral cash under 16 000 EUR. Over 16 000 EUR the collateral cash needed is at least 50% of the equity exposure.
Replication	As the core model is in operation for long time ago in several countries, the replication of the model is a good possibility to move the private money to the EE/RES investments. Still the early experiences in Hungary show, that the decision makers and executive bodies need high caution in the process of adaptation. A deep market research, analysis of needs and financial conditions of the target group, test phase, pilot investments, regularly monitoring of the system are indispensable elements of the lending of the money.
Contact details	https://www.mfb.hu/maganszemelyek/lakossagi-energiahatekonysagi-hitelprogram-t32-p32

3.3. Home savings, pre saving system for housing purpose with financial state support

Brief introduction	The biggest potential of sustainable energetics is in the radical correction of the home sector's energy efficiency and in the widest utilization of renewable energy. A result on a larger scale is only achievable in the energetics of a settlement if a substantial investment gets underway not only in the public institutions but in the residential, production and service sectors as well.	
Detailed description	Localization	The whole territory of Hungary
	Concept and background	Home savings (HS) is a very popular construction that is supported by the state with the aim of stimulating investment in housing. It is available for individuals, apartment houses and housing cooperatives as well. Basically, in this construction the saver's monthly, regular but long-term, smaller amount of savings (15-60 EUR) are matched by the Hungarian state every year with 30% of the whole amount (max 230 EUR). Furthermore, the savings continue to carry interest during the savings period. The criterion for HS and for the support that comes with it is that the saver can show receipts that the savings were spent only for housing purposes, be it the buying of a building site or an apartment, the modernization of own real estate (e.g. window replacement, heating modernization) or esthetic renovation. HS construction with the state's support and interests can reach a 9-10% out-turn in a typical four-year (or even longer) period which is better than a simple bank deposit or other investments. Thus, it is a popular savings method. Besides the savings the financial institutions giving the contract offer other loans with discounted interests for housing purposes. The savings and these optional loans together can reach an amount that enables substantial investments. The support is available for private persons and multi-apartment buildings. Primarily savings contract can be made for the individual but legally it is possible to do it for persons with diminished capacities (e.g. a child) by the parents, a legal guardian or a child protection institute. Contracting parties can be apartment houses or housing cooperatives. In this case the renovation of the common properties are possible: for example, common parts of the heating systems, renovation of chimneys etc.
	Timeframes	Available from 1997

Detailed description	Aims and activities	The key element of the construction is the limitation that it can only be used for housing purposes and this has to be proven by receipts thus a serious amount of state support can be built into it. Buying, building, replacing The savings and the loan can be used for buying the ownership rights for an apartment or a building site, as well as for replacing an existing real estate with one with higher value. Renewal, expansion, modernization Due to the nature of the construction the most popular goal is expansion and modernization. OTP's home savings website gives comprehensive examples on what you can do with the savings: • kitchen: built-in kitchen, built-in appliances: fridge, oven, dish-washer, exhaust fan, cooktop • bathroom: tiles, boiler, sanitary, shower cabin, tub, sink • doors and windows, replacement of roof, garage gate, shade, safety lock, front door • incorporating energy-saving equipments, installing solar cells and solar panels • built-in air conditioner, alarm system Public works, public utilities E.g. solid-paved road, sidewalk, powerlines, gas main, water-conduit, sewer, rainwater drainage, ditch, IT network connection Replacing a loan or a financial lease HS can be used to replace loans (the whole loan or some part of it) added earlier.

Detailed description	Barriers and problems occurred	However the Home Savings system is a popular solution and can provide a strong contribution to the energy refurbishments in the residential sector, it has several limitations of utilization. Several Hungarian households cannot save money regularly, they are not able to receive the state support. As the rules of the system did not change in last decade, it does not follow the trends of the housing market. The potential target group is limited: only adults with the means for savings for housing purpose that means maximum 25-30% of the population. The maximum of the state support did not change for years. It is not enough to buy a real estate with savings alone. Set utilization period that does not adjust to the difficulties building industry (prolonged construction, rise of costs). Low financial awareness in the population, lack of long-term planning.
	Main results	Home saving system is in concordance with energetic investments. The amount of money accessible is enough for a partial or complex energetic refurbishment in a household. However, the home saving system does not provides any statistics on the energy savings of the investments financed by it, we can estimate the benefits on the level of a household. Model calculations on different types of buildings show 46-75% energy saving after complex renovation (thermal insulation, new windows, refurbishment of the heating system). The following investments can come into question in the home savings: • Replacing windows and doors with double or triple glass (max. U=1,1 W/m^{2}K) • Lagging of walls (max U=0,3 W/m^2 K) • Lagging of roof (max U=0,17 W/m^{2}K) • Replacement of the old gas boiler to condensing boiler • Replacement of heat transfer surfaces, radiators • Wood gasification boiler • Heat pump systems • Heat recovery ventilation systems • Smart buildings, building automation • Solar collector • Solar cell • Modernization of lighting system

Financing scheme

The total amount at the end of the saving period to spend on housing purposes is the so-called contract amount.

This amount is the sum of the private savings, the bank interest, the financial support of the state and the bank loan with discounted interests that can be used beside the savings for the retrofit.

Contract amount=own savings+interests+state support+bank loan

Example: By saving 30 EUR/month in a four-year savings period you can invoke 460 EUR in state support next to your 2600 EUR savings which, depending on the costs of financial institutions, means a 10-12% out-turn and 2000 EUR savings that can be used for housing purposes.

As an additional financial source a discounted loan is offered for the household in amount of 2500-3000 EUR.

With a higher amount (60 EUR) of savings per month and a longer, but still foreseeable eight-year period the state support for one contract can be as high as 1900 EUR and at the end of the savings period you will have 8000 EUR and with the bank loan 20-22 000 EUR financial frame for housing purpose.

Model calculations of the home saving system

Monthly saving (EUR)	Saving period (months)	Own saving (EUR)	State support (EUR)	Total savings (EUR)	Contract amount (EUR)
30	48	1500	460	2000	4500-5000
30	96	3000	900	4000	10-11000
60	48	3000	900	4000	10-11000
60	96	6000	1800	8000	20-24000

Replication	The Home saving system has been operating long ago in several European countries, e.g. in Germany, Austria, Czech Republic and Slovak Republic. It's a well-tested traditional financial system, which could contribute to the development of energy efficiency of the residential sector. Because of the stable, predictable state support and the decades of experience of HSs, the construction is popular. The ratio of support and individual capital is favorable: the increase of HSs' market weight proves that they can draw in a massive amount of individual capital for housing purposes. The advantage of the construction is that – with conditions and limitations – it is very flexible and it can be used for smaller, partial investments or for a full, complex and cost-optimal renovation of a building as well as for the installation of energy recovery equipment. It would mean a huge energy saving potential if the populace would use their savings in home savings bank for energetic modernization in increasing number. To do this, we need to have the appropriate analyses and statistics and we need to be able to motivate the population. Although penetration in Hungary is still low compared to other countries, this could be avoided by the thematic communication of energetic modernization and by developing a premium system for green investments inside HS. The popularization of less-known technologies and the presentation of the advantages of energetic investments, could bring new clients to the banks. Home savings banks have a huge awareness-raising and informational potential since they can communicate to a lot of clients directly.
Contact details	In 2018 there are four operators in the field in Hungary: Fundamenta Lakáskassza www.fundamenta.hu OTP Lakástakarék https://www.otpbank.hu/lakastakarek/fooldal AEGON Lakástakarék https://www.aegonlakastakarek.hu/ ERSTE Lakástakarék https://www.erstebank.hu/hu/ebh-nyito/hitelek-es-otthon/otthonmegoldasok/lakas-takarekpenztar

3.4. Building's complex energetic development of SMEs by combined loan products

Brief introduction	The improvement of SMEs' energy efficiency and their application into energy self-sufficiency is simultaneously serves climate protection and competitiveness goals. Since SMEs could not finance the necessary investments with self-effort, the development of a construction that could accelerate the investments and motive the enterprises to mobilize alternative resources as well was needed. These combined loan products can result in the application of private capital beside the community resources to serve climate protection and the energetic goals.	
Detailed description	**Localization**	The whole territory of Hungary except the Central Region
	Concept and background	The aim of the loan program is the decrease of primary energy consumption, the increase of the utilization of renewable energy sources, the reduction of greenhouse gas emissions and the development of a green economy. The background of the combined loan program is ensured by the European Regional Development Fund and the Hungarian budget. The sum of it was 13.9 billion HUF (44.8 million EUR) and it was planned to be used for 1700-3200 projects.
	Timeframes	Claimers could apply for the program between March 2017 and January 2018 for ten months, until the resources were exhausted.
	Aims and activities	The support+loan was only eligible for complex development projects that ensure that energy efficiency is improved and some kind of renewable energy source is installed as well in the producing buildings of the applying SME. This practically mean lagging works, window replacement and the modernization of the heating system. It includes cases when an enterprise changes the previous gas heating to biomass heating, as well as the replacement of the outdated gas boilers to condense boilers. In point of renewable energies, the loans supported the installation of solar collector, solar cell, heat-pump and biomass-based systems. It is an important issue that buildings that have a residential purpose cannot apply so the loan can only be used for the improvement of buildings that are economically active in regard of production. In cases like this the function of the whole building or a part of the building must be changed and it must be proved by submitting the official papers regarding the authority. This flexibility allows those enterprises to apply as well where these questions were raised only recently. The program does not support the construction of new buildings unless it serves the installment of an equipment utilizing renewable energy (e.g. stokehole in case of biomass heating).

Detailed description	Barriers and problems occurred	The financial sources of the program exhausted within 10 months. The short supporting period and the financial framework does not ensure the utilizing the real volume of potentials of energy saving and renewable energies in the SME sector. The fast exhausting of the program creates uncertain economic conditions for the enterprises. It does not help the long term and planning.
	Main results	The fast exhaustion of the resources of the combined loan program showed that there is a substantial demand for the energetic improvement and energy self-sufficiency of the producing buildings inside the SME sector. Motivating complex building energetic investment in the sector could prove fruitful in the future as well, since it can give a systematic, long-term solution for the problems provided by energy wasting buildings and excessive energy dependence. High supporting intensity was a substantial charm of the program which is a success in one hand but one the other hand, we have to note that due to the fast exhaustion of the resources, a lot of SMEs missed the opportunity. SMEs need a more predictable, long-term support program.
Financing scheme		The total amount of the program was 13.9 billion HUF (44.8 million EUR). 50% for the non-refundable support, 50% for the discounted rate bank loan. In frame of combined loan program SMEs could apply to non-refundable support and an optional discount lending from banks in a simplified procedure. The non-refundable support was decided in a simplified selection procedure, while the loan was decided by MFB's credit assessment procedure. The maximized non-refundable support was 45% of the total project costs. The minimum own contribution was at least 10%, although they could draw-in more own resource. The remaining costs (if necessary) could be covered the low-interest bank loan. The discount rate of the loan was 2%. The loan must be paid back in maximum 10 years. The cost of the supported projects is between 3.3-111 million HUF.
Replication		Fast exhaustion is due to the program's substantial popularity. It is due to the substantial non-refundable interests and the low rate. In purpose of climate change goals the support of SME sector is necessary in the future too. The popularity of the combined loan program showed a massive demand of financial initiatives for the enterprises. It is important to note that the high, 45% support intensity in the next EU resource allocation cycle is not a realistic goal – instead, a bigger application of private capital should be motivated.
Contact details		https://www.palyazat.gov.hu/ginop-411-844-16-megjul-energia-hasznlatval-megvalsul-pletenergetikai-fejlesztsek-tmogatsa-kombinlt-hiteltermkkel-1

3.5. Energy efficiency support with combined financing tools (and with building society savings) – The Warm of Home Program

Brief introduction	In Supports the realization of cost-effective investments to build energy efficiency, condominiums, housing societies and the reduction of carbon dioxide emissions as well as the use of renewable energy sources by providing state budget resources. In order to get the support and to execute the financing of the execution quickly building society bank financing is founded and service is used.	
Detailed description	Localization	The whole territory of Hungary
	Concept and background	Under the Warm of Home Program, condominiums with a maximum of 50% support, could reach the replacement of outdated heating, hot water and power supply systems and the provision of low quality heat insulation. Despite the high aid intensity, the targeted user circle had low self-savings and savings, so a solution was made to reduce these burdens. Here comes the saving of housing, which does not qualify as dual financing, will help to efficiently finance the transaction, and will subsequently assist in the conscious saving thinking.
	Timeframes	2015 – with variable construction
	Aims and activities	Through funding, investments in energy efficiency will be implemented in homes. The energy cost of condominiums will be significantly reduced. The aid is aimed at modernizing the heating system, replacing hot water and energy supply systems and developing efficient thermal insulation systems.
	Barriers and problems occurred	During the first call for applications, many applicants applied for a quickly exhausted framework so not always the most efficient investments were selected, but the tenders received until the suspension of the framework were ranked. Another problematic element is the execution of the execution. Execution can only be carried out using registered companies. In many cases, such an undertaking has overlooked itself and slid into the implementation. With regard to financing problems, there could also be disruption in commercial banking decision-making. In the first place the lack of appropriateness of the dates of the necessary certifications hampers the case. The dates of the certificates were running in the bank's decision-making process.
	Main results	In 2015, nearly 500 applicants, sum 1.400 homes have been rebuilt to a total of 23,9 million HUF. The amount of support is 11,8 billion HUF.

Financing scheme	The course of funding: • preparation of an application, energy assessment • carrying out an implementation cost plan • the decision of the condominium assembly of a condominium on the granting of the grant, the adoption of the budget and the selection of banking financing • submission of the proposal • signature of the supporting document, preparation of the bank loan agreement conclusion of housing contracts • execution, based on schedule, bank financing, drawing up support amount • technical transfer, winding up with the contractor • After 4-5 years, spending on building society savings bank loan repayment For example: • 25 flats in the condominium • Energy classification of the building before tender: E • Energy classification of the building after tender: B • Decreased greenhouse gas emissions: 30400 CO2 emissions • Expected energy savings: 39,1% • Total investment costs: 49.649.230 HUF • Eligible investment costs: 46.391.704 HUF • Support degree: 22.800.000 HUF • Private resources degree: 26.849.230 HUF Building society savings in the financing of the private resources: Private person: 13.550.000 HUF Condominium: 6.450.000 HUF Total: 20.000.000 HUF Total LTP payment: 18.609.657 HUF
Replication	The programme can also be copied the other regions where the state financially supports investments that generate significant energy savings, the beneficiaries have their own resources, as well as incentives for housing savings. Particularly suitable for Eastern European countries where discretionary income is lower. The financing scheme can be used with other outcomes for example conversion of condominiums into a passive house. An important element of adaptability is that the applicant is motivated in the field of implementation, in contrast to exclusive non-refundable subsidies or even Community funding. The overall advantage of combined products is this.

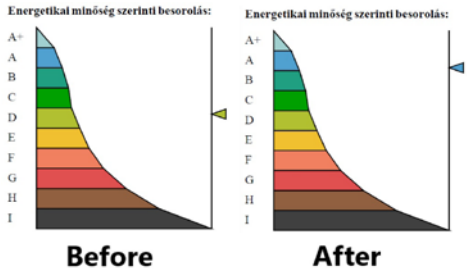
Contact details

As regards to support side:

With respect to the tender issued from the Hungarian budget, the National Development Ministry and the National Development Strategic Institute will act as of April 1, 2016.
Their task is to write, manage, evaluate, monitor, execute, promote and promote marketing applications.
Housing savings: The LTP (building society) is a specialized credit institution that deals solely with the collection of housing loans and the provision of housing loans. Flat-priced saving are a state-subsidized building finance option. The state provides support after saving. The building society provides favourable credit facility with the expiry of the savings period. All Hungarian citizens can use it, regardless of the family status or income.
There are currently four organizations in Hungary with LTP service:

Fundementa Building Savings
Erste Building Savings
OTP Building Savings
AEGON Building Savings

Commercial Banks: Financing the Investment Financing. Their tasks are carried out on a market basis.



4. Public lighting development

4.1 “Helmut - street lighting with civic participation within the Project Climate and Energy Model Region Klostertal”, Austria

Brief introduction	In the course of the project “Climate and Energy Model Region Klostertal” the municipality of Dalaas replaced 134 old street lighting fixtures with luminaire heads with modern LED technology and could thus reduce the power consumption from 77,000 kWh to 11,000 kWh per year. The measure was largely financed by an innovative public participation model and the region’s first public participation LED street lighting.	
Detailed description	Localization	Municipality Dalaas, Klostertal, Austria
	Concept and background	The municipality of Dalaas operates a total of 308 street lighting points throughout the municipality. With a total power consumption of 128,000 kWh per year, they account for 40% of the total electricity consumption of the municipality of Dalaas. 174 of the 308 lamps have already been converted to energy-saving sodium vapor lamps in recent years. With the project „Helmut“, the remaining 134 lighting fixtures were replaced by modern LED street lighting heads in the summer of 2013. The reduction of power consumption for the 134 lamps corresponds to an annual cost saving of approx. € 8,500. The municipality Dalaas has opted for a civic participation model. With a so-called “LichtSchein” (Light Tickets), the population was able to participate in this flagship project.
	Timeframes	Summer 2013 Replacement of 134 lighting fixtures with modern LED street lighting heads Quick measure during the development of the project concept
	Aims and activities	Aims: • Reduction of power consumption • Reduction of costs • Participation of the inhabitants Activities: • Replacement of 134 lighting fixtures largely financed by an innovative public participation model • Public participation through marketing and sale of “Lichtscheine”
	Barriers and problems occurred	No significant Barriers due to e.g. public information events
	Main results	• Reduction of power consumption from 77,000 kWh to approx. 11,000 kWh per year • This corresponds to an annual Cost saving of approx. € 8,500 • Successful public participation à so called LichtScheine” were sold out after ten days à € 100.000 were provided

Financing scheme	Most of the investment was financed through an innovative public participation model. By using the following model, € 100,000 were provided by the population within ten days. Every individual could by so called “Lichtscheine” (Light Tickets). One “Lichtschein” costed € 1.000, which was enough to modernize two street lamp heads. The legal basis was hire purchase. The purchaser received a refund of € 140 per year for the purchase of a license for 8 years, which equates to an effective interest rate of 3.25% and 3 LED lamps (value € 30) for home use. In addition, the purchase was cancellable at any time for a handling fee of € 80. The balance was paid in full.
Replication	Generally, yes, but the respective regional legal frameworks (here: hire purchase) must be taken into account.
Contact details	Gemeinde Dalaas Bahnhofstraße 140 6752 Dalaas, Austria Tel.: +43 (5585) 7201 e-mail: gemeindeamt@dalaas.at

4.2. Birmingham's LED street lighting project

Brief introduction		Birmingham's LED street lighting project is a small but integral component of a larger, innovative public-private infrastructure modernization effort — the Birmingham Highway Maintenance and Management PFI (HMMPFI) — which the Birmingham City Council (BCC) signed with Amey plc in 2010. The modernization is being done under the Private financing initiative (PFI) framework, which was created by the UK government to increase the availability of private financing for capital projects, and to transfer risk to the private sector through joint ventures and leasing agreements. Project scope includes modernization of streets, tunnels and related assets. The main goal of the project is for Birmingham to become the best place in the UK to live, learn, work, and visit, "with a low-carbon energy infrastructure and well prepared for the impact of climate change.
Detailed description	Localization	City of Birmingham, United Kingdom
	Concept and background	Birmingham has approximately 2,500 kilometres of streets, roads, and urban highways, as well as 850 bridges, tunnels, and related transportation structures. At night the city is illuminated by 97,000 streetlights that are owned by the city. In the past, most of these were high-pressure sodium, mercury vapour, and metal halide lamps. Before the LED program, many of Birmingham's streetlights were old and in need of replacement. Decisive interest in LED street lighting came from Amey plc, prompted by the firm's positive experience with LED luminaries in other UK cities. Within the PPP contract, Amey plc is responsible for complying with Output Specifications that meet specific lighting design standards set by the national government.
	Timeframes	2010 - 2015
	Aims and activities	The use of a full-lifecycle costing model that measures financial costs and benefits over the lifetime of the service; The innovative use of CMS technology to maximize energy savings, extend the lifetime of the LED luminaires, and create new opportunities to adapt the level of illumination on specific streets or neighbourhoods to their particular uses and needs; The aim of the project includes next: establish a national framework in order to smooth the process, minimize conflicts with precision, communication, and feedback channels, achieve greater energy savings and lower costs with periodic reviews of selected technologies and ensure the scope of the project is clear and the required outcomes are clearly defined.

Detailed description	Barriers and problems occurred	The main problem occurred during the project implementation was how to address the deterioration of its highways and street lighting. Therefore, the PFI allowed the city to redress the lack of past public investment, and offered a mechanism for standardization, specification, and long-term management and maintenance of its street and road network and associated assets within the Council's jurisdiction. Conflicts between Amey and BCC – regarding the implementation of the HMMPFI (Highway Maintenance and Management Services in Partnership) which were solved through precision, communication, and feedback channels.
	Main results	In the end of 2015 through project 97,000 streetlight luminaires were replaced. Besides that, upgrade of associated street infrastructure such as columns were made. This all allowed for LED luminaires to be assessed using a full life cycle model as part of the modernization of the large lighting system. The scale of the project also gives engineers the opportunity to incorporate a wireless Telensa CMS for the streetlights. These controls would enable the LED luminaries to be operated in the most energy efficient manner across a range of situations and over their full operating life. This complete LED system approach has enabled Amey to maximize energy savings, as well as trim current levels to the LED devices whenever appropriate, thus reducing heat build-up and extending the lifetime of the LED devices.
Financing scheme	The main financier of the project was Amey and he provided the core investment funding. National government provided PFI credits ($996 million). Other funding came from private sector – Uberior Fund, Equitix fund - $530 million). The project was financiered through Private Financing Initiative (PFI) - a public services contracting model in the United Kingdom based on the public-private partnership (P3 or PPP) model - in order to capitalize upgrades and modernization of streets, roads, tunnels, street lighting, and related assets. PFIs are long-term contracts (typically 20–35 years) where the private sector constructs the project's assets (in this case public lightening) and raises the required funding, usually on a project finance basis (i.e. where contractual payments from the public sector represent the primary security for funders). By contracting in this way, the aim is to ensure that whole-life costs associated with such assets are minimized and required associated services are provided competitively. Wherever possible, contracts specify the outputs rather than the inputs associated with a particular project. This kind of funding enables the shift of LED performance risks away from the municipality to the private sector entity (in this case Amey, the service provider).	
Replication	The best practice could be implemented in other regions where are enough conditions (framework of national institutional policies and subsidies to smooth the process) to create this type of public-private cooperation. When designed and procured well, private participation in infrastructure provision can promote new technologies, deliver higher accountability, establish more cost-effective operations and achieve financial sustainability for infrastructure undertakings. Under the right conditions, PPPs deliver a higher quality service at a lower cost. The EBRD aims to help its public sector clients achieve those right conditions.	

Contact details

Amey plc - previously known as Amey Ltd and Amey Roadstone Construction, is a United Kingdom based infrastructure support service provider. It was founded in the 1921 by William Charles Amey as an Oxfordshire-based quarry operator. Amey works for the public and regulated sectors in the United Kingdom, selling services including highways and rail management and maintenance, facilities management, waste collection and treatment provision of utilities services as well as consultancy services.

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Birmingham City Council - is the local government body responsible for the governance of the City of Birmingham in England, which has been a metropolitan district since 1974. It is the most populated local council in the United Kingdom (excluding counties) with, following a reorganisation of boundaries in June 2004, 120 Birmingham City councillors representing over one million people, in 40 wards.
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4.3. Street lighting upgrade of the City of Venlo

Brief introduction	The overall goal of the project is to build both technical and policy support for a transition to more energy efficient public lighting in City of Venlo. By increasing the energy efficiency of public lighting installed, the project will significantly reduce electricity consumption by the public lighting sector in City of Venlo. Through the project The City of Venlo is financing a street lighting upgrade which will equip around 16,000 lighting points with light emitting diode (LED) lights, presenting approx. 73% of the total lighting points of the city.	
Detailed description	Localization	City of Venlo, Netherlands
	Concept and background	Venlo has 100,000 inhabitants and was among the first cities in the Netherlands to initiate climate and energy programmes, starting in 2004. The city's existing public lighting is the biggest consumer of electricity on its electricity bill. The city therefore prioritized upgrading its street lighting in order to reduce its energy consumption and CO_2 emissions as well as to save costs for the public budget.
	Timeframes	2012 – 2016
	Aims and activities	This project is designed to overcome barriers with a comprehensive and coordinated array of technical, policy and informational resources. The project activities have been tailored for use by targeted public lighting stakeholders, and designed to be both sustainable and replicable. The project will work to ensure that local governments in Netherlands can access public lighting technologies and practices. The project includes this activities: implementation of activities aimed at strengthening and improving the policy and regulatory framework to encourage feasible EE public lighting projects in other regions; strengthen the capacity of relevant governing agencies, market monitoring and enforcement of standards with consumers, encouraging the government, financial/ banking and private sectors; to provide financial assistance to the development and implementation of EE public lighting system projects; implementation of activities aimed at showing the cost-effective design, development, financing and implementation of EE public lighting system projects; production of high quality, affordable, accessible and up-to-date information services; continuing education, and awareness improvement on the application of EE public lighting systems.
	Barriers and problems occurred	Some of barriers that project need to overcome are insufficient information and insufficient investment capital in public lighting investment choices, not well understood lifecycle cost benefits of energy efficient public lighting by purchasers and financial organizations. According to this, communities tend to choose lighting options with the lowest initial capital cost, but are then saddled with higher than necessary electricity operating costs. Finally, low market volume and a lack of significant local production also tends to drive up the price of energy efficient public lighting products compared to conventional equipment, further exacerbating the market failure.

Detailed description	Main results	The City of Venlo expects that the full implementation of the programme will achieve over 4,000MWh in primary energy savings. Although this project specifically targets public lighting (street lighting, public spaces and public buildings), the technical capacity and policies established through the project will support lighting efficiency efforts in other sectors as well. First direct lending to a municipality by EEEF. The street lighting upgrade project is part of an overall green development plan of the city. Reference project for European public authorities demonstrating efficient financing solutions for energy efficiency and renewable energy projects via EEEF.
Financing scheme		The City of Venlo and the European Energy Efficiency Fund (EEEF) signed a long-term financing contract for 8 500 000 €. The senior loan provided was used by the City for the financing of street lighting upgrades. This earmarked funding for street lighting upgrades is linked to the preparation works resulting from Technical Assistance financed by the Technical Assistant facility provided by the European Commission and should allow the City to tender and select the equipment manufacturer to deliver the LED equipment. This kind of funding is enabling to de-risk the private capital entry into the facility and can attract additional private investors to enlarge the scope of its portfolio.
Replication		This good practice could be implemented in other regions since the public lighting is growing rapidly in many developing countries, and many countries face similar barriers to development and financing of more mature, energy efficient markets for public lighting equipment and services. The Venlo transaction is the Fund's first direct lending structure to a municipality, and it demonstrates the wide variety of financial products the EEEF can offer. Since the Fund offers debt, equity and forfaiting finance for mature energy efficiency, renewable energy and clean urban transport projects it is applicable in any region.
Contact details		City of Venlo - Venlo is a municipality and a city in the south-eastern Netherlands, near the German border. It is situated in the province of Limburg. City of Venlo Hanzeplaats 1 5912 AT Venlo Netherlands European Energy Efficiency Fund - was created by the European Commission and the EIB to provide specific and tailored financing for energy efficiency projects originated by public sector entities.