Interreg
CENTRAL EUROPE
RURES

European Union
European Regional Development Fund

D.T3.4.1 Online Handbook for Value Calculator

Version 1

Content

1. Introduction

The online Value Calculator Tool and present handbook were developed in the frame of the Interreg CENTRAL EUROPE project RURES, which aims at promoting the sustainable use of renewable energy sources (RES) and energy efficiency (EE) in rural regions. The project is funded by the European Regional Development Fund.

Throughout the duration of the project, eleven partners from six European countries have analysed best practices, conducted regional studies and elaborated results. Based on these outcomes, the online Value Calculator Tool was created. The present handbook introduces the functions of the Value Calculator Tool. The tool and the handbook are available in English and six additional languages and was developed by the University of Ostrava (CZ) who is a specialist in the field of energy utilization and RES. Responsible Partner for this Tools is P11 – TUO (CZ)

2. Calculator Mission, National specifics, Future updates

The present calculator serves as a tool to explain advantages and to show suitability of using specific renewable energy sources.

It deals with their arrangement and basic boundary conditions.

The calculator is available online in several languages and respects national specificities.

The data used within the calculator was collected not only from the project consortium (12 partners from 7 countries), but also from general rules. The calculator is applicable for physical persons, business/companies, and public corporation.

The web address of the calculator is: http://decisiontree.eu/ and on the same web page you could find the online handbook

When using the calculator, you will always find help and additional information about what you should do, answer or select.

All (Information) sections marked with "*" have to be answered.

Selection of the subject

Corporation ▾ Next

Small enterprise ▾ Next

Information on the energy consumption

- (●) Consumption of electric energy
- ( ) Consumption of heat energy
- ( ) Consumption of hot water
- ( ) Consumption not known

Next

Enter consumption

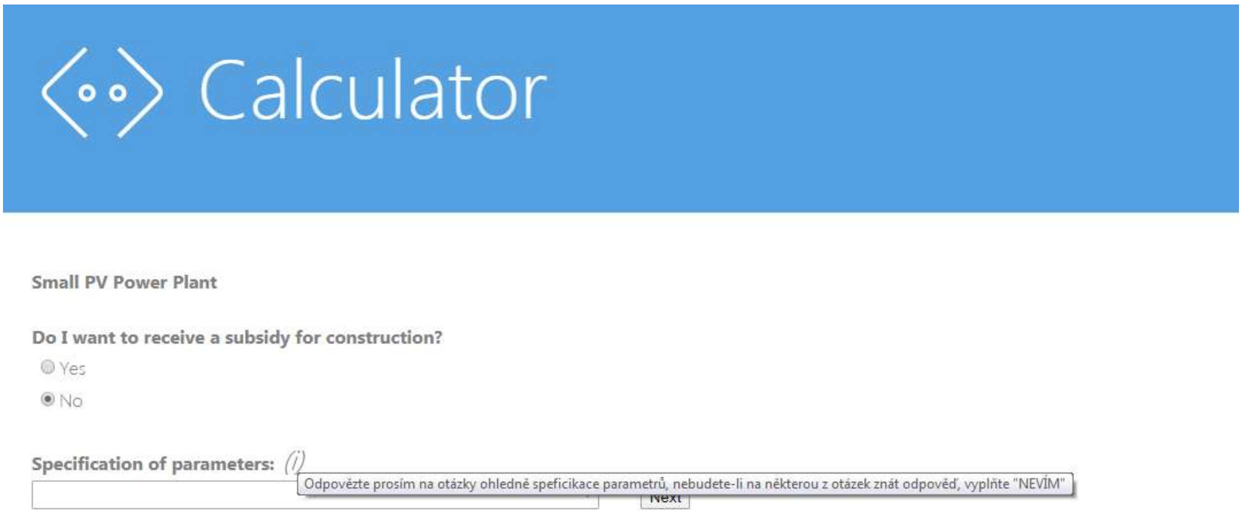
100 kWh/year Next

Selection of RES *

- (●) Small PV Power Plant
- ( ) Biogas station
- ( ) Heat pump
- ( ) Biomass boiler

Submit

Additional tooltips are marked with “*(i)*” – There you could find help by dragging your mouse (cursor) over it



The Calculator will be updated regularly in collaboration with the partners; although the essential things will not change, e.g. technical and physical principles remain unchanged.

3. Calculator structure

3.1. Function description

The RES Calculator works based on the functional diagram shown in Fig. 1. The user defines the parameters in each step, specifies his preferences more closely, and answers questions about the parameters and important technical information (like questions about the source – e.g. roof orientation for PV). With regard to the added information, the RES Calculator selects a suitable source, respectively a suitable installation example and then displays the model example (or examples) that fit best to the user's needs. In addition to the model example, the user can also find information about economic and environmental benefits related to the use of a given RES.

3.2. Description of data input and decision process

Based on 'country selection', 'subject type selection' (business/company, private person or public institution) and more detailed specification on consumption, the user will provide basic information that sets the baseline for decision-making process. In the next step, the user specifies which of the selected RES he would prefer to implement (possibility of PV and solar collectors, heat pump, biomass boilers, small biogas plant). According to the preferred RES, the user answers a set of basic questions about the selected resource. This information will help with a more accurate selection of the model example. If the user does not know some of the answers, he will fill in the "I do not know" field. In this case, the decision process will take place, but a larger number of installations will be selected as suitable sources. The user will be notified of this and he will be motivated to fill in as many replies as possible. The decision process will be triggered based on all information received from the user.

The result of this process will be the display of suitable installations complemented by a model example and economic and environmental benefits.

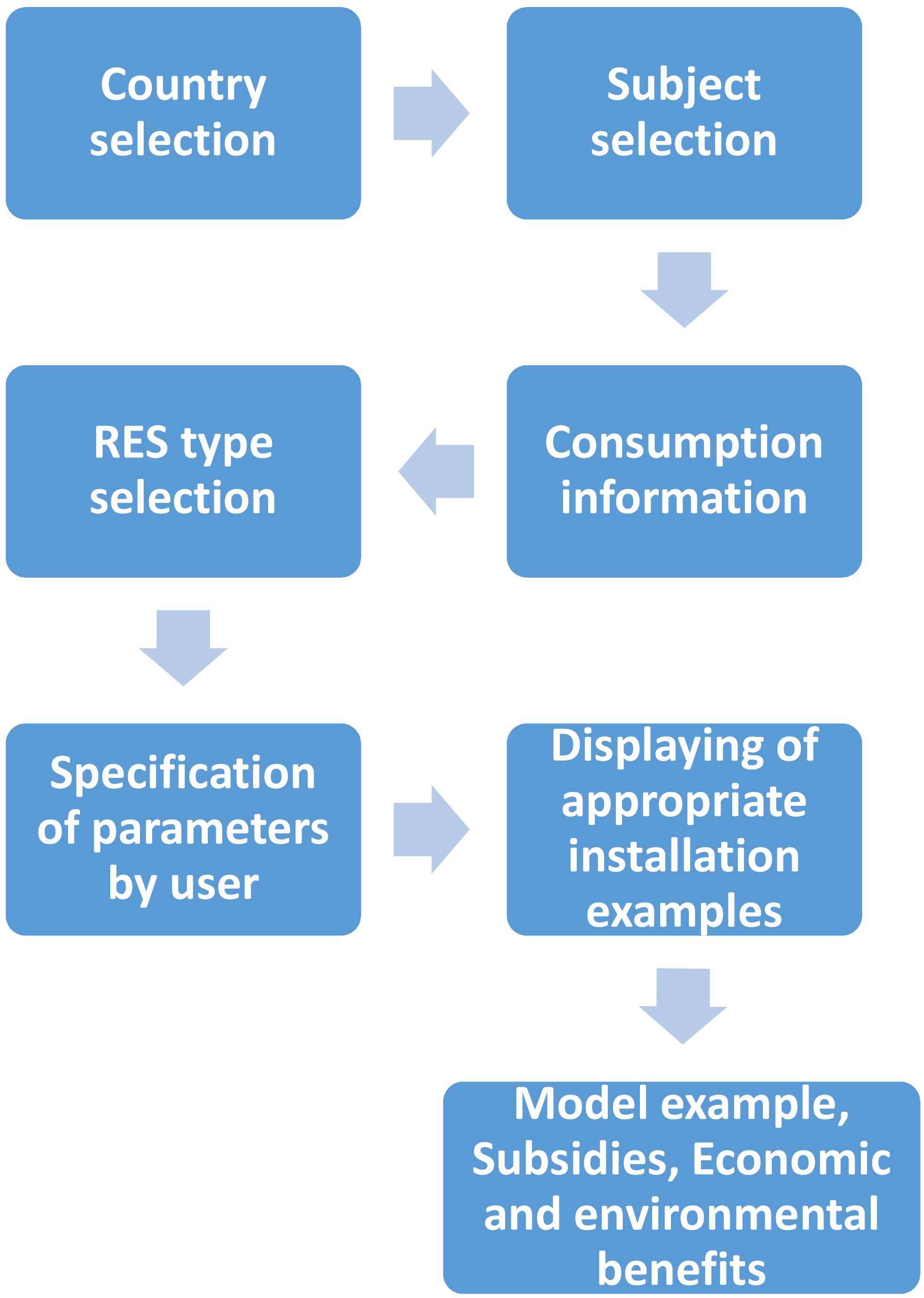


Fig. 1 Functional diagram

3.3. Function diagram steps

1. Country selection

After having selected a language, the list of countries will show respective options in the next step. The country for which the calculator will be used should be selected.

General information is provided on English

Country selection

- Czech Republic
- Germany
- Slovenia
- Poland
- Hungary
- Croatia

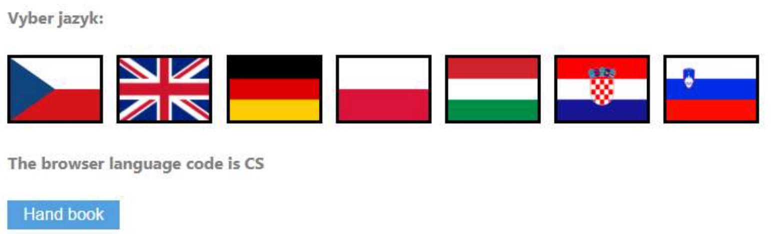


Fig. 2 Step „Country selection“

2. Subject selection

In this step, the user specifies the entity for which the calculator is used. The user has the choice of business/company, physical person or a public institution. The selection options in this step are shown in Fig. 3.

Subject selection

- **business company**
- **private person**
- **public institution**

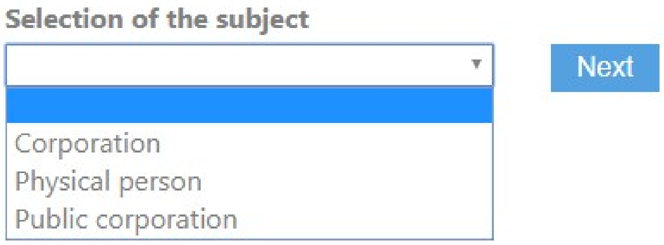


Fig. 3 Step „Subject selection“

3. Consumption information

In this step, the user specifies his consumption data. The selection options in this step are shown in Fig. 4. If the user knows, he can add information about electricity, heat, or hot water consumption per year.

Consumption information

- **electricity consumption**
- **heat consumption**
- **hot water consumption**

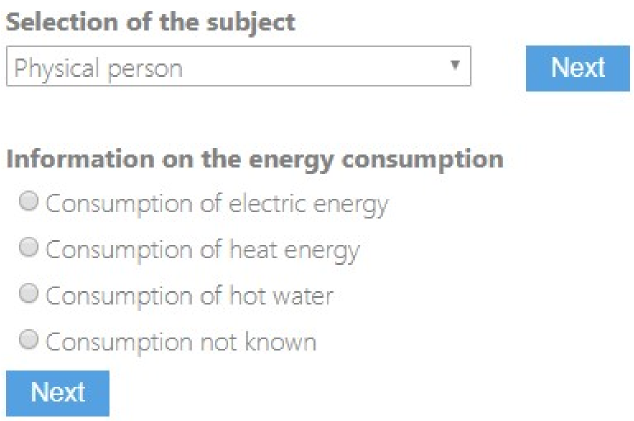


Fig. 4 Step „Consumption information“

4. RES type selection

In this step, the user selects one of the possible RES types. The selection options in this step are shown in Fig. 5. The user **must** select one of the offered sources to get some results.

RES type selection

- PV and solar collectors
- heat pump
- biomass boiler
- small biogas plant

Fig. 5 Step „RES type selection“

5. Specification of parameters by user

In this step, the user answers questions about the selected RES type. If the user does not know some of the answers, he will fill in the "I do not know" field. An example of the question structure is shown in Fig. 6.

Specification of parameters by user

- question 1

↘ answer 1 YES - NO - I DO NOT KNOW

- question 2

↘ answer 2 YES - NO - I DO NOT KNOW

Fig. 6 Step „Specification of parameters by user“

After step 5, all inputs will be processed

6. Displaying of appropriate installation examples

In this step, the user will get the most appropriate installation examples from the RES calculator based on the information provided in the previous steps. Possible installation examples are shown in Fig. 7.

Displaying of appropriate installation examples

- **installation 1 - type, performance, design**
- **installation 2 - type, performance, design**

Fig. 7 Step „Displaying of appropriate installation examples“

7. Model examples, Subsidies, Economical-ecological benefits

In this step, the user can select to view different models for the selected installation example. The model shows the device performance, basic circuit diagram, installation conditions, orientation investment costs and other relevant information. In the case of interests, the user can also view economic and environmental benefits. In the case of economic benefits, the real models example shows savings in annual operating costs compared to other sources. In the case of environmental benefits, the release of emissions compared to conventional fossil fuel sources for the given model example is shown.

4. Summaries, Important information

According to the collected information in the study the calculator is based on the following structure:

- Country selection
- Subject selection (private, SME, …)
- Consumption information (heat, electricity, …)
- RES type selection (PVE, Biomass-gas, geothermal, Biomass-combustion)
- Specification of parameters by user
- Displaying of appropriate installation example(s)
- Model examples, Subsidies, Economical-ecological benefits
  - Model examples,
  - Subsidies,
  - Economical-ecological benefits

The information provided in the calculator has only informational character; providing an overview of possible questions and answers that the investor or candidate should ask.
It does not serve as a basis for project documentation or generating data.
It is always necessary to re-calculate the investment for a specific location, installation and investor's needs

Annexes – Country (alphabetic) best practices

Each of the project partners selected Best Practices examples best suited to the needs of their LSG (Best practices are in English and national language delivered) – separated file

Croatia

Czech Republic

Germany

Hungary

Poland

Slovenia

PROJECT RURES

Value calculator – Best practice

Photovoltaic

1.Križevci solar roofs

1.1. Description of the system

The integrated solar photovoltaic power plant of 30kW power has been installed on a roof of a public building (Development Centre and Technology Park) in Town of Križevci, Croatia. The produced electric energy is used to power the public building it has been installed on and the excess energy is being sent to the grid.

1.2. Financing

The project has been financed through crowdfunding/crowdinvesting initiative triggered by Green Energy Cooperative (Zelena Energetska Zadruga) in cooperation with Regional Energy Agency North and the Town of Križevci. Within 10 days from the launch of the campaign, the initiators collected all of the planned 230.000 HRK (around 31.000 EUR) which shows great interest of the citizens to improve their living environment.

Green Energy Cooperative has signed a 10-year contract with Development Centre and Technology Park for the lease of the roof the power plant is installed on. After the 10-year period, the power plant will be owned by the owner of the building itself. The investors are getting their funds back with the interest rate of 4,5% through selling the excess energy to the grid.

1.3. Contact

For any further information you can contact Green Energy Cooperative on contact@zez.coop or by phone on 00385 (0)92 502 2690.

1.4. Photos

Source of photos: https://www.ekovjesnik.hr/clanak/955/krizevacki-suncani-krovovi-prva-solarna-elektrana-u-hrvatskoj-koju-su-financirali-gradani

2. Solar power plant Kaštelir

2.1. Description of the system

The solar power plant Kaštelir is non-integrated system installed near the Kaštelir settlement in Istria and has the power of 1MW. It has been built in year 2018 and has expected annual production of 1,5 million kWh or electric energy which is equal to annual consumption of electricity made by 500 households. The solar panels installed were produced by Croatian company Solvis Ltd. from Varaždin.

2.2. Financing

This power plant has been built by company Solvis Ltd., a private investor using their own funds. After the installation, the investor sold the power plant to Croatian electric utility company – HEP for the amount of 10,2 million HRK (around 1,4 million EUR). Also, this power plant is included in the system of incentives.

2.3. Contact

For any further information you can contact Croatian electric utility company – HEP by phone on 00385 (0)1 63 22 111.

2.4. Photos

Source of photos: https://istarski.hr/node/55868-hrvatska-elektroprivreda-preuzela-suncanu-elektranu-kastelir

PROJECT RURES

Value calculator – Best practice

Geothermal power plants

1. Geothermal Power Plant Velika Ciglena

1.1. Description of the system

The largest ORC system i.e. geothermal power plant in Europe of 17,5 MWe has been built in Velika Ciglena, near Town of Bjelovar, Croatia. This geothermal power plant exploits steam and hot water at 170 degrees Celsius to produce electricity to feed the local power grid. The geothermal source this power plant uses has been found in the year 1980 while exploring oil and gas reservoirs.

1.2. Financing

The project has been financed by consortium of private investors from Croatia and Turkey (GEOEN Ltd. and MB Holding). It also has a contract with the Croatian Energy Market Operator Ltd. (HROTE) for the feed-in tariff for 10 MW which is in line with the annual consumption of 29.000 Croatian households and is now selling the electricity to the grid.

1.3. Contact

For any further information you can contact company GEOEN Ltd. by phone on 00385 (0)1 4851 261.

1.4. Photos

Sources of photos: https://www.helb.hr/hr/reference/gte-velika-ciglena/; https://www.tportal.hr/biznis/clanak/u-cigleni-kod-bjelovara-otvorena-prva-geotermalna-elektrana-u-hrvatskoj-foto-20191119

2. Geothermal heat pump in nursery in Labin

2.1. Description of the system

In the Pjerina Verbanac nursery in Labin, Istria, Croatia, a geothermal heat pump has been installed in year 2014. The mentioned geothermal system is being used for heating of inner space as well as for heating of water.

The system has been installed to the newly built building and designed to satisfy the needs for heat energy of the building users. A test 100-meter-deep borehole has been drilled and by performing a TRT testing it has shown that two more 100-meter-deep boreholes have to be drilled to satisfy the need for the heat.

With three 100-meter-deep boreholes the need of the building of 18,8 kW heat energy is being covered since they give 16,2 kW of energy. The COP of the heat pump installed is 3,5 which gives almost 21 kW of total energy for heating.

2.2. Financing

The geothermal heat pump system has been financed through project LEGEND which has been implemented within Adriatic IPA Cross Border Cooperation 2007-2013 programme. The cost of the investment was 23.800 EUR and the co-financing rate has been 85%. The rest of the funds have been secured by Croatian partners in the project.

2.3. Contact

For any further information you can contact Istrian Regional Energy Agency by e-mail irena@irena-istra.hr or by phone on 00385 (0)52 351 555.

2.4. Photos



Sources of photos: https://www.labin.com/vijesti/instalacija-geotermalne-dizalice-topline-u-jaslicama--djecjeg-vrtica-u-labinu-blizi-se-kraju-23392; http://www.regionalexpress.hr/site/more/instalacija-geotermalne-dizalice-topline-u-jaslicama-u-labinu-pri-kraju

PROJECT RURES

Value calculator – Best practice

Use of biomass

1. Pyrolytic wood furnace in public building in Čakovec

1.1. Description of the system

In the public building containing offices and used for administrative purposes, a pyrolytic wood furnace has been installed in the year 2016. The building is located in Čakovec, Medjimurje County, Croatia and is a part of an ex-military complex that has been built at the turn of the 19^{th} to the 20^{th} century. It has 600 m2 net floor space with three floors and according to the energy audit is classified as D energy class building.

Before the installation of the pyrolytic wood furnace, the building was heated using gas boiler that was located in other building nearby and the heat was transferred by pipes. The heat loses were significant and this has been identified as a major problem. Due to the loses, the expenses were also very high and the whole system has been marked as inefficient.

In order to resolve the issue described above, the pyrolytic wood furnace of 75 kW has been installed in the building's boiler room. For flue gas extraction purposes, new chimney has been installed and built into the designed slit. Alongside the furnace, an accumulation water tank of 3000 litre of has also been installed in the kitchen next to the boiler room. Control of boiler circuit with extensions for control of two heating circuits with mixers has also been installed.

1.2. Savings achieved

Before the installation of the biomass heating system the building was consuming around 104.000,00 kWh of heating energy from gas annually which costed around 32.000,00 HRK (around 4.500,00 EUR) annually. After the installation of the mentioned system the costs for wood on an annual basis came to 24.000,00 HRK (around 3.200,00 EUR) which is a decrease of the heat costs of almost 30%.

1.3. Financing

The project was applied to the call for proposals issued by The Environmental Protection and Energy Efficiency Fund (EPEEF), a Croatian national fund in year 2015. The cost of the whole system installation was 221.833,08 HRK (around 30.000,00 EUR) and has been co-financed up to 80% of the costs i.e. in the amount of 174.897,00 HRK (around 23.600,00 EUR). The rest of the funds has been secured by Medjimurje County who owns the building. The project has been realised in year 2016.

1.4. Contact

For any further information you can contact Medjimurje Enargy Agency Ltd. on info@menea.hr or by phone on 00385 (0)40 395 559.

1.5. Photos

Source of photos: Medjimurje Energy Agency Ltd.

2. Cogeneration power plant on wooden chips in Bjelovar

2.1. Description of the system

Private company Bio energana Bjelovar Ltd. has installed a biomass cogeneration system in business zone in Bjelovar, Croatia. The construction of the powerplant begun in mid-2017 and it has been finalised in the beginning of year 2019. In the plant wooden chips will be used to generate heat and electricity.

It is calculated that the plant will generate 1.200 kW electric energy and 6.330 kW heat energy. Part of the generated electric energy will be used to cower own consumption and around 1 MW will be passed on to the electricity distribution grid. The heat energy will be used for drying technical wood in the neighbouring facility as well as for the heating of nearby production facilities.

For the supply of the raw material, the company signed a contract for the period of 14 years and it covers the total need of the power plant.

2.2. Financing

Total value of the investment described above is 57 million HRK (about 7.7 million EUR). 30% of those funds were secured by the private investor i.e. the company itself and the rest was gained through the loan. In the financing of this project an ESCO company has also been involved (HEP ESCO).

2.3. Contact

For any further information you can contact company Bio energana Bjelovar Ltd. by phone on 00385 (0)43 220 025.

2.4. Photos

Source of photos: https://www.bjelovar.hr/u-bjelovaru-otvoreno-novo-kogeneracijsko-postrojenje-na-drvnu-biomasu/

PROJECT RURES

Value calculator – Best practice

Use of biogas

1. Biogas power plant in Hrastin

1.1. Description of the system

The biogas cogeneration power plant in Hrastin, Croatia has been installed in year 2018 by private company MICO Ltd. A biogas is being produced in the plant which is then further used for production of electric energy and heat. The installed electrical power of the plant is 355 kW and the heat power is 402 kW. Expected annual production from the plant of electrical energy is 2.500.000 kWh and of heat energy is 2.950.000 kWh.

The fuel for the biogas power plant is gained from the local farmers and it mainly contains crops and chaff as well as organic residue from plants and animals (manure). Beside gaining fuel from local farmers, companies located in the near also provide the plant with maintaining of the machinery.

1.2. Financing

The project has been financed solely by a private investor, a company MICO Ltd. from Osijek, Croatia and the cost of the project was 1,6 million euro. The company signed a contract with Croatian Energy Market Operator Ltd. (HROTE) for the feed-in tariff for next 14 years and is now selling the electricity to the grid. This way the return of the investment will be much sooner than in case they wouldn't sell for a feed-in tariff.

1.3. Contact

For any further information you can contact company Consultare Ltd. on info@consultare.hr or by phone on 00385 (0)91 2281 981.

1.4. Photos

Sources of photos: http://www.obz.hr/hr/index.php/k2-listing/item/550-bioplinsko-postrojenje-hrastin-uspjesan-projekt-i-primjer-dobre-prakse; https://radio.hrt.hr/radio-osijek/clanak/bioplinsko-postrojenje-hrastin-uspjesan-je-projekt-i-primjer-dobre-prakse/184173/

2. Biogas power plant organica Kalnik

2.1. Description of the system

Biogas power plant Kalnik has been operating since year 2016 and is located in Gregurovec, municipality Sveti Petar Orehovec, Croatia. It has the power of 2,4 MW and it produces both electric energy and heat. Apart from producing energy, the biogas power plant also provides 60.000 tonnes of excellent manure from the processed substrate annually.

This power plant is being loaded continuously and is operating in the middle temperature area in the anaerobe environment. Energy value of the biogas produced under those conditions is 5,2 – 6,5 kWh/m^3. In the cogeneration process 83,3% of usable energy is being produced – 42,1% of electric energy and 41,7% of heat. The rest are losses in the process.

Produced electric energy is being sent to the grid and the heat is being used for raw material processing for biogas production. The raw material which is being used as a fuel is divided to substrate (animal manure, vegetable biomass) and co-substrate (animal side products). The named material is being provided by farmers in the neighbourhood.

2.2. Financing

Total value of this project was 93 million HRK (about 12,5 million EUR) and it has been financed by Croatian and foreign (Russian) private investors. Also, a contract has been signed with Croatian Energy Market Operator Ltd. (HROTE) for the feed-in tariff for next 14 years and they are now selling the electricity to the grid.

2.3. Contact

For any further information you can contact company BIOEN Ltd. on e-mail info@bioplinara.com or by phone on 00385 (0)48 850 134.

2.4. Photos

Sources of photos: https://bioen.hr/bioplinara-organica-kalnik/;
http://www.consultare.hr/hr/projekti/bioplinara-organica-kalnik-1

SELECTED GOOD PRACTICE – SLOVENIAN PROJECT PARTNER

BASIC INFORMATION

Title of the Best Practice: Solar Power Plant Pomurske mlekarne[1]

Location: [city, region, country]:
Mesto: Murska Sobota
Regija: Pomurska regija
Država: Slovenija

Implementation year: The start of operation of the solar power plant is in 2011. It is managed by Pomurske mlekarne d.d. Installation performed on the sloping roof of the factory hall.

Photos (source): Master's Thesis, Maribor 2016, p. 49 - Author's archive[2]

Figure 1: *Starting the installation of a solar power plant, April 2011*

Figure 2: *Roof with solar power plant - warehouse*

BRIEF DESCRIPTION OF THE PROJECT WITH SYSTEM CHARACTERISTICS

Process: The main activity of Pomurske mlekarne (dairies) is dairy and cheese making. The company operates in two locations, namely Ljutomer, where it is a cheese factory and Murska Sobota, where other products are produced.

Pomurske mlekarne decided to invest in a solar power plant based on a desire for less energy dependency, lower taxes on environmental pollution and higher revenues in 2010.
However, most of the hard-to-measure benefits have come from a competitive advantage over other dairies due to their better carbon footprint in terms of marketing.

Procedure of installation / installation of a solar power plant:

- Assessment of the suitability of the location, which is appropriate given the data on the multi-annual average of solar radiation (number of hours of sunshine).
- Choosing the right contractor.
- The contractor must comply with the client / investor requirement prior to the installation of the solar power plant that the panel cells are at the same inclination as the roofs of the buildings.
- 419 kW solar power plant installed.

The final layout of the solar power plant thus includes:

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[1] Slovenian portal for photovoltaics, list of all Solar power plants in Slovenia: *http://pv.fe.uni-lj.si/SEseznam.aspx*

[2] *See the content source in:* Hlebič B., CBA analysis of a solar power plant in Pomurske mlekarne d.d. Master's thesis, Maribor, University of Maribor, Faculty of Agriculture and Life Sciences, 2016. https://dk.um.si/Dokument.php?id=96868

- 5,713 photovoltaic modules of the type FS 277. The total area of the module is 3,828 m2.

The equipment contained in a transformer station is as follows:

- transformer as a basic machine with a capacity of 600 kVA,
- feeds and drains,
- switches,
- control, regulation and control devices,
- measuring devices,
- protection devices.

The task of the transformer station is to transform the low-voltage electrical current into high-voltage, which can then be distributed to the electrical grid through the existing infrastructure.

FINANCIAL STRUCTURE OF THE PROJECT AND FINANCING DETAILS

Basic information on financing the investment

Due to a better interest rate on the investment, the investor agreed with NLB[3] that the investment would be financed on the basis of a loan from SID[4] Bank. Two contracts were signed for this purpose; one for the value of 471,200.00 EUR whose annuities were due six months and the other for the amount of 589,000.00 EUR whose annuities were due monthly.

The investment value of a solar power plant	1.116.000,00 EUR
The investment value of the transformer station	62.000,00 EUR
Together	1.178.000,00 EUR
Method of financing	
Own resources 10%	117.800,00 EUR
Credit 90%	1.060.200,00 EUR
Credit agreement LD1020100137	589.000,00 EUR
Credit agreement LD1020100135	471.200,00 EUR
Return period	10 let
Interest rate 6-month EURIBOR + 2.8%	3,886 %
Monthly principal annuity	9.816,66 EUR
Securing maximum mortgage on parc. no.	1487/1 in 1487/2 K.O. Murska Sobota
Additional claim insurance	Electricity sales and operating support

Table 1: Overview of financing data (Source: credit agreements) - see Hlebič B., p .: 47. (when the link is open you click I agree)

In order to obtain the loan, an investment study was made in which, based on the estimated power of 380 kW (actually installed 419 kW), total revenues and total expenses were calculated. Revenues consist of revenue from the sale of electricity and revenue from operating support. The investor is entitled to operating support for 15 years. Operating support amounts to approximately 82% of total revenues.

You can read more about the Solar power plant Pomurske mlekarne at the following link: https://dk.um.si/Dokument.php?id=96868&lang=eng

[3] https://www.nlb.si/en

[4] https://www.sid.si/en (SID Bank provides loans to companies, especially SMEs, with favorable interest rates and longer repayment periods)

SELECTED GOOD PRACTICE – Biomass district heating – SLOVENIAN PROJECT PARTNER

BASIC INFORMATION

Title of the Best Practice: BIOMASS DISTRIC HEATING KUZMA

Location: [city, region, country]: Kuzma
Region: Pomurje Region
Country: Slovenia

Year of project implementation: October 2011-September 2012
Implementation of the investment: August – September 2012

Figure 1-3: Installing of the biomass district heating, source: http://alfalaval.si/novice/29/dolb_kuzma/

BRIEF DESCRIPTION OF THE PROJECT WITH SYTEM CHARACTERISTICS[1]

The project started with the signing of a concession agreement between Miran Petak and the municipality of Kuzma. The Concessionaire has undertaken to build a new boiler room with a new wood biomass heating system, to which the facilities in the area of the awarded concession have been connected.

District heating system consists of three indispensable elements

- Source of energy or boiler room on wood biomass. In the case of BDH Kuzma, two biomass boilers of 500 kW and 220 kW were installed for this purpose
- The hot water network was rebuilt with high quality pre-insulated pipes
- The heat stations were connected to the existing boiler rooms, to the internal divisions of individual buildings.

With the start of the heating season from 1 October 2012 to the end of April 2013, nearly 1000 MWH of heat was produced and sold to 23 users. In the 2012/2013 season, 1500 nm3 of G50 chips were consumed. The wood chips are produced by our own chopping machine, while the raw material for the wood chips is obtained from the surrounding forest owners and the Forestry Murska Sobota. They also tried burning the leftover corn cones, which turned out to be excellent, with excellent yields.

For 100,000 liters of light fuel oil, as it is replaced in buildings, 320 tons of carbon dioxide would be emitted into the atmosphere when used in Kuzma. Wood biomass heating emits only 24 tonnes of carbon dioxide into the atmosphere using modern technology.

Brief Description:

- Length of hot water pipeline: 1390 m
- Number of connected heat stations: 21
- Installed power: 720 kw
- Boiler room:
  - 1 biomass boiler - thermal power of 500 kW
  - 1 biomass boiler - thermal power of 220 KW
  - efficiency 85%
- Date of construction: 2012

FINANCIAL STRUCTURE OF THE PROJECT AND FINANCING DETAILS

The entire investment has been submitted to a call by the Ministry of Economic Development and Technology - Wood Biomass District Heating. The total investment, estimated at EUR 900,000, was partly co-financed by a European Union grant. The amount of co-financing was 50% of the total eligible costs. They received a grant of 375,000 EUR for the investment.

POSSIBLE SOURCES OF FINANCING[2]:

The existing invitation to public tender

National funds: Call for public tender for co-financing district heating using renewable energy sources for the period 2019 to 2022

Date of publication: 27th September 2019

Closing date: By the time the funds are used up or not later than 3th September 2020

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[1] http://alfalaval.si/novice/29/dolb_kuzma/

[2] https://www.energetika-portal.si/javne-objave/objava/r/javni-razpis-za-sofinanciranje-daljinskega-ogrevanja-na-obnovljive-vire-energije-1229/

Publisher: Ministry of Infrastructure

The subject of co-financing:

The subject of co-financing is financial incentives intended for investments in new district heating systems (hereinafter referred to as DH RES) and DH RES micro-systems. The investors that are expanding the existing remote DH RES system or build a new boiler plant with biomass boilers as the source for an existing network are also eligible for financial incentives.

The legitimate purposes of this invitation to tender are:

construction of DH RES systems with a boiler capacity of up to 10 MW or construction of DH RES systems with a boiler capacity of up to 1 MW;

expansion of the remote network in the existing DH RES system with or without upgrading of additional wood biomass boilers;

insofar as the use of solar energy as an additional source contributes to improving the economy of the entire RES system, the solar hot water system may also be part of the operation.

SELECTED GOOD PRACTICE – Heat pump - SLOVENIAN PROJECT PARTNER

BASIC INFORMATION

Title of the Best Practice: Installation of a heat system in a new building (residentail house) – heat pump
Location: [city, region, country]:
City: Murska Sobota
Region: Pomurje Region
Country: Slovenia

Implementation year: Preparation of documentation (preparation of a hydrological report for obtaining a water permit for direct water use for the production of heat from the well, application for non-refundable incentives to citizens for new investments in renewable energy sources), installation of a heat pump system, implementation of a well from 2016 - 2017.

Photo (source): The photos are from investor`s archive

Figure 1-2: Installing a heat pump and ventilation with recuperation

Figure 3: Heat pump – installation is completed

BRIEF DESCRIPTION OF THE PROJECT WITH SYTEM CHARACTERISTICS

Brief Description:

Procedure: The example above describes the installation of a heat pump in a newly built residential house. The house began to build in 2016 and was ready to move in 2018. For the described house, the investor decided to install a heat pump - water / water for heating (heating, washing, rinsing) according to expert advice.

Course of the installation process:

- In 2016, the selected contractor carried out measurements of the levels during the pumping and filling test with the purpose of obtaining a water permit for direct water use for heat generation with a water-water heat pump from the GDČ-1/16 well.
- The hole GDČ-1/16 is drilled vertically up to a depth of 9.0 m. Pumped water from the hole GDČ-1/16 will then, when the heat will be taken away for the purpose of heating the house, returned to the cocrete implementatiion digged well GDČ-2/16 depth 4.5 m.
- A pumping test was carried out in the GDČ-1/16 well and a filling test in a digged well GDČ-2/16.
- Obtaining a water permit from the *Ministry of the Environment and Spatial Planning – Slovenian water agency* for direct water use for heat generation for heating the building on the land:
  - Pumping water from well: GDČ-1/16
  - Returning water to the digged well: GDČ-2/16

  in the range of no more than 0.70 l/s, maximum 4900 m^3 /year (the basis for calculating the payment for water rights) or 22.76 MWh / year.

- The client must comply with the following conditions when execution his water right:
    - All pumped water with changed temperature must be returned to the aquifer via the sinking well GDČ-2/16.
    - At the appropriate location, between the outflow from the well and the heat exchanger, it must have a measuring device installed to determine the actual amount of water extracted from the well so that it is possible to check at any moment the current and total water abstraction, specified in point 1 of this decision.
- In 2017, *the supply and installation of a heating system with heat pump, water / water, heating of a residential house and preparation of warm sanitary water (residential area up to 250 m2) has followed.*

- Built was:

1. HEAT PUMP WI 10TU

- Heat output of the heat pump is 9.6kW, heating number 5.9 - data measured according to EN 14 511 standard
- in the primary part there is a standard inox heat exchanger, so no groundwater analysis is necessary for corrosion
- The serially integrated meter of the generated heat and the meter, which measures the energy taken from the ground water (allows us to monitor the heating number)

2. BOILER WPS 300 HR WOLF
   2.6 m^2 of exchanger

3. STORAGE TANK PSP 100E

4. …other accessories, material required for the proper operation of the heat pump.

Time needed for implementation: It took about 5-7 days for the installation of the heat pump (water-water) and all the parts included (as shown in ***Figure 3***), a day or two were needed for electrical work to establish the system. When installing a heat pump, boiler, storage tank and ventilation system with recuperation, etc. it had to be ensured that there was enough space around the system for easy access for possible repairs, services, etc. However, in order to connect the heating system, the pipes for the connection of the heating system were positioned at the stage of preparing the panel for the house.

FINANCIAL STRUCTURE OF THE PROJECT AND FINANCING DETAILS

Total investment value: [in EUR]: 13,360.22 € (VAT included, 9.5 %) - (12,201.11 € + 1,159.11 VAT)

Sources of financing: Private source – The major part of the investment was from the investor (own funds); 10,860.22 €. Private financing from personal savings. **National source** - Eco Fund, Slovenian Environmental Public Fund; 2,500.00 €.

***Procedure for obtaining an Eco Fund financial incentive for this example*:** An investor (applicant) submits to the Eco Fund in due time an application for a non-refundable financial incentive for a measure:

- C – installation of a heat pump for central heating of an residental building,
- H – installation of ventilation by returning the heat of the exaust air in the residential building

after the Public call 37SUB-OB16 non-refundable financial incentives for citizens to make new investments in the use of renewable energy sources and to increase the energy efficiency of residential buildings (Official Gazette of RS, Nos. 18/16 and 26/16) - all required documentation (contractors' calculations, photographs, etc.) had to be enclosed with the application.

Partner's name: Pałecznica Municipality		
Title of the best practice: **Photovoltaic systems at public utilities in Pałecznica Municipality**		
Brief introduction *Please describe shortly the scope of best practice.*	Pałecznica Municipality has been investing in photovoltaic systems, producing electricity for public facilities, since 2015,.	
Detailed description	Localization	Pałecznica Municipality is located in the Małopolska Region, about 40 km North of Krakow. It covers 48 km2, the number of inhabitants is about 3,600. The commune has 14 villages and administrative authorities are located in Pałecznica.
	Concept and background	Public buildings, and in particular their roofs and the surrounding area, are an unused space that is great for locating PV installations. In addition, public utilities are characterized by stable power consumption (continuous use), hence the additional power sources are an additional source of savings.
	Timeframes	since 2015
	Aims and activities	In 2015, the municipality completed the implementation of the project "Alternative energy sources as a chance to improve the quality of the natural environment in Pałecznica Municipality"", under Priority 7. Environmental protection infrastructure, Measure 7.2. Improving air quality and increasing the use of renewable energy sources, Małopolska Regional Operational Programme 2007-2013. As part of the project, seven solar installations with a total capacity of 261.36 kW were installed. Individual installations are located at or near the school, library, cultural centre, fire station, two pumping stations and a water intake. Further PV installations were made (and are still being built) during modernization works carried out in public buildings - 20kWp on the

		roof of the Municipality Office (20 kWp), social buildings in Niezwojowice (3.08 kWp) and Lelowice Kolonia (5.04 kWp), and are under construction at the Social Development Center (2x40 kWp) and at the modernized Senior Home in Winiary (40 kWp).
	Barriers and problems occurred	In the case of small installations (up to 50 kWp), the connection is made only in the mode of reporting the installation to the local power plant, hence the administrative procedure is maximally simplified.
	Main results	The basic and overriding effect of the implemented investments is the increase in the self-sufficiency of public service facilities and the reduction of electricity bills.
Financing scheme *Please specify the amount of funding/financial resources used and/or the human resources required to set up and to run the practice. Please describe financing and co-financing method, specify the alternative methods.*	In order to implement projects in the field of renewable energy sources, the Pałecznica Commune acquires external funds. These are programs dedicated to renewable energy or thermo-modernization of facilities (when conducting thermo-modernization, the RES component is additionally placed). For example, in the described project from 2015, the cost of implementation amounted to just over PLN 2 million (~500 000 €), and co-financing from the MROP 2007-2013 accounted as 85% of the net amount and amounted to almost PLN 1.39 million (~347 000€).	
Replication *Is it possible to implement this good practice in other regions? Which aspects?*	Investment in photovoltaic systems is possible in virtually all regions of Central Europe. Only local (cell location, available space) and financial conditions can become a barrier to the implementation of this type of investment.	
Contact details *Short responsible investor(s) introduction and contact details.*	Pałecznica Municipality ul. św. Jakuba 11, 32-109 Pałecznica tel. 0048 41 384 80 37	

Photos *If possible, please paste max. 5 photos, pictures, charts etc.*	   

<table>
<tr><td colspan="3">Partner's name: Pałecznica Municipality</td></tr>
<tr><td colspan="3">Title of the best practice: Heat pumps in public buildings in Pałecznica Municipality</td></tr>
<tr><td>Brief introduction
Please describe shortly the scope of best practice.</td><td colspan="2">Pałecznica Municipality has been investing in modern heating systems based on the use of heat pumps since 2013, replacing traditional heating sources in public facilities.</td></tr>
<tr><td rowspan="4">Detailed description</td><td>Localization</td><td>Pałecznica Municipality is located in the Małopolska Region, about 40 km North of Krakow. It covers 48 km2, the number of inhabitants is about 3,600. The commune has 14 villages and administrative authorities are located in Pałecznica.</td></tr>
<tr><td>Concept and background</td><td>Public buildings in the Pałecznica commune are an example for the inhabitants when it comes to using alternative energy sources. As a part of a sustainable development policy, the commune authorities decided to invest in modern heating systems based on heat pump technology. Thus, traditional boiler rooms, powered by coal or heating oil, are replaced by modern heating systems. This increase a comfort of facilities use while reducing emissions of air pollutants. In the case of the Pałecznica commune, this is also reduction in the cost of maintaining the facilities.</td></tr>
<tr><td>Timeframes</td><td>since 2013</td></tr>
<tr><td>Aims and activities</td><td>In 2013, the municipality completed the implementation of the project "Air protection through use of renewable energy for heating systems of public buildings in Pałecznica Municipality", under Priority 7. Environmental protection infrastructure, Measure 7.2. Improving air quality and increasing the use of renewable energy sources, Małopolska Regional Operational Programme 2007-2013.

Within the project, ground heat pump installations were made. Energy from the ground is taken through 57 vertical wells 30 - 150m deep. Heating systems are supported by</td></tr>
</table>

		the following heat pumps: – Primary School in Pałecznica 161 kW – Library 11,10 kW, – Culture Centre 2 x 14,65 kW, – multifunctional building 2 x 22,20 kW. Further heat pumps were installed in the following years, during modernization works carried out in public facilities, e.g. air heat pumps for the building of the Municipality Office (30 kW), or the nursery in Ibramowice (11 kW). In 2020-2021, heat pumps are planned for installation at the Social Development Center (80 kW) and at the modernized Senior Home in Winiary (10 kW).
	Barriers and problems occurred	In previous years, the commune focused on ground heat pumps, which due to a more stable lower heat source had a better COP ratio. However, installations of this type involve the need for underground work, so a suitable surface for laying the collector or expensive vertical wells is required. Technological progress in the development of heat pumps has contributed to ever better energy performance of air heat pumps, so the commune began to invest in this type of solutions, significantly reducing investment costs.
	Main results	The main and overarching effect of the implemented investments is the increase of energy self-sufficiency of public facilities and reduction of bills for their maintenance. In addition, heat pump installations make it possible to move away from traditional heating systems using fossil fuels. Thus, the emission of harmful substances by communal installations is reduced.
Financing scheme *Please specify the amount of funding/financial*	In order to implement projects in the field of renewable energy sources, the Pałecznica commune acquires external funds. These are programs dedicated to renewable energy	

resources used and/or the human resources required to set up and to run the practice. Please describe financing and co-financing method, specify the alternative methods.	or thermo-modernization of facilities (when carrying out thermo-modernization, the RES component is additionally placed). For example, in the described project from 2013, the cost of implementation amounted to almost PLN 1.66 million (~400 000 €), and co-financing from the MROP 2007-2013 amounted to almost PLN 1.39 million (~347 000 €).
Replication *Is it possible to implement this good practice in other regions? Which aspects?*	Investment in heat pump installations is possible in all regions of Central Europe. Only local (especially in the case of ground pumps) and financial conditions can become a barrier to the implementation of this type of investment.
Contact details *Short responsible investor(s) introduction and contact details.*	Pałecznica Municipality ul. św. Jakuba 11, 32-109 Pałecznica tel. 0048 41 384 80 37
Photos *If possible, please paste max. 5 photos, pictures, charts etc.*	 

	  HITACHI

<table>
<tr><td colspan="3">Partner's name: The Association of Municipalities Polish Network „Energie Cités"</td></tr>
<tr><td colspan="3">Title of the best practice: Installation of RES systems in public utility buildings and private households in Niepołomice</td></tr>
<tr><td>Brief introduction</td><td colspan="2">Solar energy</td></tr>
<tr><td rowspan="4">Detailed description</td><td>Localization</td><td>Niepołomice, Poland</td></tr>
<tr><td>Concept and background</td><td>Since March 2011 Niepołomice is implementing its Sustainable Energy Action Plan, which foresees CO2 emission reduction by nearly25% by 2020, compared to the baseline values from 2008. One of the planned actions supporting achievement of this ambitious target is increasing the amount of RES systems installed on the territory of the municipality. That is why Niepołomice became a leader of the project entitled "Installation of renewable energy systems in public utility buildings and private households in the municipalities of Niepołomice, Wieliczka, Skawina, Miechów, Myślenice and Zabierzów".</td></tr>
<tr><td>Timeframes</td><td>2012 - 2016</td></tr>
<tr><td>Aims and activities</td><td>The project consisted in installation of RES systems in public utility buildings and private households, accompanied by educational & information campaign addressed to the citizens. Following results were achieved: installation of solar thermal collectors on 3 900 buildings (with the total surface of 25 000 m^2), installation of PV modules on 29 buildings (with the total surface of 5 000 m^2 and capacities varying from 10 kWp to nearly 160 kWp) and installation of 9 heat pumps (including air-source heat pumps with the capacity of 8 kW used for preparation of warm usable water and heat pumps with the capacity of 204 kW satisfying energy demand of the indoor swimming pool).
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 consortium composed of Viessmann sp. z o.o and Wachelka INERGIS S.A. companies. First solar systems were installed on private residential buildings in December 2013.
At first it was planned to finalize all project activities by December 2015 but due to the increase of the CHF exchange rate (and thus increase of the project budget) they were</td></tr>
</table>

		prolonged until December 2016. In case of Niepołomice 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.
	Barriers and problems occurred	
	Main results	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 the 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. Large number of RES installations also increases touristic attractiveness of the region.
Financing scheme	The project was co-financed by Switzerland within the Swiss-Polish Cooperation Programme. 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.	
Replication	This type of investment is generally prevalent in Poland.	
Photos		

	  Solar.TV Niepołomice - Pływalnia Fronius ENERGIA 17.5 15 12.5 10 7.5 5 2.5 0 MWh 2015 2016 156.9 kWp 21.23 MWh 11.25 t 

	 Photos: St. Nowacki, Municipality of Niepołomice

Partner's name: The Association of Municipalities Polish Network „Energie Cités”		
Title of the best practice: Biogas plant with the capacity of 0,2 MW at the wastewater treatment plant in Siemiatycze		
Brief introduction	Biogas	
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 Przedsiębiorstwo Komunalne 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 doubleimpeller agitators, which ensure complete sludge mixing.

	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 Protection and Water Management in Białystok. The project 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.	

Photos	 fot. Marcin Jakimczuk  fot. Marcin Jakimczuk

The application is assessed as complete if all the required documentation is attached. The applicant obtains a decision granting the right to a non-refundable financial incentive.

The non-refundable financial incentive is paid with available funds within 60 (sixty) days after receipt and verification of all required proof of completion of the investment, as required by the public call. The non-refundable financial incentive may be paid up to the amount specified in the theorem, but not more than 20% of the actual (calculated) recognized investment costs for measures C and H. The payment amount shall be reconciled with the invoices submitted, subject to the terms of the public call.

A contract for the payment of a non-refundable financial incentive between the Eco Fund and the recipient is also concluded. The conditions for the payment of the non-refundable financial incentive are the completion of the deadline for the completion of the investment and the submission of the relevant closing documentation.

Amount of incentive and recognized costs - The amount of the non-refundable financial incentive is up to 20% of the recognized investment costs, but not more than:
- 2,500.00 € for a water / water-type heating water pump or brine (such as soil) / water;
- 1,000.00 € for an air / water heat pump;

during the first installation of the heating system in the residential building or if the heat pump did not replace the old combustion plant throughout the territory of the Republic of Slovenia.

National funds

Eco Fund, the Slovenian Environmental Public Fund[1] (Eco Fund), is the largest public financial institution set up to promote environmental investments in the Republic of Slovenia. The founder and owner of the Eco Fund is the Republic of Slovenia, which with its help pursues part of the set goals in the field of environment.

[1] https://www.ekosklad.si/information-in-english

Country: CZ

Part Photovoltaic (PVE)

1. Good practices

Links (web), location, Name	*Investor* *E.g. private, municipalities,…*	*Other remarks, limitation* *Investment cost in €, if applicable* *% or amount of subsidy*
Solar collectors, residential house, Plesná https://www.inkor.cz/index.php/reference/82-portfolio/solarni-systemy/245-rd-plesna-solarni-system-kondenzacni-system	Private	-
Solar collectors, 3kW, residential house, Nový Bor - Chotovice http://www.termowatt.cz/reference/reference-07.aspx	Private	-
Hybrid small PV power plant, 3,24kWp, battery system 9kWh, residential house, Bravantice http://www.prosolar.net/reference-index/solarni-hybridni-elektrarna-3-24kwp-storion-9kwh-bravantice	Private	-
Small PV power plant, 10kWp, Bašť https://www.solarenvi.cz/r-162-bast-fotovoltaicka-elektrarna-10kwp.html	Private	-
Mid-size PV power plant, 25kWp, Jeseník https://www.asb-portal.cz/stavebnictvi/technicka-zarizeni-budov/fotovoltaika/zkusenosti-s-provozem-fotovoltaicke-elektrarny-na-strese	Business company	Profit 76 000 CZK/year Saving electricity 46 000 CZK/year

Part Biomass (Bio)

1. Good practices

Links (web), location, Name	*Investor* *E.g. private, municipalities,…*	*Other remarks, limitation Investment cost in €, if applicable % or amount of subsidy*
Biomass boiler Multibio 199 PLCS, Pačlavice near Kroměříže https://www.multibio.eu/kotel-na-biomasu	Business company	-
Gasification boiler for biomass, storage tanks, heating system, residential house, Ostrava https://www.inkor.cz/index.php/reference/72-portfolio/ustredni-a-podlahove-vytapeni/236-rd-ostrava-kondenzacni-kotel-zplynovaci-kotel-akumulacni-nadrze-vytapeni	Private	-
Boiler for pellets, 2x320kW, Zábřeh na Moravě	Business company	2 000 000 CZK
Boiler for woodchips, 250kW, Rokytnice	Business company	1 700 000 CZK
Boiler for woodchips, 50kW, Němčičky http://www.kotlenabiomasu.com/?92,teplovodni-kotel-szdo-50kw	Private	-
Small biogas plant, agriculture, 250KW, Telč https://www.farmtec.cz/uploads/soubory/reference-bps-telc.pdf	Business company	-
Biogas plant, agriculture, 500kW, Farm Stonava http://www.farmastonava.cz/cs/predstaveni-nasi-bioplynove-stanice.html	Business company	-
Small biogas plant, waste landfill, 270kW, Růždol	Business company	-
Small biogas plant, Water treatment plant, 400kW, Mikulov	Public institution	-
Biogas plant, agriculture, 544kW, Vysoká http://www.kk-technology.cz/useruploads/files/BPS%20Vysok%C3%A1.pdf	Business company	-

1. Good practices

Links (web), location, Name	*Investor* *E.g. private, municipalities,…*	*Other remarks, limitation* *Investment cost in €, if applicable* *% or amount of subsidy*
Heat pump, floor heating, residential house, Horní Lhota https://www.inkor.cz/index.php/reference/83-portfolio/tepelna-cerpadla/247-rd-horni-lhota-tepelne-cerpadlo-podlahove-vytapeni	Private	-
Heat pump for a large residential house, air-to-water type, 64kW, České Budějovice https://www.nibe.cz/cs/reference/category/207-3x-nibe-f2300-ceske-budejovice-sidliste-maj	Private	-
Heat pump, installation in new building, water-to-water type, 9kW, Mělínk https://tepelna-cerpadla-spirala.cz/reference	Private	120 000 CZK
Heat pump, air-to-water type, 17kW, Nové Město nad Metují http://www.tepelna-cerpadla-vzduch.cz/reference/	Private	-
Heat pump, ari-to-water type, 21kW, Primary school Malý Újezd	Public institution	-

Supporting information:

Please indicate averages cost/pricing/dates

- Cost of 1GJ gas
  approx. 0,36 €/GJ (by exchange rate 26 CZK/€)
- Cost of 1kWhe
  approx. 0,21 €/kWh (by exchange rate 26 CZK/€)
- Cost of 1 tonne of biomass
  approx. 226,5 €/t (wooden pellets, bulk material, by exchange rate 26 CZK/€)
- Averages production of CO_2 per 1 kWh
- 1,17 kg/kWh (by document "Calculating carbon dioxide savings", Ministry of Industrial and Trade)

2. Subsidy options general

Please indicate up to 5 important subsidy options in your country (where is Photovoltaic supported)

Links	*Who can use it* *E.g. private, municipalities,…*	*% or amount of subsidy* *Boundary conditions?*	*Other remarks, limitation* *E.g. support only up to 100 kWh,…*
https://www.novazelenausporam.cz/	private	up to 150 000 CZK up to 30% of total investment cost	Reducing the energy consumption of existing homes for living End of the grant program 31.12.2021
https://irop.mmr.cz/cs/Vyzvy/	Business company	up to 40% of total investment cost	End of the grant program 29.11.2019
https://www.novazelenausporam.cz/	Business company	up to 150 000 CZK up to 30% of total investment cost	Reducing the energy consumption of existing homes for living End of the grant program 31.12.2021
https://www.novazelenausporam.cz/	Public institution	up to 150 000 CZK up to 30% of total investment cost	Reducing the energy consumption of existing homes for living End of the grant program 31.12.2021
http://www.oppi.cz/usporyenergie/	Business company	50/40/30% of total investment cost (Subsidy amount according to the size of the company)	Installation of renewable energy sources (PV <100 kW), installation of energy storage from own RES installation of PV

Country: Hungary

D.T.3.2.2 Analysis of value creation of selected renewable energy systems

Part Biomass (Bio)

This document represent a summaries of the partner's collected knowledges and experience within the RURES project supported by the INTERREG CENTRAL programme 2nd call.

The collected information will then form the basis for the calculator.

In the document please concern on the Biomass combustion and Biogas units

1. <u>Good practices</u>

Körmend - biomass heating plant

The power plant was built in 2003 using EU tender sources in Körmend. At that time, it was a new thing, not very common in the country. The EU also provided help, as there were no state programmes in the country yet. Today, this heater is one of many. The country and the Union are increasingly being forced to support and strengthen these programmes.

The heating plant has a capacity of 5 MW, 62 TJ district heating (6,000 tons / year of wood demand), which supplies heating to nearly 4000 people, that is two thousand flats in Körmend. Thus, 35 to 40 percent of homes and many public institutions, including hospitals, are supplied with heat by the power plant. The fully automated heating plant significantly reduces the use of natural gas, by as much as 50 percent in Körmend.

Wood chips; clippings, cut trees, which can no longer be used for other purposes, are used as the combustion material. They are sourced from a fifty kilometre radius. However, in order for the system to be self-sufficient, 200 hectares of supply contracts would be required. At the moment, 37 hectares have been contracted. In the recent period, as the price of gas has risen, as well as has the price of wood, so has the price of heating been increased, too. However, heating with biomass is still more profitable, as if it were not available, energy would be 10-15 percent more expensive in Körmend.

The Körmend power plant operates in cogeneration (cogeneration technology), which is used to produce electricity from a given combustion material, and heat that can be used in the district heating system. It uses less combustion material than producing the same heat and electricity in separate power plants would requite. Cogeneration is energy efficient and cogeneration plants emit less greenhouse gases.

Country: HU

Part Photovoltaic (PVE)

This document represent a summaries of the partner's collected knowledges and experience within the RURES project supported by the INTERREG CENTRAL programme 2nd call.

The collected information will then form the basis for the calculator.

In the document please concern on the small PVE units, or units integrate at the building

1. Good practices

45,000 panels have been installed in the solar power plant Nádasd, which was completed at the end of 2019, and it will cover the electricity needs of about 18,000 people. The Nádasd plant has a capacity of 15MWp and the investment cost is about HUF 6 billion. The plant will be operating for about 25 years. It will probably be employing 4-5 people on a permanent basis who are involved in panel and electrical maintenance. The electricity produced goes up into the electricity grid and is sold as subsidized "green energy" to the system operator.

Electricity produced by solar panels does not produce any emissions at the point of production - panel production has a CO2 footprint, but it is still a fraction of the emissions of any other fossil-fueled electricity.

The panels produce only direct current from the sun's radiation, which the inverters convert into AC and this is fed to the power grid.

The existence of a well-endowed industrial park, a supportive local government, and an electric network with sufficient capacity have played a major role in choosing the location of the solar farm.

https://solar-markt.com/

Country: HU

Part Geothermal (GT)

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In the document please concern on the Geothermal units.

1. Good practices

The first K-10 thermal well was created in 1963 in Vasvár by the conversion of an oil well drilling. After conversion the water of a well with a low salinity of 80 ° C at maximum yield was soon used for heating stables and poultry houses. In the early 1990s, a power line was built to one of the boiler rooms of the local district heating system, and part of the district heating was converted to geothermal energy. The other boiler room remained on gas heating. In total, only approx. 15% of the district heating in Vasvár is obtained from thermal water. Even this was in jeopardy when, in 2010, Government Decree No. 147 imposed a deadline for the design and construction of a recuperation for existing water uses for energy purposes. However, there was not the least reason to press it back in Vasvár. The quality of the thermal water is drinking water, no constituent, not even the percentage of Na presence, has exceeded the limit of the water pollution fine.

The thermal water reservoir has been used only by the Vasvár well, and the annual amount of water abstraction was not significant, and there was no decrease in the water level. However, the regulation was clear and no one would have expected any authority to continue to authorize energy recovery without recharging. The municipality, as the body responsible for local district heating, began to collect for re-injection. There were two favourable circumstances for this. On the one hand, money remained in the Environment and Energy Operational Programme (KEOP), as well as a call for proposals was expected. On the other hand, the replacement of fossil fuels necessary for the success of the tender did not seem impossible, as geothermal energy represented only 15% of heat production.

Preparing the investment

In preparation for the call for tenders, the municipality had prepared a feasibility study on the planned investment. The analysis carried out in 2012 included the following development ideas:

• Drilling of a new thermal well in the inner city near the heating plant called Járdányi. In the case of a favourable result, the new well is used for production and the old well for re-feeding.

• Assembling a closed, pressurized thermal technology in a pump house next to the new well. Re-injection equipment, filters and pumps are also to be placed here.

- Construction of a thermal centre with two central heat exchangers for the two district heating circuits in the Járdányi heating plant.
- Laying a district heating pipeline between the Járdányi and Béke heating plants to transport the thermal water energy to the Béke heating district.
- Partial mechanical renovation of existing district heating substations.
- Development of a new control and remote monitoring system for both the thermal and district heating systems.

The above list of tasks clearly illustrates that a significant part of the investment is not geothermal. In fact, the elements that make it possible to utilize thermal water for energy purposes, are the smallest proportion. Here are the three main areas of investment, with their approximate cost of investment:

- Environmental Protection (Well Drilling): 40%
- District heating infrastructure (new and renovation) 40%
- Thermal water recovery technology: 20%.

The study was accompanied by the environmental and water licensing. By the beginning of 2013, everything was available for submitting a KEOP application. Fortunately, the result was positive: the municipality received 85% non-refundable grant for its implementation. Due to the delay in signing the grant agreement, the execution planning was not completed until July 2014. The following year, the joint application of Porció Ltd. and Vikuv Co. won the execution tender.

The process of construction

According to the main contract, the implementation should have been completed within only 5 months. Therefore, in April 2015, construction began with two working parts, the well drilling and the modernization of the district heating system. Both had been going smoothly, according to the original schedule, until the well was drilled to the planned depth of 2300 m, but no aquifer was found. Of course, further drilling had to be done, down to 2436 m, from where the sludge loss was increasing. The final depth of the well exceeded 2500 m. Despite the acidification of the stratum, during the test cultivation of the well, only 36 m3 / h of water was achieved, which was below expectations, but the water temperature increased above 80 ° C in a few days, which fortunately compensated for the lower discharge. The purpose of the investment, the replacement of natural gas, was thus not endangered. The water quality and gas content of the new thermal wells B-15 after the well training were significantly different from the existing K-10. The technology of water extraction and treatment had to be redesigned and the quality of the material used had to be changed. Due to additional well drilling work and design changes, the execution deadline was extended by about one and a half months and approx. 5% additional work was generated. By the September 30 deadline, construction work had been completed and the pilot run had been successfully completed in early October.

Operational experiences

Due to the long-term operation, the temperature of the effluent water exceeded 88 ° C. The water test carried out in November 2015 yielded an interesting result: the salinity of the thermal water dropped dramatically to the value of the water quality of the K-10 well. Remote monitoring data collection on the district heating system has made it possible to analyse the functioning of district heating services as a user of geothermal energy, and fine-tuning the system and, in some places, significantly increasing the efficiency of thermal energy utilization. The energy recovery system created during the project resulted in the replacement of nearly 22 TJ / year of natural gas with geothermal energy. The maximum geothermal power of the installed equipment is 1,400 kW. The annual volume of thermal water used is 181,833 m3. After commissioning, 929 t / year CO2 eq. (Climate Change Gas), 107.6 kg / year SO2 and 1.4 kg / year NOx, reduce air pollution with emissions.

Use of renewable energy

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)

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