POLISH AND NORWEGIAN CITIES
together for climate and energy

norway grants

Catalogue of Polish and Norwegian best practices in the field of energy efficiency and RES use

This document was developed within the umbrella project **"Polish-Norwegian cooperation platform for climate and energy conservation"**, financed in the framework of Bilateral Cooperation Fund at the level of the PL04 Programme from the Norwegian Financial Mechanism 2009-2014.

Project is implemented by three partners from Poland and Norway:

Association of Polish Cities (coordinator)
biuro@zmp.poznan.pl
www.zmp.poznan.pl

Association of Municipalities Polish Network "Energie Cités"
biuro@pnec.org.pl
www.pnec.org.pl

Norwegian Association of Local and Regional Authorities
gunnbjorg.naavik@ks.no
www.ks.no

Catalogue prepared and edited by:
Association of Municipalities Polish Network "Energie Cités"
biuro@pnec.org.pl
Sławkowska St. 17; 31-016 Cracow, Poland
tel. 12 429 17 95; tel./fax 12 429 17 93

Cracow, August 2016

Introduction

1. Introduction

Polish and Norwegian local self-governments carry out many interesting projects in the field of energy efficiency and use of renewable energy sources. Many of solutions already tested have great potential of replication and can be a source of precious inspiration for other cities and municipalities. In this catalogue there were gathered some examples of good practices in the field of energy building modernization, public lighting modernization, use of RES, sustainable transport&mobility, support of civil energy production and energy-related education of citizens. It is also possible to get familiar with them by using the thematic search engine on the project's website: www.razemdlaklimatu.eu

The catalogue was prepared within the umbrella project "Polish-Norwegian cooperation platform for climate and energy conservation" co-financed from the resources of Norwegian Financial Mechanism 2009-2014 and implemented from January 2016 till April 2017. During this time, a contest for the most interesting ideas for innovative energy projects based on Norwegian experiences was organized. The contest was dedicated to Polish municipalities and municipal entities interested in establishing cooperation with Norwegian partners. The best projects, which got the financing in the form of micro-grants for the preparation of the analyses and documents necessary for their implementation, include: building of energy effective and RES laboratories to train the future installers, heat utilization system for cold production, complex use of locally available RES, energy consumption monitoring system installed in the whole municipality or improvement of energy efficiency in the waste management sector.

The representatives of 10 awarded municipalities (Bydgoszcz, Bielsko-Biała, Lublin, Milanówek, Pałecznica, Płońsk, Raciechowice, Rumia, Sztum i Sopot) took part in a one-week study trip to Norway in September 2016. During the trip they had a chance to see model installations and learn about pro-energy initiatives which are implemented by Norwegian municipalities and their partners. They had also the opportunity to establish bilateral cooperation with Norwegian municipalities which assist them in the implementation of the suggested solutions. The cooperation consists of exchange of experiences, knowledge, technology and best practices in the area of energy effectiveness and use of RES in municipal sector including public buildings.

The completion of project actions resulted in the development of the diagnosis of Polish and Norwegian municipalities situation in terms of energy efficiency and RES use, creating Polish–Norwegian Cooperation Platform operating via interactive website, and creating sustainable frames of cooperation between Polish and Norwegian entities which form a base for future joint actions including the ones in the frame of NMF 2015 – 2020.

POLISH AND NORWEGIAN CITIES
together for climate and energy

MODERNISATION OF STREET LIGHTING IN ANDRYCHÓW

Sector: Energy efficient lighting

Timeframe: 2015

Location: Andrychów, Poland

PROJECT BACKGROUND

Andrychów (approx. 20 800 inhabitants) is located in the southern part of Poland, in the Małopolskie Voivodeship. For several years the city has been planning street lighting modernisation, among others due to significant amounts of money paid for electricity consumption. The 1st step towards more energy efficient lighting was signing an agreement with the Tauron company (lighting infrastructure owner), where the municipality leased for many years all lighting poles located on its area. Then, a public procurement was launched and a contract was signed with the company responsible for street lighting replacement. As a result Andrychów became a model for other municipalities wishing to modernise their public lighting.

PROJECT DESCRIPTION

The street lighting modernisation investment included replacement of 2 513 sodium luminaires with LED ones, which were installed on the existing supporting structures of the transmission lines and on the separate lighting lines. Selection of the luminaires was based on the requirements set in the street lighting standard PN-EN 13201 and done using Relux computer programme. In this way the project team decided on the capacity of light sources, their luminous flux and light distribution. The project included also reconstruction of the 3030-meter long cable lighting installation, replacement of 121 light poles and lamps with new ones and installation of the PLANet lighting control system. The system is composed of the base stations ensuring communication and so called "telecells" (control and monitoring nodes) fitted to the luminaires. Selection of the number and distribution of the base stations was done using the computer analysis of wave propagation. As a result 6 base stations were installed in selected locations, ensuring good system communication within the whole city area. It is worth to highlight that 10 mobile communication stations working at similar frequencies cannot ensure GSM communication covering the same area. Possibility of installing only limited number of base stations is one of the important advantages of the PLANet system over the other solutions. Installation of PLANet base stations was followed with installation of the luminaires with the Telecell controlls that were


Photo: Enis Solutions

activated on the spot. Each Telecell device contains a processor for radio communication management, lighting control and monitoring of the electric grid parameters (together with the metering unit). The luminaires are switched on using a photo sensor measuring the external light levels. Depending on the street and related lighting requirements, the luminaires are dimmed to the level which takes into consideration the margin factor and re-dimensioning of the luminaires. During the night hours the lights are additionally dimmed following the decrease of traffic intensity.

FINANCING SCHEME

The total cost of the investment came to PLN 7 million. Co-financing of PLN 3,1 million and a loan of PLN 3,8 million were granted by the National Fund for Environmental Protection and Water Management within the 1st call for proposals organised under the Priority Programme **"Green Investment Scheme (GIS) part 6: Owl - Energy efficient street lighting"**.

PROJECT RESULTS

As a result of the street lighting modernisation implemented in Andrychów the capacity of street luminaires was lowered from 439,88 kW to 226,38 kW. Replacing sodium luminaires with LED ones, accompanied by further capacity reduction from automatic control, allowed for CO_2 emission reduction by 1 150 Mg per year. Installation of the PLANet lighting control system helped to additionally lower LED luminaires capacity by 48%. Annual financial savings achieved due to the project come up to PLN 500 000.

Replacement of the street lighting also contributed to the improved visual comfort and safety of the citizens and people passing through the city. This is possible thanks to the white light emitted by LEDs, which renders colours better than the light from the sodium lamps. The PLANet lighting control system enables further energy and financial savings coming from dimming newly installed LED lights to the levels established in the up-to-date external lighting standards. Expanded programming possibilities allow for optimum and energy-saving exploitation of the lighting system. Using the reports database municipal staff will be able to obtain favourable price for maintenance services after the end of the guarantee period.

Andrychów qualified for the national contest for "the best lit city and municipality of 2015", which is organised by the Polish Association of Lighting Industry since 1998. The municipality received 1st award in the category of street lighting modernisation. The contest committee came to Andrychów to see by themselves how the streets lit with LED lights look like. During the award ceremony they highlighted the very large scope of the investment, as well as the additional electricity consumption reduction resulting from the implementation of the automatic control system.

DEVELOPMENT PROSPECTS

It is possible to connect to the PLANet communication systems also other devices, following the Internet of Things (IoT) concept. At present in Europe there are conducted the normalisation works, on the basis of which the data transmission method used by the PLANet system will be in future an open platform for other IoT devices. This means that the PLANet system is an open system and may be further developed, also by connecting new luminaires coming from different producers.

MORE INFORMATION

Bogdan Mężyk
Managing Director
Enis Solutions Sp. z o.o.
e-mail: b.mezyk@enis.pl
phone: +48 506 693 845

POLISH AND NORWEGIAN CITIES
together for climate and energy

POWERHOUSE, BÆRUM
WORLD'S FIRST RENOVATED OFFICE BUILDING PRODUCING MORE ENERGY THAN USED

Sector: Energy efficiency, solar energy, geothermal energy

Timeframe: 2012 – 2014

Location: Kjørbo, Bærum, Norway


fot. PNEC

PROJECT BACKGROUND

The Powerhouse consortium constructs energy-positive buildings in Norway. Among the partners are Skanska entrepreneur, state owned real estate company Entra Eiendom, architectural firm Snøhetta, the environmental organization ZERO and the consultancy firm Asplan Viak. The consortium aims to demonstrate that it is possible to create energy-plus buildings, even in colder climates, and that developing such buildings makes commercial and environmental sense.
The Kjørbo project in Sandvika, 15 km from Oslo, involved the redevelopment of two 1980s office buildings into energy-positive houses. Prior to the project, both buildings had an annual energy use of around 250 kWh/m^2. The state body Enova and local authorities supported the project.

PROJECT DESCRIPTION

Old ineffective houses are converted into modern offices buildings with comfortable and attractive indoor environment. Existing structures and building elements are reused and incorporated.

After the renovation, the buildings' energy need is reduced by 90 per cent. Local energy is produced by solar panels installed on the roof. These can supply over 200 000 kWh each year – double the amount of the building's need. Ground wells in the park outside the buildings provide heating for radiators, water and ventilation air, and cooling in the summer.

The buildings are also equipped with new energy systems (heating, ventilation, cooling and lighting), designed to be used only when needed, though with limited number of sensors and control units. Exposed concrete absorbs heat and releases it again when it becomes cooler.

A good acoustic environment without suspended ceiling was created using suspended baffles on the ceiling in addition to acoustic dampening fins around the central cores. The fins and baffles are made of recycled plastic bottles. The core wall is designed as a curved waveform, among other reasons because it traps noise and creates calm zones in the open office landscape. Facades are clad with charred wooden panels, which are almost maintenance free.

In addition to producing more energy than it consumes, the project has also been rewarded with the highest classification in the BREEAM-NOR environmental certification system 'outstanding'.


fot: PNEC

PROJECT RESULTS

The success of the project is based on close cooperation between the various partners, the ability to find the most optimal solutions and the innovative combination of these solutions. The result is a unique combination of extreme energy performance with good indoor air quality, low environmental impact and robust solutions. This is achieved through:

- Energy concept based on integrated and holistic solutions
- Good insulation values, low air-leakage and a lot of daylight
- Extensive utilisation of thermal mass
- Effective solar screening
- Energy efficient lighting controlled by sensors according to daylight and presence
- Controlling technical equipment consumption
- Energy efficient and building-integrated ventilation solution
- Thermal energy supply based on energy wells, heat pumps and use of excess heat from server facilities, optimised according to heating and cooling requirements
- A large photovoltaic system
- Reuse of materials from old building i.e. facade panels
- Comprehensive testing and commissioning of technical systems
- Training of maintenance personnel, and careful follow-up of daily energy use
- Facilitating increased bicycle and electric car use

The primary energy calculation over the 60 year life of the building results in a surplus of about 200 kWh/m^2 of heated area. Delivered energy, excluding technical equipment, is calculated to about 20 kWh/m^2/year.

Net internal area:	5200 m^2
Number of users:	225
Energy sources:	Photovoltaics (electricity), heat pump water-water (energy wells for cooling and heating). Heat pumps cover 100% of load, also DHW (separate heat pump). Heat pump water-water (waste heat from server room used for heating), district/ local heating system (backup in case of heat pump failure).
Environmental standards:	BREEAM Outstanding. Passive house. Plus energy building
Room heating:	4.9 kWh/m^2/year
Ventilation heating:	1 kWh/m^2/year
Domestic hot water:	1.4 kWh/m^2/year
Fans:	2.3 kWh/m^2/year
Pumps:	1.6 kWh/m^2/year
Lighting:	7.7 kWh/m^2/year
Technical equipement:	12 kWh/m^2/year
Ventilation cooling:	0.2 kWh/m^2/year
Other energy posts:	18 kWh/m^2/year
BUILDING COSTS:	Approx.15.9 MNOK. Project support from Enova.

MORE INFORMATION

Fact sheet (Power House):
www.powerhouse.no/en/prosjekter/kjorbo/

Web site (Future Built):
www.futurebuilt.no/prosjektvisning?lcid=1033&projectID=258201

Technical fact sheet (Skanska):
www.sapagroupmedia.com/share/?458f41ea7eff8e6aaf61d3307a9aeb431e6e0c25

POLISH AND NORWEGIAN CITIES
together for climate and energy

"BOSSNETT", BERGEN
AUTOMATIC UNDERGROUND WASTE SYSTEM

Sector: Waste, transport, energy efficiency

Timeframe: 2008 – 2020+

Location: Bergen, Norway

PROJECT BACKGROUND

BIR is Norway's second largest waste management company and is responsible for waste handling from approximately 320,000 inhabitants in the nine municipalities owning the company.

Waste trucks and waste bins used to create risk of fire and traffic accidents, especially in the old city centre with narrow streets and wooden houses. Waste bins occupied limited street space, attracted rats and recycling was hampered because the number of bins had to be minimised. Even in newer residential/business areas, traditional waste trucks are not necessarily the best solution, in terms of energy use, noise and pollution.

PROJECT DESCRIPTION

The underground waste system (bossnett) is an automated system that transports waste underground using air pressure. It replaces waste bins, containers and waste trucks. Instead, waste is transported from local waste inlets to a terminal where it is stored in large containers. These containers are picked up and transferred to various recycling facilities.

It is twenty years since this type of technology first was applied in smaller scale in Norway. Smaller systems can also be constructed without terminals, the waste is instead collected using vacuum systems mounted on waste trucks.

The city of Tromsø has a plant, which directly connects a modern residential area to the nearby waste sorting central (Stakkevollan). Tromsø uses the system in combination with differently coloured plastic bags for different waste fractions. Bergen has instead several inlets for different fractions at the collection points.

From autumn 2015 the Bergen system is in full operation, as the first full scale system for city centres in Norway.

PROJECT RESULTS

Advantages with underground waste systems include better waste sorting, because different fractions (residual waste, paper, plastic packaging, etc.) are disposed of at the same place. The underground waste system is closed and fireproof. In addition to better fire safety, removing waste bins from the city centre gives significantly more effective use of limited street space. Overflowing bins, bad odour and pests (especially rats) is avoided. Less heavy vehicles in the city centre and residential areas give less noise, better traffic safety and less exhaust pollution.

Illustrations: BIR

Significant reduction in greenhouse gas emissions and energy use are obtained by less transport and increased recycling of waste.

fot. BIR

MORE INFORMATION

Information from BIR, including contact details
www.bir.no/birkonsernet/Sider/ThisisBIR.aspx
www.bir.no/bossnett/Documents/Bossnett_engelsk_brosjyre.pdf
www.bir.no/losninger/Documents/Brosjyre_Bossug_engelsk.pdf

POLISH AND NORWEGIAN CITIES
together for climate and energy

"THE TREE", BERGEN
HOUSING IN THE WORLD'S TALLEST WOODEN BUILDING

Sector: Energy efficiency, reduced carbon footprint

Timeframe: 2014 – 2016

Location: Damsgård, Bergen, Norway


fot. BOB

PROJECT BACKGROUND

BOB is one of several membership based cooperative building associations in Norway.

For this project, BOB wanted to use as much wood as possible to reduce carbon footprint. BOB aims to be at the forefront of developing homes for the future, with a strong focus on energy consumption, sustainable development and communal outdoor spaces.

The project has got broad support including the municipality, and is recognized Worldwide. Taller wooden buildings are now planned in Austria and Canada.

PROJECT DESCRIPTION

The apartment building is 51 meters tall, with 14 storeys. There are 11 flats there with two bedrooms (40 m^2) and 51 flats with two bedrooms (approx. 65 m^2). A common gym is included.

Designed by architects Artec and engineered by Sweco Norway, the structure comprises a mix of cross-laminated timber and glulam, built on concrete ground floor. Although being the first in its size, the building relies on well-known and well-proven construction technology. Laminated wooden constructions have for many years been used in Norwegian bridges and other types of buildings, i.e. the speed skating hall for the Lillehammer Olympics in 1994. "The Tree" now seems to contribute to a Worldwide breakthrough for use of wood in tall residential and office buildings.
Wood in the construction binds CO_2 throughout the building's lifetime.
The house is built according to the passive house standard, demanding low energy use. The whole building has balanced ventilation with highly efficient heat recovery system (80%).
All fire safety requirements are met.
Owner: BOB, flats sold.
Funding: Sold flats, contributions from national programs.

PROJECT RESULTS

Wood products used, store approximately 1,000 metric tons of CO_2. Using timber instead of non-renewable construction materials represents an important step towards reducing global warming. The role of forests as 'carbon sinks', whereby the wood stores carbon as long as the tree


fot. BOB

is alive or is used in a structure, is expected to become increasingly important in the future.

Total area:	7137 m^2
Heated area:	3780 m^2
Energy label:	A
Energy consumption:	Net energy: 71 kWh/m^2/year. Delivered energy: 84 kWh/m^2/year.
Ordinary heating:	3 kWh/m^2/year
Heating from ventilation:	4.5 kWh/m^2/year
Hot water:	29.8 kWh/m^2/year
Fans:	4.8 kWh/m^2/year
Pumps:	0.1 kWh/m^2/year
Light:	11.4 kWh/m^2/year
Technical equipment:	17.5 kWh/m^2/year
Delivered energy:	Direct electricity: 33.8 kWh/m^2/year District heating: 8 kWh/m^2/year Biofuel: 41.9 kWh/m^2/year

Despite the initial cost being somewhat higher than that of a steel and/or concrete structure, the erection time of such module-based buildings is significantly shorter, with related savings.

The flexible construction offers better earthquake safety than most other construction types.

A landmark of which Bergen can be proud.


fot. BOB

MORE INFORMATION

ReThinkWood web site
www.rethinkwood.com

The Design and Construction of the World's First 14-Story Wood Building (YouTube):
www.youtube.com/watch?v=e5XsqauBCX4

Contact information: www.bob.no

MUNICIPAL WASTE INCINERATION PLANT IN BIAŁYSTOK

Sector: Waste management

Timeframe: 2013 – 2016

Location: Andersa Str., Białystok, Poland


Photo: PUHP LECH

PROJECT BACKGROUND

Białystok (295 600 inhabitants) is located in the northeastern part of Poland and is the capital of the Podlaskie Voivodeship. It is one of the first cities in Poland, whose authorities undertook efforts to adapt their waste management system to the EU requirements concerning necessary reduction of the amount of traditionally stored waste. In 2010 Białystok entrusted its municipal company "Lech" with the implementation of the project entitled "Integrated waste management system for the Białystok agglomeration". Main component of the project was the construction of the installation for incineration of municipal waste. Białystok's Municipal Waste Treatment Plant (ZUOK) is one of the first operating waste incinerators in Poland and was the first to receive permit for electricity and heat production.

PROJECT DESCRIPTION

The construction of ZUOK was performed by the consortium composed of following companies: Budimex S.A. (consortium leader), Keppel Seghers Belgium N.V. and Cespa Compania Espanola de Servicios Publicos Auxiliares S.A. Agreement signed with the municipality concerned both designing and building of the installation. The construction of the plant took two years and its operation was officially launched in February 2016. The plant is fed with mixed municipal waste from Białystok city and nine neighbouring municipalities. It is also planned to receive and use remains from the waste sorting process, whose calorific value exceeds 6 MJ/kg. The plant is able to process 15,5 tonnes of waste per hour, which gives up to 372 tonnes per day. Thanks to the technology used it is possible to produce approx. 38 000 MWh of electricity and 360 000 GJ of heat per year. The heat is used to meet plant's own needs and the surplus is supplied to the municipal heating network. The amount of electricity produced can supply with power approx. 16 000 households, while the amount of heat generated can heat in winter approx. 900 single-family houses. The first transports of waste arrived at the facility in late September 2015, when the contractor began so called hot start-up of the installation.

The plant uses flue gas treatment method based on the NID system, i.e. semi-dry technology combining several functions in one piece of equipment: gas absorption of hydrogen chloride, hydrogen fluoride and sulphur dioxide, removal of heavy metals, dioxins, furans and solid particulates using active coal and lime, and dust extraction from flue gas using bag filter. Fly ash and other solid combustion products, which are extracted in the process, are subjected to the process of solidification and stabilisation. The flue gas is continuously monitored by the company's own services and by the Inspectorate for Environmental Protection. Białystok's waste incineration plant also uses state-of-the-art solutions, which prevent unpleasant odours from leaving the waste unloading hall. Thanks to the underpressure created they are kept


Photo: PUHP LECH

inside the building and therefore are not bothersome for the neighbourhood. Another important element of the system is the slag valorisation installation which is used to separate metal components from the slag and to improve its quality so that it could be sold on the market and used in construction. Part of the slag, which is not suitable for sale, is deposited at the landfill site in Hryniewicze.

ZUOK also uses other modern and environmentally friendly solutions. Whole rainwater from the area of the plant (roofs, roads, yards) is recovered and used in the technological process. Water from the municipal water supply system is used at the minimum level, mostly for the sanitary purposes. Warm sanitary water is heated with the heat recovered from the facility's air compressors. At the entrance to the plant there is installed a radioactivity detector, whose task is to detect radioactive waste, therefore there is no risk that radioactive material will enter the installation. Waste transportation vehicles leave the plant cleaner than they were at the entrance - before leaving they pass through the pressure washer which cleans their chassis and wheels.

FINANCING SCHEME

The total net cost of the project entitled "Integrated waste management system for the Białystok agglomeration" comes to PLN 394,4 million, including PLN 333 million for the construction of ZUOK in Białystok. To carry out the investment, municipal company "Lech" obtained co-financing from the European Cohesion Fund. PLN 210 million were granted within the Operational Programme "Infrastructure & Environment", measure 2.1: **Comprehensive undertakings in the scope of managing municipal waste with particular attention to hazardous waste.** Additional PLN 164 million comes from the loan granted by the National Fund for Environmental Protection and Water Management, PLN 10,6 million comes from the bridge loan from the Fund and the remaining amount was covered from the "Lech" company's own budget.

PROJECT RESULTS

Before the construction of the waste incineration plant approx. 90% of municipal waste was deposited at the municipal landfill site located in the neighbouring village (Hryniewicze). It is estimated that now, after start-up of the investment, the amount of deposited waste will decrease to approx. 12%. Annually the plant will incinerate approx. 120 000 tonnes of waste.

The installation is environmentally friendly and advantageous for the inhabitants of Białystok. It is a part of the modern waste management system, which is currently under development and includes also launching of the selective waste collection and construction of the sorting plant at the landfill site in Hryniewicze.

The construction of ZUOK and creation of modern waste management system will not only bring benefits to the present inhabitants of Białystok and Białystok's agglomeration, but will also help to take care about future generations and future quality of the environment.


Photo: PUHP LECH

MORE INFORMATION

Zbigniew Gołębiewski
Service, Trade and Production Company "LECH" in Białystok
phone: +48 691 22 44 18; +48 85 653 94 44
e-mail: z.golebiewski@lech.net.pl
biuro@lech.net.pl
www.lech.net.pl

POLISH AND NORWEGIAN CITIES
together for climate and energy

SMALL HYDROPOWER PLANT WITH THE CAPACITY OF 38 kW IN BIELECKIE MŁYNY

Sector: Water energy use

Timeframe: 2011

Location: Bieleckie Młyny, Poland

Photo: MEW Bieleckie Młyny

PROJECT BACKGROUND

Bieleckie Młyny is a village located south from Kielce, in the Świętokrzyskie Voivodeship. It has approx. 200 inhabitants and is a part of the Morawica municipality. At the village territory there is a small hydropower plant (SHP) operating, located at the 24+620 kilometre of the Black Nida river. The run-of-the-river power plant belongs to the group of micro hydropower plants with the capacity below 100 kW and is equipped with the first spiral turbine entirely designed and produced in Poland. In 2011, when the plant was put into operation, only two other facilities in Poland were using the Archimedes screw turbine to transform water fall energy into mechanical energy.

PROJECT DESCRIPTION

The heart of the plant is the hydroelectric set composed of the Archimedes screw turbine with the diameter of 2 800 mm and the asynchronous generator with the capacity of 38 kW, which are coupled through the toothed and belt gear. The worm wheel is suspended on both sides on the bearings placed in the steel trough. The trough is situated at an angle of 22˚ to the vertical. The Archimedes screw turbine is located outside the SHP building, which contains the generator and the control cabinets with the electric and control equipment. The hydropower plant also includes a concrete dam with wooden beams, which enables damming up the water to 1,5 m. The dammed water is then directed to the turbine chamber through the open feeding canal. The water intake is equipped with a screen, which separates and detains solid elements carried by the water, like tree limbs and branches, bottles and other waste. Maximum water flow through the turbine, which can be reached, amounts to 3,2 m^3/s.

Except for the construction of the new SHP building and the installation of the Archimedes screw turbine (with the necessary equipment), the project included also renovation of the concrete dam and of the stone dyke that cooperates with it. The action covered replacement of the existing and installation of new gate guides from steel, installation of wooden gates, restoration of the upper and the lower slope of the dam, strengthening of the river bottom with the stone riprap, construction of the footbridge giving access to the SHP building and maintenance of the gates. Additionally, parts of the dam were demolished and old turbine cage was partly dismantled, which helped to increase dam's throughput by 30%. Moreover, the project included widening of the left river bank and strengthening of the scarp and the bottom of the canal transferring water to the turbine chamber.

Electricity generated by the SHP is fed to the electric grid through the transformer station. The parameters

of the plant and the hydropower potential of the river allow for generating approx. 170 MWh of electricity per year, which is enough to supply over 100 households and is equivalent to approx. 80 tonnes of hard coal burnt in the conventional power plant. Thanks to its simple construction and lack of movable components, the turbine is characterised by high operational reliability and long lifetime. And this translates into minimisation of the operational costs.

FINANCING SCHEME

The total investment costs came to approx. 650 000 PLN. 40% of this amount was covered with co-financing from the Regional Operational Programme for the Świętokrzyskie Voivodeship for 2007-2013. The rest was covered with the loan and the investor's own funds.

PROJECT RESULTS

Small hydropower plant in Bieleckie Młyny not only produces clean energy, contributing to the reduction of air pollution, but also has positive influence on the local hydrological conditions by raising groundwater level over the dam. Increasing so called "small retention" helps to improve biodiversity and to minimise negative impact of the dry weather periods, which are especially bothersome for the agriculture. The hydropower plant also decreases the bottom erosion over the dam. According to the provisions of the permit required by the Water Law Act, the owner of the SHP is obliged to maintain the river bed in a good shape, both within the object and in its nearest neighbourhood. These activities help to keep the river bed clean and to secure the scarps, which reduces the threat of flooding neighbouring areas during high water. SHP in Bieleckie Młyny also works as a "river vacuum cleaner", which catches all anthropogenic waste carried by the river.

It is also worth to mention that the Archimedes screw turbine is friendly for the fish, which is a result of its low rotational speed, open and pressure-free construction, large working areas filled with water and low level of turbulence.

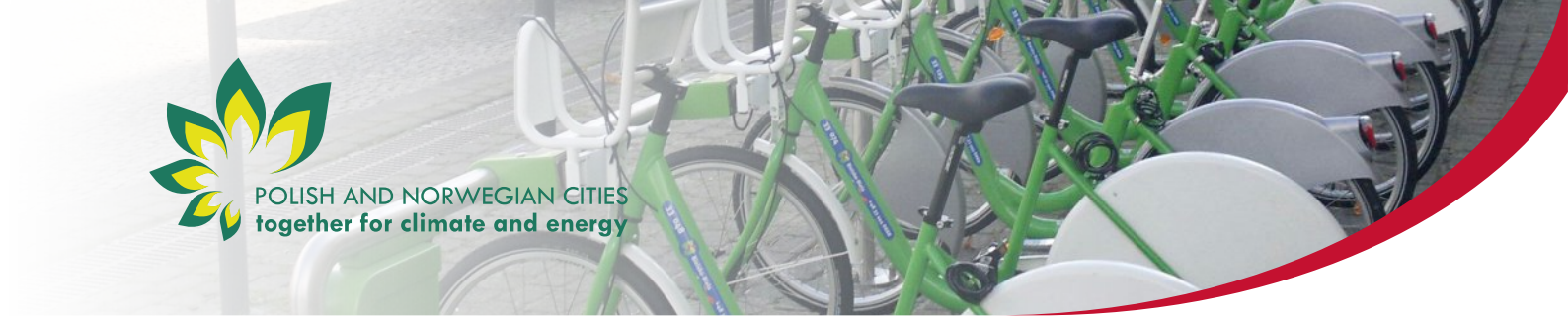
DEVELOPMENT PROSPECTS

By using the Archimedes screw turbine it is possible to use for hydropower production also the rivers that have small inclination and thus slow water flow, where traditional turbines wouldn't guarantee economic profitability. Due to the fact that hydropower potential in Poland is mostly connected with the small rivers, the technology presented may become more popular in the future. Additional arguments for the development of small hydropower plants were given by the study conducted within the RESTOR Hydro project, which ended in 2015. Within the project 6 thousand of different types of dams and old water mill installations were identified on the territory of Poland. They are potential locations for future investments in SHPs.


Photo: Enerko Energy

MORE INFORMATION

Łukasz Kalina
Head of the Development Department
Instytut OZE Sp. z o.o.
email: kontakt@instytutoze.pl
phone: +48 41 301 00 23
www.instytutoze.pl



POLISH AND NORWEGIAN CITIES
together for climate and energy

SELF-SERVICE BIKE RENTAL SYSTEM IN BIELSKO-BIAŁA

Sector: Sustainable transport

Timeframe: 2014

Location: Bielsko-Biała, Poland

Photo: Marek Klimek

PROJECT BACKGROUND

Bielsko-Biała has approx. 178 000 inhabitants and is located in the southern part of Poland, in the Silesian Voivodeship. In January 1994 the city joined the Association of Municipalities Polish Network "Energie Cités" as one of the first cities in Poland. It is still an active member of the network implementing many projects and actions aiming at sustainable energy development and climate protection. In January 2009 Bielsko-Biała signed the Covenant of Mayors and its representative participated in the first formal signature ceremony organised in Brussels, in the seat of the European Parliament. In 2010 Bielsko-Biała's City Council approved local Sustainable Energy Action Plan (SEAP), which was the first document of this kind adopted in Poland. The SEAP shows how the city plans to achieve its climate & energy targets set for the period 2010-2020. In August 2015 another important document was unanimously approved for implementation - a "Low Emission Development Programme and a new Sustainable Energy Action Plan for Bielsko-Biała", which is an update of the plan from 2010. One of the actions included in Bielsko-Biała's SEAP is the development of the cycling infrastructure and the promotion of cycling. In November 2014 the length of the bicycle trails and the pedestrian/bicycle trails within the city came to 26 km. It is planned that by 2020 it will reach 52 km.

PROJECT DESCRIPTION

Development of the self-service bike rental system in Bielsko-Biała was preceded by the contest for the best name of the new service, which was organised in November 2013. The Internet users could vote for one of six different proposals and the definite winner was "BBbike". Following results of the contest, "BBbike" is the name of the new bike rental system, which was launched by the City in October 2014.

Another important step was the selection of the most proper sites for the construction of bike rental stations. The team working on the localization of the stations was composed of the representatives of the City Road Management Office, Beskidy's Cyclists Association and the City Hall. In order to choose the best sites the team contacted other cities, where such systems are already in place and are working successfully. As a result of these consultations, the bike rental stations were built in places frequently visited by the inhabitants, including the city center, main bus station, universities, bus terminals and leisure areas. One of the most important factors, which was taken into consideration when designing the bike stations' network, was making it possible to reach another station within a less than 20-minute ride (as renting a bike for less than 20 minutes is free of charge).


Photo: Bielsko-Biała City Hall

In total, 12 bike rental stations were built in different parts of the city and together they give access to 120 bikes (there are also 10 reserve bikes available). Each station includes 10-14 bike docks and respectively 8-12 bikes, leaving 2 empty docs for those, who would like to leave their rented bikes there. Each bike is equipped with the electric lock, which enables its release from the dock and re-attaching to it after usage, as well as with additional combination lock, which enables returning the bike even to the station which is already full.

The bikes bought for the city's self-service rental system were presented during the 37th Family Bike Rally organised in Bielsko-Biała in September 2014. Renting them is possible after registering at the official website of the service - **www.BBbike.eu** - and after paying initial fee of 20 PLN. The telephone number provided during the registration is used as the client's identification number and it is assigned with individual login and PIN number. Renting a bike is free of charge for up to 20 minutes. After that time, following fees are charged: from 20 to 60 minutes – 2 PLN, from 60 to 120 minutes – 5 PLN, from 120 to 180 minutes – 8 PLN. Each hour more costs 4 PLN. The maximum rental period of one bike is 12 hours. If a client doesn't return the bike by that time, he/she will be charged with the additional fee coming up to 200 PLN. The cycling season lasts from the 1st of April till the 31st of October. Since the 1st of November till the 30th of March is the winter break, when the bike rental service is not available. The bikes are systematically collected from the bike stations during the night before the beginning of the winter break.

FINANCING SCHEME

Implementation and maintenance of the Bbbike rental system is financed entirely from the municipal budget. The investment cost came up to 1 480 000 PLN and will be repaid by the municipality within a 4-year period. This means that the annual instalment comes up to 370 000 PLN.

PROJECT RESULTS

Since the beginning of the bike rental system's operation the number of clients have been gradually increasing, exceeding 2 500 users by the end of October 2015. In this number, nearly 60% of registrations were made in 2015. So far the bikes were rented to customers almost 25 000 times, which gives approx. 3 500 rentals per month.

Implementation of the "BBike" self-service rental system contributed to the improvement of the cycling comfort, reduction of road traffic density and promotion of the healthy way of life. Economic benefits include reduction of fuel consumption in private transport sector, while environmental ones include CO_2 emission reduction from the territory of the city. It was estimated that implementation of all actions aiming at the development of cycling communication in Bielsko-Biała, which are planned until 2020, will result in CO_2 reduction amounting to 390 Mg CO_2/year and energy consumption reduction amounting to 1536 MWh/year.


Photo: Marek Klimek


Photo: Bielsko-Biała City Hall

"BBbike" SYSTEM DEVELOPMENT PROSPECTS

"Low Emission Development Programme and a new Sustainable Energy Action Plan for Bielsko-Biała" include various actions aiming at the development of cycling communication, which are planned for implementation until 2020. Among them there are: construction of new bicycle routes, construction of bicycle parks located near public facilities and transfer hubs, as well as installation of self-service repair stations for bikes.

City officers highlight that the "BBbike" rental system is quite popular among the citizens, therefore it is worth to plan its successive development. There is a chance that in 2017 new public procurement will be launched, concerning the construction of the new bike rental stations, which will be compatible with the existing ones.

MORE INFORMATION

Piotr Plewiński, Department for City Promotion
Bielsko-Biała City Hall
e-mail: bpm@bielsko-biala.pl
phone: +48 33 47 01 239

Energy Management Office
Bielsko-Biała City Hall
e-mail: pze@bielsko-biala.pl
phone: +48 33 49 71 518

www.um.bielsko.pl
www.bbbike.eu


Photo: Bielsko-Biała City Hall

POLISH AND NORWEGIAN CITIES
together for climate and energy

EDUCATIONAL & PROMOTIONAL CAMPAIGN "BIELSKO-BIAŁA PROTECTS THE CLIMATE"

Sector: Educational & promotional campaign

Timeframe: 2011 – 2020

Location: Bielsko-Biała, Poland

Photo: Bielsko-Biala City Hall

PROJECT BACKGROUND

Bielsko-Biała has approx. 178 000 inhabitants and is located in the southern part of Poland, in the Silesian Voivodeship. In January 1994 the city joined the Association of Municipalities Polish Network "Energie Cités" as one of the first cities in Poland. It is still an active member of the network implementing many projects and actions aiming at sustainable energy development and climate protection. In January 2009 Bielsko-Biała signed the Covenant of Mayors and its representative participated in the first formal signature ceremony organised in Brussels, in the seat of the European Parliament. In 2010 Bielsko-Biała's City Council approved local Sustainable Energy Action Plan (SEAP), which was the first document of this kind adopted in Poland. The SEAP shows how the city plans to achieve its climate & energy targets set for the period 2010-2020. From the document it is clear that it is impossible to reach 3x20 goals without active engagement of different local stakeholders and without aid funds. Until now, the city has done a lot to improve its energy situation. It needs to be taken into consideration, however, that only 10% of all buildings located in Bielsko-Biała are in the hands of local authorities. Therefore, it was necessary to involve in this process as many citizens and local entities as possible.

PROJECT DESCRIPTION

In 2011 Bielsko-Biała was invited by the European Network "Energy Cities" to join the project entitled ENGAGE, which aimed at encouraging citizens and local stakeholders to play their part in building more sustainable energy future. The project was based on two main pillars: poster exhibition involving so called "Climate Ambassadors" and an open-air "Energy Days" event for the citizens. The poster exhibition was the main tool for influencing local society and comprised of 300 posters presenting silhouettes of Climate Ambassadors - over 1 000 citizens representing different social environments, institutions and families, who individually committed to undertake actions aiming at reducing energy


Photo: Bielsko-Biala City Hall

consumption and at using natural resources in a more reasonable way. The exhibition was used as a basis for the organisation of a dedicated event for the citizens called "Beskid Festival of Good Energy". Over 100 Climate Ambassadors engaged in this common event, helping to transfer knowledge about rational use of energy and other resources. Couple of thousands of people took part in the festive activities and 65 Climate Ambassadors agreed that the city will monitor the execution of their energy commitments.


Photo: Bielsko-Biala City Hall

Based on the outcomes of the ENGAGE project Bielsko-Biała launched long-term promotional & educational campaign, which received its own logo and name - "Bielsko-Biała protects the Climate". The campaign comprises of the three main elements: contests for children and teenagers called "Conserve energy and protect the Climate", cyclic meetings with institutions and businesses (over 60 different entities) aiming at promotion of local good practices and annual celebration for the citizens called "Beskid Festival of Good Energy". The event integrates the citizens around the idea of environmental & climate protection. There have been already five editions of the festival and as a result over half of the Bielsko-Biała's citizens heard about the energy conservation concept. The most valuable, however, is the cooperation with the educational community. 150 teachers coordinate campaign-related activities in their own educational centers. Thanks to their engagement


Photo: Bielsko-Biala City Hall

and permanent cooperation, thousands of children and their parents can be activated.

The benefits of the campaign are felt by more and more inhabitants of our city, who become convinced that it makes sense to use energy more reasonably as in this way they can spend less money on buying it. In the long term this will result in better air quality and improved health of the citizens.

FINANCING SCHEME

The campaign is financed from the municipal budget and supported with contributions from different local entities. It costs approx. 100 000 PLN per year. From time to time also funds from other funding sources (including Voivodeship Fund for Environmental Protection and Water Management, Operational Programme "Infrastructure & Environment", "Intelligent Energy Europe" programme, etc.) are used to finance specific elements of the campaign.

PROJECT RESULTS

It turned out that in 2011 Climate Ambassadors, who agreed to monitor their performance (65 people and institutions), saved over 7,6 million kWh of energy and nearly 4 million kg of CO_2. The value of so called "negawatts" could reach even 2-3 million PLN.


Photo: Bielsko-Biala City Hall

The monitoring procedure was different for institutional ambassadors (organisations and businesses) and for individual people. The citizens' performance was monitored on the basis of a special questionnaire designed by the municipal Energy Management Office and concerning their way of life and related carbon footprint. The questionnaire was developed on the basis of the on-line tool for calculating environmental footprint: www.ziemianarozdrozu.pl/encyklopedia/50/moja-emisja-co2-kalkulator, www.ziemianarozdrozu.pl/kalkulator, which was designed by Marcin Popkiewicz.

Individual Climate Ambassadors completed the questionnaire in 2011 and one year later. After entering their inputs into the special database, there were calculated energy and CO_2 savings achieved for different types of energy and as a total. Data from institutional Climate Ambassadors, on the other hand, were gathered through individual contacts with people responsible for energy & environmental issues in participating companies and organisations. They concerned the same monitoring period. People and institutions, whose performance was monitored, constitute approx. 22% of all Climate Ambassadors.

Measurable results of the social campaign include also: 5 editions of the Beskid Festival of Good Energy, 300 posters presenting 1 000 citizens - Climate Ambassadors (that have already been publicly displayed 10 times), 150 teachers and 120 educational centres (kindergartens and schools) involved, 120 companies saving energy and 70 citizens trained in eco-driving.

In 2013 Bielsko-Biała received European Public Sector Award (EPSA 2013), which was granted for the "Bielsko-Biała protects the Climate" campaign. The competition aims at honouring these self-government projects, which are particularly well organised, efficient and consistent with self-governments' social mission. In this edition 230 project from 26 countries and European institutions were competing. What attracted jury's attention to the Bielsko-Biała's campaign was wide cooperation with local society, scale of activities and innovative approach.


Photo: Bielsko-Biala City Hall

Also the European Community of Natural Sciences Teachers awarded the "Bielsko-Biała protects the Climate" campaign. It received the main prize in the category of "Cooperation between the municipality and the educational community", which was handed in at the festival Best Project on Science on Stage in 2013.

Reports developed by the Voivodeship Environmental Protection Inspectorate in Katowice prove that the air quality in the city of Bielsko-Biała is slowly and systematically improving. It is especially visible in case of particulate matter PM 10, whose annual mean concentration is decreasing from year to year. "Bielsko-Biała protects the Climate" campaign is surely one of the contributors to this improvement.

MORE INFORMATION

Energy Management Office
Bielsko-Biała City Hall
Plac Ratuszowy 6
43-300 Bielsko-Biała, Poland
e-mail: pze@um.bielsko.pl
phone: +48 33 4971 518
www.miastodobrejenergii.pl

POLISH AND NORWEGIAN CITIES
together for climate and energy

PV PLANT WITH THE CAPACITY OF 1,4 MW IN BORDZIŁÓWKA

Sector: Solar energy use

Timeframe: 2014

Location: Bordziłówka, Rossosz Municipality, Poland


Photo: M. Majewski

PROJECT BACKGROUND

The territory of the Lubelskie Voivodeship has the highest insolation values in Poland. In 2012 mayors of five municipalities – Wisznice, Rossosz, Sosnówka, Jabłoń and Podedwórze – established a partnership called "Energia Dolina Zielawy" ("Zielawa Valley Energy"), which aims at ensuring energy security of their territories. Municipalities' share in the partnership depends on their size and number of inhabitants. The first task of the enterprise was submitting an application for co-financing of the construction of the PV plant with the capacity of 1,4 MW. The application was submitted to the Regional Operational Programme for the Lubelskie Voivodeship for 2007-2013 and was accepted. The plant was built in 2014 in Bordziłówka, a village located in the Rossosz municipality (approx. 2 300 inhabitants). It is the first PV plant in the region and one of the biggest ones in the country.

PROJECT DESCRIPTION

The plant consists of 5 560 polycrystalline PV panels with the capacity of 250 W each. There were also installed approx. 100 thin-film solar panels, which are used for research and development purposes. Owners of the plant check how they are working in different weather conditions and how they react to the changes of the inclination angle.

Location of the plant was selected based on several criteria. First of all, it was necessary to find a vast enough area that would be located in an un-shaded terrain and that would include a medium-voltage line, which could collect power generated by the plant. An important factor was also the possibility of issuing the construction permit.

PV farm in Bordziłówka covers the area of 3,5 ha and the total surface of the PV panels exceeds 0,87 ha. The plots of land, where the plant is located, where purchased from their owners.

The investment was carried out by two companies – Maybatt and Elektromontaż from Lublin. 70 solar inverters (Delta Solivia 20TL G4 inverters with the capacity of 20kVA), which transform direct current into alternating current, were delivered by Delta Energy Systems company. The company also provided the central system for reactive power compensation, which is based on choke coils of 85 kVar. The purpose of the system is to reduce the operational costs and increase life of the equipment. The inverters include the function of switching off the reactive power compensation in the periods, when the insolation values are not sufficient. The main task of the compensator is the reduction of reactive power during the start-up of the farm during sunrise and sunset, as well as when the inverters are in the stand-by more and the system for internal, automatic reactive power compensation is switched off. Properly selected connection stages of the choke coils allow for additional supplementation of compensation also during the day, if the solar radiation


Photo: M. Majewski

is low and parts of the installation are temporarily shaded. External compensation unit was integrated with the dedicated system for monitoring inverters operation and with the grid analyser installed in the connection point to the distribution network. As a result it was possible to obtain a very precise automatic compensation unit, which adapts to the dynamically changing situation at the PV farm. The unit helped to significantly reduce the reactive power in the system. In the worst case its level doesn't exceed 1% of the system's maximum capacity, regardless of the dynamically changing amounts of generated energy.

Start-up and commissioning of the PV plant in Bordziłówka took approx. a month. During this period there were conducted measurements, as well as efficiency and functionality tests of different components of the installation. During the test run the plant produced approx. 60 MWh of electricity, which was purchased by "PGE Obrót" company seated in Lublin. Currently, generated electricity is sold to Tradea Ltd. in Częstochowa.

FINANCING SCHEME

The cost of the PV plant construction came to PLN 7,6 million. The project received co-financing from the European Regional Development Fund granted within the Regional Operational Programme for the Lubelskie Voivodeship for 2007-2013. The co-financing amounted to PLN 3,1 million. Remaining amount came from the loan granted by the Cooperative Bank in Wisznice.


Photo: M. Majewski

PROJECT RESULTS

In the autumn time the amount of electricity generated by the PV plant in Bordziłówka is lower, but there are days when it comes to 4 000 - 6 000 kWh per day. It is estimated that this amount equals the energy demand of approx. 450 households.

Members of the "Zielawa Valley Energy" partnership assume that the loan will be paid off within 8-10 years. After that, the company's profit should reach PLN 0,5 million per year. The partner municipalities also hope that the PV power plant will attract new investors to the Podlasie region.

DEVELOPMENT PROSPECTS

The "Zielawa Valley Energy" partnership plans construction of the next plants. Moreover, the mayor of Rossosz doesn't rule out the possibility of expanding the PV farm in Bordziłówka. It all depends on funding opportunities that will be available in the future.

Partner municipalities also consider establishing cooperation with research centers and schools. Except for generating power, the plant will be used as a research facility, e.g. for testing which inclination angle gives the best energy output or how the solar panels react in different weather conditions.

MORE INFORMATION

Mateusz Majewski
Inspector for Municipal Services and Environmental Protection
Municipality of Rossosz
e-mail: gmina@rossosz.pl
phone: +48 83 378 45 57

POLISH AND NORWEGIAN CITIES
together for climate and energy

RES DEMONSTRATION CENTRE IN BYDGOSZCZ

Sector: Energy education

Timeframe: 2011-2014

Location: Mechanical School Complex No. 2, 19 Słoneczna str., Bydgoszcz, Poland

Photo: R. Sawicki

PROJECT BACKGROUND

Bydgoszcz (approx. 357 600 inhabitants) is the largest city of the Kujawsko-Pomorskie Voivodeship. It is an active member of the Association of Municipalities Polish Network "Energie Cités" and - since November 2011 - also a Covenant of Mayors signatory. It is implementing many environmental and climate protection actions and initiatives. From the late '90s Bydgoszcz has been benefiting from the EU aid funds. It developed and formally approved a "Climate Mitigation and Adaptation Plan for the city of Bydgoszcz" and a "Sustainable Energy Action Plan for the city of Bydgoszcz for 2012-2020".

The city hires an energy manager and participates in various international projects, such as CASCADE - "Cities Exchanging on Local Energy Leadership", co-financed from the IEE programme, and "Demonstration of energy efficiency and utilisation of renewable energy sources through public buildings", co-financed from the ERDF within the Central Europe Programme. The latter resulted in the construction and opening of the RES Demonstration Centre, which is located at the area of the Mechanical School Complex No. 2. The school educates future RES installers, mechatronics technicians, CNC mechanical technicians and electricians. Thanks to the new center the students will be able to see how different environmentally friendly solutions work in practice.

PROJECT DESCRIPTION

The RES Demonstration Centre integrates different solutions used in low-energy and passive construction. It is a low-emission building with the useful area coming to 367,26 m^2. It is equipped with the RES installations and serves as a model for future buildings, which should meet requirements set in the Directive 2010/31/EU. It states that after the 30th of June 2019 all new buildings occupied and owned by public authorities in the EU should be nearly zero-energy buildings. The centre was equipped with the metering and control system covering ventilation and heating system, as well as measuring, archiving and reporting such values as the temperature in the building, meteorological factors (external temperature, air humidity, atmospheric pressure, wind direction and speed, solar radiation, precipitation), devices operating parameters and power and heat supply parameters. The building of the centre was designed as a very tight construction built on a rectangular plan. It has an internal circular wall made from reinforced concrete with large thermal interia. The wall separates the auditorium from the passageways and technical rooms. The wall has an in-built surface heating installation. The projected tightness of the building envelope eliminates uncontrolled infiltration and enables heat recovery from the ventilation system. Due to the restrictive requirements concerning the energy characteristics of the buildings, special windows and doors have been installed, which guarantee high air tightness and sufficient thermal insulation. The whole


Photo: R. Sawicki

construction is surmounted by a roof slab from the reinforced concrete (with the total surface of 200 m^2) serving as a basis for a green roof, which adds to the concept of low-emission passive building. The green roof improves thermal insulation of the building, reduces so called "heat island effect" and improves building's esthetics.

The building uses heat and cold generated by air-source heat pumps. The set of devices supplies surface heating installations, central ventilation unit and installation for preparation of warm usable water. Electricity used for powering internal and external lighting is generated by 100 monocrystalline PV panels (each having the capacity of 100 W) and a vertical-axis wind turbine with the capacity of 3,0 kW. The PV installation is operating in an off-grid system, i.e. independently from the electrical grid, but can be potentially connected to it. The generated energy is stored in special accumulators and then, through the inverter, it is supplied to the receivers. If the accumulators get discharged, the system automatically starts using power from the grid.


Photo: R. Sawicki

Also other modern energy solutions have been used in the building, such as a hybrid lamp, a solar thermal collector and a ground-source heat exchanger. Collectors installed at the western façade reflect solar energy, while the ones installed at the eastern façade let it through.


Photo: Bydgoszcz City Council

FINANCING SCHEME

Construction of the RES Demonstration Centre was funded from the municipal budget and from co-financing from the European Regional Development Fund granted within the Central Europe Programme. The total project budget for Bydgoszcz came to 585.500 EUR, including:

- co-financing from ERDF (85%): 497.675 EUR
- own contribution (15%): 87.825 EUR

The cost of the pilot investments within the project budget came to 386.000 EUR.
Additional funds from the municipal budget, amounting to approx. 590.550 EUR (2.538.702 PLN) were used to finance construction works, equipment and construction of the access road.


Photo: R. Sawicki

PROJECT RESULTS

The RES Demonstration Centre serves as a reference building, which uses model solutions in the area of energy efficiency and RES use that can be replicated in other buildings. This high-quality building enables testing different energy-saving solutions and checking how they work in practice. Annual heating demand, determined according to the Passive House Planning Package [PHPP-Passivhaus-Projektierungs -Paket], cannot exceed 15 kWh/(m^2a). At the same time, total primary energy demand related with all building's needs (heating, preparation of warm usable water, electricity) cannot exceed 120 kWh /(m^2a).

The centre aims at the practical demonstration of the solutions used in passive construction, as well as at the promotion of energy efficiency and RES use in buildings. Achievement of these targets required designing a building, where all the applied solutions are visible for the visitors and achieved results are demonstrated in a form of measurements, visualisations and data archiving.

For the construction of the centre the city of Bydgoszcz was awarded with the Eco-laurel of the Polish Chamber of Ecology. The award was granted within the category "Environmental education". The city also succeeded in the contest "Green cities - towards the future!" announced by the Polish Ministry for Environment. This time the award was granted within the category "Energy efficiency in construction".


Photo: R. Sawicki

DEVELOPMENT PROSPECTS

Due to the didactic character of the centre, the Mechanical School Complex No. 2 makes it accessible to all interested visitors, as well as organises various events devoted to the topic of RES use and energy efficient construction. The RES Demonstration Center is also used for education purposes. Its location on the territory of the vocational school positively influences the educational process, especially in the field of energy efficiency and renewable energy sources.


Photo: R. Sawicki

MORE INFORMATION

RES Demonstration Centre
Mechanical School Complex No. 2 in Bydgoszcz
19 Słoneczna str.
85-348 Bydgoszcz
e-mail: zsmnr2@op.pl
phone: 52 373 12 39
www.zsm.ckunr1.vdl.pl

POLISH AND NORWEGIAN CITIES
together for climate and energy

ENERGY AND ENVIRONMENTAL MANAGEMENT IN PUBLIC UTILITY BUILDINGS IN CZĘSTOCHOWA

Sector: Sustainable energy management

Timeframe: since 2003

Location: Częstochowa


Photo: City of Częstochowa

PROJECT BACKGROUND

Częstochowa (approx. 235 000 inhabitants) is located in the southern part of Poland, in the Silesian Voivodeship. Since January 2012 the city is a member of the Association of Municipalities Polish Network "Energie Cités". In the same year it also signed the Covenant of Mayors, and two years later it developed and formally approved local Sustainable Energy Action Plan. The document shows how the city plans to fulfil its commitment in the area of GHG emission reduction. One of the foreseen initiatives improving energy efficiency in the public sector, and thus contributing to the decrease of GHG emissions, is the programme entitled "Energy and environmental management in public utility buildings in Częstochowa", which is being implemented since 2003. It includes thermal retrofitting of public utility buildings, modernisation of district heating substations and implementation of different types of low-cost, managerial and educational measures. They all contribute to the realisation of the concept of sustainable energy economy. Częstochowa is basing all its activities on the "5 x E" rule, where "E" stands for Energy, Efficiency, Economy, Ecology and Education. A unit responsible for the implementation of sustainable energy measures is the City Engineer's Office, which hires three specialists subordinate to the municipal engineer.

DESCRIPTIONS AND RESULTS OF IMPLEMENTED PROJECTS

FREE MARKET

Częstochowa started benefiting from the free electricity market already in 2009, as the first city in Poland. When organising open tenders it follows the rule of separating purchase of distribution services from the purchase of electricity itself, which introduces real competition between the energy retailers. The tenders are organised for a purchasing group composed of all municipal institutions and companies. In 2015, following biding regulations concerning electricity market liberalisation, Częstochowa announced another joint tender for electricity supply covering the demand of 5 departments of local administration, 137 organisational units, municipal companies and the City's Road and Transport Authority. Change of the energy provider was successfully conducted. Energy volume covered by the tender amounted to 44,25 GWh.

Financial savings achieved in the period 2009-2015 as a result of the first change of the energy provider reached 21,3 Mio PLN (approx. 5 Mio EUR). It is estimated that in 2016 they will come to further 5,8 Mio PLN (approx. 1,3 Mio EUR), which gives together over 27 Mio PLN (approx. 6,3 Mio EUR).


Photo: City of Częstochowa

Częstochowa also selected a winning tender for the gaseous fuel supply for the purchasing group composed of the Control and Administration Department and the city's 88 organisational units and companies. The contract was awarded for the period 01.04.2016 – 31.03.2017. Foreseen financial savings resulting from this action come to 640 000 PLN (approx. 149 000 EUR).

Moreover, Częstochowa is the first Polish self-government, which won the tender organised by the President of the Energy Regulatory Office and received an Energy Savings Certificate (ESC) with the value of 689 toe. Such certificates, also called the "white certificates", are issued for energy-saving activities resulting in a certain reduction of energy consumption. They are the securities that can be traded on the market.

RESULTS

Savings achieved in the period 2009-2015 in result of an open tender for electricity supply came to 21,3 Mio PLN (approx. 5 Mio EUR). Together with the additional savings predicted for 2016 they should exceed 27 Mio PLN (approx. 6,3 Mio EUR). The tender awarded for the gaseous fuel supply should bring the municipality further annual savings of 640 000 PLN (approx. 149 000 EUR). The "white certificates", obtained for energy-saving measures implemented, were sold for 660 000 PLN (approx. 153 490 EUR).

USE OF ENERGY PERFORMANCE CONTRACTING - THERMAL RETROFITTING OF BUILDINGS

The retrofitting works consisting in thermal insulation of the envelope and modernisation of the heat source were conducted in 14 educational facilities. Moreover, in cooperation with the ESCO company, the municipality modernised district heating substations in 22 educational facilities and re-constructed 2 boiler houses switching from solid fuel to heating oil. District heating substations in further 19 buildings were reconstructed by the Fortum company to


Photo: City of Częstochowa

satisfy municipality's claim concerning compensation for the property (elements of district heating network) passed over to the company until 1997. The compensation included also installation of automated boiler houses using eco-pea coal as a fuel in 4 facilities.

RESULTS

In 2014 heat consumption in Częstochowa's educational facilities decreased by 40% compared to the baseline year (2003). In the same year the heating costs were reduced by 6% (486 000 PLN ≈ 113 000 EUR) compared to 2013. Regarding other types of municipal buildings, heat consumption decreased by 20% compared to 2003 and the heating costs were reduced by 10% (359 000 PLN ≈ 83 500 EUR) compared to 2013.

USE OF ENERGY PERFORMANCE CONTRACTING - "DROP TO DROP" PROJECT

In November 2012 Częstochowa launched a pilot project named "Drop to drop", which was implemented in five educational facilities and three buildings occupied by the municipal boarding house. In March 2013 the project was extended to include further 16 educational buildings and in March 2016 next 10 buildings joined. The main aim of the action


Photo: City of Częstochowa

was to reduce water consumption in participating buildings, at the same time reducing amount of energy needed to heat it and the related costs. This is achieved by implementing relevant technical solutions, tailor-made for each building, and by organising educational activities addressed to the building users.

RESULTS

Implementation of the programme entitled "Energy and environmental management in public utility buildings in Częstochowa" resulted in significant water savings. In 2014 water consumption in 118 educational facilities came to 124 367 m^3, which is 77 036 m^3 (38,2%) less than the consumption in 2003.


Photo: City of Częstochowa

SYSTEM FOR MONITORING UTILITIES CONSUMPTION

Since 2003 the City Engineer's Office has been gathering data on utilities consumption and related costs incurred by all municipal units. In order to improve the process of utilities management, in 2008 Częstochowa introduced an on-line System for Monitoring Utilities Consumption, which is used to collect data from energy and water bills received by all municipal institutions and companies. The system includes modules enabling relevant analyses and reporting. Since 2003 the data on energy and water consumption (including the settlement terms) are obtained directly from respective institutions, which enables on-going monitoring of the efficiency of their use and the correctness of the settlements made.
Engaging building managers in the process of data acquisition serves also educational purposes as it helps them realize how important it is to regularly monitor utilities consumption and related costs, as well as to take actions rationalising this consumption.

RESULTS

According to the analyses made real savings resulting from reducing utilities consumption reach approx. 27 Mio PLN (approx. 6,3 Mio EUR). In 2014 total energy and fuel consumption registered in 118 educational facilities, where detailed monitoring and reporting procedures were implemented, came to 44 682 MWh and was 38,5% lower that the consumption in 2003. Also CO2 emission was reduced (coming to 20 666 tCO2, which gives 36,9% reduction compared to 2003), as well as the water consumption (coming to 125 152 m^3, which gives 37,9% reduction compared to 2003).


Photo: City of Częstochowa


Photo: City of Częstochowa

MODERNISATION OF STREET LIGHTING

Modernisation of street lighting was conducted on the basis of the lighting service provision agreement made between the City of Częstochowa and the company Tauron Dystrybucja S.A., Częstochowa's Branch. The action started with the comprehensive inventory of street luminaires made at the beginning of 2012, which helped to determine the scope and technical details of planned modernisation works. They included replacement of 4 862 old luminaries with the new, energy efficient ones, as well as installation of 1 172 additional luminaires.

RESULTS

As a result of the investment the output of the lighting network was reduced by 550 kW, decreasing also electricity consumption by approx. 2 200 000 kWh per year. The costs of electricity and distribution services, incurred from the municipal budget, dropped by 1,65 Mio PLN (approx. 0,4 Mio EUR) per year.

JOINT RESULTS OF ALL IMPLEMENTED ACTIONS

Joint results achieved in 118 educational facilities due to the implementation of all described measures (period 2004-2014) are following: reduction of energy consumption by 197 058 MWh, reduction of CO_2 emissions by 83 689 tonnes and reduction of water consumption by 678 931 m^3.

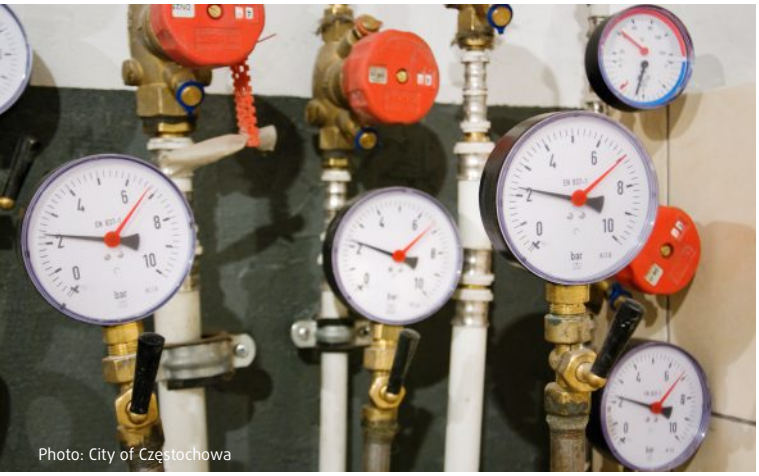


Photo: City of Częstochowa

In recognition of Częstochowa's activities for sustainable development and energy conservation, the city was nominated to the national contest and received an Eco-Inspiration Emblem 2014 in the category of "City of Sustainable Development". It took the first place both in the eyes of the Contest's Programme Council and in the on-line voting organised within another contest, announced by the editorial office of the "Ekologia i Rynek" ("Ecology and Market") magazine and Ekorynek.com portal, which took place under the patronage of the Ministry for Environment.

Częstochowa's authorities efforts were also appreciated by the international organisation CDP, which marked out the city in its "CDP Climate Change Report 2015" for the strategic approach towards the development of low-emission economy, building dialogue and exemplary cooperation with the business sector in this area.


Photo: City of Częstochowa

MORE INFORMATION

Bożena Herbuś, City Engineer
City Engineer's Office
e-mail: bherbus@czestochowa.um.gov.pl
phone: +48 34 370 76 16

POLISH AND NORWEGIAN CITIES
together for climate and energy

STRØMSØ, DRAMMEN
CLIMATE-FRIENDLY CITY DEVELOPMENT

Sector: Community energy project

Timeframe: 2009 – 2020

Location: Strømsø, Drammen, Norway

PROJECT BACKGROUND

Strømsø is centrally located on the south side of the Drammen river. The area is about 340 acres with about 220,000 m^2 of buildings. The potential for increased density is calculated to be about 200,000 m^2. Central part of Støms ø is dominated by offices and small retail facilities, and it is home to about 1800 people. There is a relatively high rate of movement of people in and out of the area, and the population is culturally very mixed. The area has many small and some large property owners, and the businesses are poorly coordinated. Drammen's train station, which is the fourth busiest in the country, and the local and regional bus hub is located nearby.

PROJECT DESCRIPTION

Strømsø will be developed into a low carbon neighbourhood with both businesses and residences.

The municipality has in cooperation with local energy suppliers conducted a feasibility study for a future-oriented energy system, including technical possibilities and limitations on how to reduce greenhouse gas emissions from the energy system. A three-year pilot scheme was launched in 2013 to advice on the rehabilitation and energy-efficiency improvements of existing buildings. For a number of buildings using different materials that are typical for Strømsø and Drammen, a brief building assessment and proposed rehabilitation measures were introduced.

Street parking is widely eliminated and measures are planned to ease access for buses, pedestrians and bicyclists. A new common parking house is built with concrete produced with low CO2-emission cement, energy saving LED lighting, green roof and charging facilities for electric cars. In 2013 a safe "bicycle hotel" with 250 places and charging facilities were opened at the train station.

A cultural historic site analysis, which includes the mapping of cultural monuments as a spatial resource for development, was completed in Strømsø in 2013. The analysis provides a knowledge base in connection with the further development of the area.

As part of adaptation to climate change, a flood strategy is developed, including the nearby river.

PROJECT RESULTS

In April 2012 the city council adopted objectives for the further development of the area. Through the planning process, and cooperation with

stakeholders, the objectives are now turned into results, i.e.

- Potential for increased density of about 150,000 m^2 business
- 300 to 500 new homes
- Numerous example projects
- High architectural and environmental quality
- Increased energy-efficiency of the existing building stock
- Development of working practices that contribute to the involvement of property owners, residents and other groups who use Strømsø in the planning process
- Knowledge sharing, viewing and profiling

MORE INFORMATION

Association of Norwegian Architects:
www.arkitektur.no/stromso-climate-friendly-city-development-in-drammen?lcid=1033&coty=3308aadd-567d-4c99-a45b-babec9e65005

POLISH AND NORWEGIAN CITIES
together for climate and energy

FJELL KINDERGARTEN, DRAMMEN
PASSIVE HOUSE KINDERGARTEN WITH GROUND-SOURCE HEAT PUMP

Sector: Geothermal energy, energy efficiency

Timeframe: 2008 – 2010

Location: Fjell, Drammen, Norway

PROJECT BACKGROUND

Fjell kindergarten is situated on a hill near a small stand of trees, with a view over the residential area and Drammen town centre. It accommodates 80 children, with 5.1 m^2 per child. This residential area has integrational and social challenges and positive projects like this one are welcome.

PROJECT DESCRIPTION

The heating requirements of Fjell Kindergarten are reduced through a series of initiatives. The building has only a few, but large, windows. The total glass area is only 18 percent of the floor area. The exterior walls have 250 mm of insulation, with 600 mm of insulation in the roof. Cold bridges are minimised, and the house is built with a high level of airtightness (0.6 air exchanges at 50 pA pressure). The kindergarten has balanced ventilation with a highly efficient heat recovery system (annual efficiency of 83.2%). The cooling needs are reduced through, among other things, good external sun shading, with a total sun factor of 0.55. The building is equipped with central heating, a ground-source heat pump and an electric boiler for peak loads.

Prefabricated solid wood elements are used in the walls and ceiling, forming a robust and precise sandwich-building system. The load-bearing elements are insulated with mineral wool, and also function as an external cladding. The load-bearing elements are all visible internally. All surface treatments, both inside and outside, are moisture permeable, which contributes to a more stable and comfortable indoor air quality.

The ground floor slab and the foundations are mainly constructed using reinforced concrete and Leca and insulated with EPS. The interior slab towards the cellar is concrete with 300 mm insulation, under-floor heating and vinyl flooring. The group rooms have rubber flooring.

PROJECT RESULTS

Gross area: 830 m^2
Heated area: 755 m^2

Greenhouse gas calculations (tons CO2 equivalents)

	Reference	Project	Completed	Operational
Energy	40	16	–	–
Material Use	14	7	–	–
Transport	17	16	–	–

Energy label:	A
Net energy:	66 kWh/m^2/year - passive house
Estimated energy delivered:	51 kWh/m^2/year passive house
Energy sources:	Ground source heat pump (from energy wells)
Room heating:	16.6 kWh/m^2/year
Ventilation heating:	7.3 kWh/m^2/year
Domestic hot water:	10 kWh/m^2/year
Fans:	10.2 kWh/m^2/year
Pumps:	0.7 kWh/m^2/year
Lighting:	15.7 kWh/m^2/year
Technical equipment:	5.2 kWh/m^2/year
Specific fan power	1.47 kW/(m^3/s)
Heat recovery efficiency	83 %

MORE INFORMATION

FutureBuilt web site:
www.futurebuilt.no/prosjektvisning?lcid=1033&projectID=204300

In Asker and Oslo municipalities, two new plus house kindergartens are planned. These projects are not fully developed yet, lacking energy calculations. For more information, see
Asker:
www.futurebuilt.no/prosjektvisning?lcid=1033&projectID=265052
Oslo:
www.futurebuilt.no/prosjektvisning?lcid=1033&projectID=265301

POLISH AND NORWEGIAN CITIES
together for climate and energy

"DROP TO DROP" WATER SAVING PROGRAMME

Sector: Public-private partnership

Timeframe: 2011 – present

Location: Warsaw

PROJECT BACKGROUND

The "Drop to drop" programme was developed to answer the need for actions improving water and energy efficiency in public utility buildings and at the same time increasing environmental responsibility of local societies. The project aimed at coming up with a solution that could be applied in nearly any building, without engaging building owner's funds. The capital employed by the investor would be returned from the savings achieved as a result of implemented measures, which should bring immediate economic, environmental and social benefits. Additionally, implementation of the programme would be possible without building's temporary shut-down or major technical interventions, which is a novelty for the building owner. The programme focuses on the reduction of warm usable water consumption as the cost of energy needed to heat the water is often the second biggest cost item related with building's operation (after the cost of heating the building).

The programme was developed by the team of the EFERGO company and enables improvement of energy efficiency, decrease of water consumption and wastewater production and reduction of carbon footprint of a public building.

PROJECT DESCRIPTION

The "Drop to drop" programme is a proprietary solution, which consists of few complementary stages composing comprehensive approach to water saving.

The first step is the water audit - a service created specifically for the programme needs. It serves as a basis for qualifying the building to take part in the programme and for determination of the necessary parameters of economic and environmental results of the action. A water audit aims at the presentation of the current situation of a building in terms of water consumption, amount of energy needed to heat it, resulting CO_2 emissions and amount of generated wastewater. It also includes a simulation of the balance of utilities consumed after the intervention. The audit presents the cost side of the investment and provides a key set of information for both parties concluding an agreement. A precondition for joining the programme is a positive result of the audit, which should show satisfactory level of estimated savings. The audit consists of the site inspection, analysis of historical data concerning the building and its operation (provided by the owner), technical analysis of water consumption points, interview and in-depth analysis of the results. The audit needs to be paid for by the building owner only when he doesn't sign an agreement on the programme implementation afterwards. The amount depends on the size and purpose of the building and varies from 1 000 - 2 000 PLN net (approx. 230 - 460 EUR net). In case of building owners, who decide on joining the "Drop to drop" programme, costs of the audit are recovered from the savings achieved as a result of its implementation. Signing of a relevant contract is the second important step of the process.

The third step is the implementation of water-saving solutions, which are adapted to the building, its technical state and operating conditions. They aim at the achievement of both economic and environmental benefits. In each case proposed water- and energy-saving measures are tailor-made, using branded, good quality solutions and taking into consideration epidemiological safety requirements. Relevant programme documentation is completed. Among the proposed solutions there are the following: automated control of water flow, water aeration, removal of leakages and maintenance works. One of the examples of implemented actions is the modernisation of water use points in a Warsaw school, including installation of timed flow taps, tap aerators and flushes with automatic water dosing. Another type of activity was the division of gastronomic units into different zones, including zone for washing the dishes and zone for water intake, where the water flow was adapted to the actual needs. Water consumption for social uses (showers) was reduced thanks to the installation of certified, water-saving shower heads and automatic timers.

The next step is ensuring adequate information and communication using common visual elements characteristic for the programme. Special labels, including programme's logo and selected educational theme, are placed next to different water use points, in toilets and bathrooms, etc. They aim to inform the users on the rational water consumption. The stickers are made from special material that is resistant to washing and wearing down and that doesn't spoil the surface that it is attached to. Except for the labels, which are only one of the elements of the educational campaign addressed to the building users, the teachers also receive dedicated educational material with the instruction how to use it.

The last step is monitoring of the economic and environmental results of the action. In includes the development of monthly reports and one final report, which is elaborated after the complete repayment of the costs incurred from the savings achieved. Except for the reports, also an Example of Good Practices is developed for each building involved.

The programme is recommended by the Energy Conservation Foundation in Warsaw. The solutions that it comprises of, including the water audit, were awarded by the Institute of Industrial Design in Warsaw. The award was granted under the category "The best designed services on the Polish market in 2012". The EFERGO company is also a laureate of the programme "Warsaw as the capital of ambitious business" and a winner of the contest organised by Money.pl portal and NETIA company, where it received 1 Mio PLN (approx. 0,23 Mio EUR) award for promotional activities, also concerning the programme discussed.

FINANCING SCHEME

The "Drop to drop" programme is building on the ESCO formula, where the investor engages his own capital in the solution that aims at obtaining both economic and environmental result. The costs incurred are repaid from the financial savings resulting from the reduction of water consumption, wastewater production and the consumption of energy needed to heat the water. The settlements between both parties involved are made on the monthly basis but already from the first day of the programme implementation a certain percent of savings (defined in the contract - usually 20-30%) is returned to the building owner.

PROJECT RESULTS

Currently, the "Drop to drop" programme is implemented on a larger scale in two municipalities, where it covers several dozens of buildings. It is also applied in single facilities from different regions of the country.

1. City of Częstochowa - 36 educational facilities, including schools, kindergartens, municipal boarding house and swimming pools.

Exemplary savings achieved due to the programme implementation from the end of November 2012 till December 2015:

- reduction of water consumption - 26 730 m^3
- reduction of wastewater production - 26 730 m^3
- reduction of energy consumption (concerning energy needed to heat the water) - 584 mWh
- reduction of CO_2 emission - 189 t

2. Capital City of Warsaw - 46 facilities, including schools, kindergartens, swimming pools and offices.

Exemplary savings achieved due to the programme implementation from the beginning of 2013 till December 2015:

- reduction of water consumption - 35 615 m^3
- reduction of wastewater production - 35 615 m^3
- reduction of energy consumption (concerning energy needed to heat the water) - 766 mWh
- reduction of CO_2 emission - 276 t

Except for the water-saving and energy-saving solution, in each building there were also implemented educational activities addressed to the building users, including staff, pupils, visitors, etc. Special labels were designed and produced to encourage rational use of resources and shape desired consumption habits.

MORE INFORMATION

Piotr Kurak
e-mail: info@kropladokropli.pl
phone: +48 22 207 29 29
www.kropladokropli.pl

POLISH AND NORWEGIAN CITIES
together for climate and energy

EURONET 50/50 MAX PROJECT – REDUCING ENERGY CONSUMPTION IN PUBLIC BUILDINGS THROUGH IMPLEMENTATION OF THE INNOVATIVE 50/50 METHODOLOGY

Sector: Energy education

Timeframe: 2013 – 2016

Location: 13 EU countries

PROJECT BACKGROUND

The 50/50 concept was created and used for the first time in Germany, in the 1990's. It actively involves public building users (originally school teachers and pupils) in the energy management process and teaches them environmentally friendly behaviours by practical action. Achieved financial savings are shared equally between the users and the local authority, which covers the building's energy bills. As a result everybody wins: building users (including teachers and pupils) get additional financial resources, local authorities reduce their energy costs and the local community gets cleaner local environment. Moreover, reducing energy consumption in public buildings involved in the scheme contributes to the achievement of local climate & energy goals.

The 50/50 concept was tested in different environments within the 1st edition of the EURONET 50/50 project, which was co-financed from the IEE programme and implemented in the period 2009-2012. Back then 50/50 methodology was introduced in over 50 schools from 9 European countries, who managed to achieve really impressive results. In total 6 900 pupils, teachers and other members of school staff launched cooperation for climate protection with their city halls. 40 schools managed to achieve energy and financial savings with the average savings per one school coming to 2 100 EUR. Altogether, the schools emitted 339 tonnes of CO_2 less to the atmosphere and saved over 1 100 MWh of energy! The EURONET 50/50 project also won the European Sustainable Energy Award 2013. Due to this huge and spectacular outcome it was decided to continue the project on a larger scale.

PROJECT DESCRIPTION

2nd edition of the project - EURONET 50/50 MAX - started in April 2013 and lasted till April 2016. It aimed at mobilizing energy savings by implementing the 50/50 methodology in 500 schools and nearly 50 other public buildings from 13 EU countries: Austria, Croatia, Cyprus, Czech Republic, Finland, Germany, Greece, Italy, Latvia, Lithuania, Poland, Slovenia and Spain. The methodology consists of 9 steps: setting up of the energy team, initial energy tour, raising building users' knowledge and awareness on climate & energy issues, extended energy tour, long-term temperature measurements and energy use assessment, proposing energy-saving solutions, development of information campaign, reporting measures requiring small investments and calculating and using the money saved. In Poland 139 schools and 9 other public buildings got involved in the project in cooperation with their city halls: Bielsko-Biała,

Bielawa, Bydgoszcz, Chorzele, Ciechanowiec, Cieszyn, Częstochowa, Dąbrowa Górnicza, Dębica, Dzierżoniów, Jasło, Józefów, Kościerzyna, Laszki, Lubin, Lublin, Miechów, Niepołomice, Nowa Dęba, Nowy Sącz, Pałecznica, Raciechowice, Spytkowice, Śrem, Warszawa and Wilkowice.


Photo: P. Zieliński

Within the project framework the energy teams created in schools were equipped with so called e-packs, including measuring devices - digital thermometer, luxmeter and energy meter. Using this equipment the team members were checking temperature and light brightness in different rooms during their watch. From the guidelines they knew what should be the optimum temperatures in classrooms, bathrooms, changing rooms and at the corridors. After in-depth analysis of the energy situation of their school and pinpointing all the places and processes where energy is wasted, the pupils looked for possible energy-saving solutions and monitored their implementation. Energy teams also shared their findings with the whole school community and taught their colleagues good, energy efficient behaviours. This precious knowledge is transferred also to pupils' homes. After the full year of 50/50 activities it is possible to calculate the savings. In order to learn how much money and energy have been saved, it is necessary to collect data from invoices issued for the reference years (3 years back in case of heating and 1 year back in case of electricity) and for the 50/50 implementation year. To reduce impact of weather conditions it is also necessary to take into consideration heating degree days for this period. After gathering the data, the municipal coordinator (municipal employee responsible for the project) enters them into the special on-line programme and receives a report on energy and financial savings achieved. Half of the savings is then paid back to the school (or other public building participating in the 50/50 scheme). A very important aspect of the EURONET 50/50 MAX project is engaging energy teams in taking decision on the use of the money received. In some schools they have been used to fund small investments further improving energy efficiency of the building (e.g. installation of thermostatic valves at the radiators), while in others to purchase additional equipment for classrooms (e.g. multimedia boards, projectors, laptops).

In order to facilitate municipal and school co-ordinators' work, the consortium of the EURONET 50/50 MAX project created special on-line calculation tool, which helps to calculate how much money and energy each building has saved and how much CO_2 less has been emitted to the atmosphere as a result of the undertaken actions. They also created special Facebook profile enabling exchange of experience between schools and other buildings involved in the project. Here they can share their opinions and ideas for energy saving, as well as display pictures from project activities or posters prepared by pupils. Moreover, a set of new brochures, guidebooks, articles and information material was developed for all those that might be interested in implementation of the 50/50 methodology in their municipality or school. In order to

Photo: J. Płazak

award pupils for their energy-saving efforts, each year 50/50 festivals took place in selected municipalities. After the 1st year of the 50/50 implementation such event was organised in Dąbrowa Górnicza (29th of May 2015), gathering over 200 pupils and 30 teachers from 28 schools. Next year the event took place on the 15th of April in Częstochowa and gathered over 160 pupils and 20 teachers from 12 schools.

FINANCING SCHEME

The project was co-financed by the European Commission within the Intelligent Energy Europe (IEE) programme. The co-financing rate was 75% of the project cost.

PROJECT RESULTS

It was already the 1st year of 50/50 implementation at schools that proved that the energy saving pays off. The calculations made show that most of the schools managed to save electricity, heat or both of these energy sources. Out of 136 Polish schools, for which the calculations were finalized, in 2014 83 (i.e. 61%) achieved total savings. Together they managed to save 2 665 186 kWh of energy (with the average of 32 110,67 kWh per school), which gives financial savings amounting to 623 482,86 PLN (with the average of 7 511,84 PLN per school). As a result 848,14 tonnes of CO_2 less were emitted to the atmosphere.


Photo: M. Najdek

Another unquestionable success of the EURONET 50/50 MAX project is the popularization of the 50/50 methodology among Polish local self-governments. Over 90 schools from 4 voivodeships (podkarpackie, pomorskie, śląskie and małopolskie) have recently joined the 50/50 Network gathering energy saving institutions. Part of them has already been provided with necessary measuring equipment and guidebooks on 50/50 implementation, as well as took part in the trainings organised within mini-projects co-financed by relevant Voivodeship Funds for Environmental Protection and Water Management.

Soon, another group of schools will start their adventure with energy saving.


Photo: A. Jaskuła

MORE INFORMATION

Patrycja Płonka
Project Manager
e-mail: patrycja.plonka@pnec.org.pl

Association of Municipalities
Polish Network "Energie Cités"
17/30 Sławkowska str.
31-016 Kraków
e-mail: biuro@pnec.org.pl
phone: +48 12 429 17 93
www.pnec.org.pl

POLISH AND NORWEGIAN CITIES
together for climate and energy

PASSIVE BUILDING - SEAT OF THE VFEP&WM IN GDAŃSK

Sector: Energy efficient buildings

Timeframe: 2015 – 2016

Location: 8 Rybaki Górne str., Gdańsk, Poland


Photo: WFEP&WM in Gdańsk

PROJECT BACKGROUND

Gdańsk (approx. 461 800 inhabitants) is located in the northern part of Poland, in the Pomeranian Voivodeship. For many years the city has been a seat of the Voivodeship Fund for Environmental Protection and Water Management (VFEP&WM). Since 2007 the Fund is acting as the Managing Authority for the 2 priority axes of the **Infrastructure and Environment Operational Programme** - axis I: Water and sewage management and axis II: Waste management and the earth protection. This function was assigned to the organisation on the basis of the agreement signed with the Minister for Environment. VFEP&WM in Gdańsk is also a Territorial Coordinator of the Covenant of Mayors and as such cooperates with cities and municipalities in the field of energy saving.

PROJECT DESCRIPTION

Management Board of the Fund decided to move its seat to a new location as the previous one was difficult to access and not adapted to the needs of older and disabled people. Another important factor was also the lack of adequate conditions and space for organising trainings and providing wide consultation services.

New, environmentally friendly seat of the Fund was built using state-of-the-art energy saving solutions. As a result its energy demand and operation costs are low. Thermal insulation of the walls, roof and floors has parameters that considerably exceed current standards in force, which prevents heat losses in winter and limits overheating in summer. The building façade is mainly composed of glass and red brick, which was necessary due to the fact that it was constructed on the area protected by the historic preservation officer and had to fit into the surroundings. New buildings has 10 meters of height and 1370 m^2 of office area. Except for the offices, inside there are also conference & training rooms, social facilities and a library, where many books and articles on environmental protection may be found. The ground floor is used for organising conferences, workshops and trainings. It can be divided into several smaller rooms or used as a single conference area. All of the offices have floor heating, which can be individually regulated, and the ones oriented towards the south are additionally equipped with air conditioning. PV panels have been installed on the roof, in the skylights and on the southern façade. They will produce approx. 40 kW of electric energy. Building operating parameters are controlled and regulated by the central management system called BMS (Building Management System), which collects and gathers in one place information coming from the whole building and allows for immediate reaction to any changes in external or internal conditions. Thanks to BMS it is possible to ensure optimum energy (and other resources) consumption, improve building's functionality, increase security and improve building users' comfort.


Photo: WFEP&WM in Gdańsk

In order to encourage employees to use alternative, more environmentally friendly modes of transport, the building contains changing rooms and bathrooms for cyclists. Another ecological solution is the green roof. Sedum plants seeded there don't require frequent watering or nurturing but help to increase biologically active area of the building and create another green space within this part of the city. The Fund moved to the new seat in March 2016. The building is open both for the VFEP&WM beneficiaries and the Gdańsk inhabitants and tourists.

FINANCING SCHEME

Total cost of the construction of the VFEP&WM's new seat came to PLN 7,3 million and was entirely covered from the Fund's own budget.

PROJECT RESULTS

VFEP&WM's new seat in Gdańsk is the first public utility building in the Pomeranian Voivodeship that uses state-of-the-art ecological solutions. It is a showcase in the area of environmentally friendly construction. This modern and energy efficient facility promotes RES use and sets good practice standards for other public buildings built in the region. The Fund wants to encourage other organisations and companies to follow its lead. Especially that after 2018 all newly constructed public buildings will have to have energy efficient lighting, heating and heat recovery systems.

During the commissioning works there were conducted thermographic readings and a pressure tightness test of the building. All the tests ended with a very good results. What is more, the total amount of electricity produced in the building should exceed by approx. 10-11% its energy demand. It should be noticed, however, that due to the weather conditions the energy yield may not be steady. During the summer months electricity surplus will be transferred to the grid, making the Fund an energy supplier, while in the winter the institution will be able to get back the same amount of electricity from it.

New facility, located at the banks of the Radunia Canal, contributed to the revitalisation of the areas adjacent to the old shipyard territory that was earlier dishevelled and disordered.

DEVELOPMENT PROSPECTS

It is the Fund's intention that all interested people are able to get familiar with the environmentally friendly solutions used in its building, therefore the visitors will be able to see the energy unit and the building management system, as well as the "hotels" for pollinating insects and bird feeders. It is also planned to install a charging station for electric vehicles in front of the building. Moreover, the Fund intents to install a gas co-generation unit that will incinerate natural gas to produce both heat and electric energy.


Photo: WFEP&WM in Gdańsk

MORE INFORMATION

Zdzisław Czucha
Coordinator of the Energy Consultants Team in the Pomeranian Voivodeship
VFEP&WM in Gdańsk
e-mail: zdzislaw.czucha@wfos.gdansk.pl
phone: +48 58 301-91-92, ext. 62

DEVELOPMENT OF ENVIRONMENTALLY FRIENDLY PUBLIC TRANSPORT - TROLLEYBUSES IN GDYNIA

Sector: Sustainable transport

Timeframe: 2005 – 2013

Location: Gdynia, Poland


Photo: Marcin Czapnik

PROJECT BACKGROUND

Gdynia (approx. 247 800 inhabitants) is located in the northern part of Poland, in the Pomeranian Voivodeship. In 2011 the city signed the Covenant of Mayors and established cooperation with the Association of Municipalities Polish Network "Energie Cités" - official Covenant Supporter. In 2012 Gdynia adopted Sustainable Energy Action Plan until 2020 and in 2015 it adopted Low-Emission Development Programme. Gdynia is one of the three Polish cities with trolleybus systems. Its trolleybus network is considered the biggest and the most modern in the country and extends to two neighbouring municipalities - Gdynia and Sopot. The network comprises of 12 permanent lines and 1 seasonal line. The low-floor vehicles carry over 25 million passengers per year, travelling 5 million vehicle-kilometres. In the period 2010-2013 the city implemented a project called Trolley, which aimed at promotion of trolleybuses as the cleanest and most economical form of transport for sustainable cities and regions in Central Europe. In December 2012 the Trolleybus Communication Enterprise Sp. z o.o. in Gdynia (**Przedsiębiorstwo Komunikacji Trolejbusowej Sp. z o.o. w Gdyni**) signed contract concerning implementation of the EU research & innovation project named CIVITAS DYN@MO (carried out by a consortium of 28 partners), while in June 2015 it joined the ELIPTIC project co-financed from HORIZON 2020 programme (carried out by a consortium of 34 partners).

PROJECT DESCRIPTION

In the period 2005-2007 the Trolleybus Communication Enterprise Sp. z o.o. (TCE) implemented the EU-funded project entitled "Development of environmentally friendly public transport in Gdynia", which consisted in the construction of a new trolleybus depot in Gdynia, new trolleybus loop in Kacze Buki quarter and new trolleybus lines with the total length of 10.6 km, as well as the purchase of 10 new low-floor trolleybuses. In the period 2010-2013 TCE implemented another environmental project entitled "Development of environmentally friendly public transport in the Tri-City". Project activities included reconstruction of the traction network along the Zwycięstwa str. in Gdynia and Niepodległości str. in Sopot (together with a trolleybus loop in Reja str.), construction of 4 new and reconstruction of 5 existing traction substations, construction of the Substation Remote Control Centre with remote controlled disconnectors and purchase of 28 new low-floor trolleybuses.

The CIVITAS DYN@MO project, implemented within the CIVITAS II PLUS initiative and co-financed from FP7, included purchase of 2 new Solaris trolleybuses with an alternative power source - a lithium-ion battery, choice of a trolleybus line to be served by new hybrid trolleybuses, further expansion of the trolleybus network to cover areas, which couldn't be reached with traditional trolleybuses (due to the lack

Photo: Marcin Czapnik

of the traction network), and enhancing the overall reliability of the trolleybus transport services in Gdynia.

Enrichment of the fleet by purchasing new hybrid trolleybuses was a breakthrough moment for the trolleybus transportation system in Gdynia as the vehicles equipped with lithium-ion batteries can move also on the roads without the traction network. The previous alternative power source - nickel-cadmium batteries - weren't as efficient as the new ones and didn't bring such vast opportunities. The trolleybuses are also equipped with automatic pantographs enabling automatic raising and lowering of the current collector. Asynchronic drive with the energy recuperation system allows for collecting energy during moving and giving it back during breaking. Another task envisaged within the CIVITAS DYN@MO project was the reduction of the electric power demand of the trolleybus system through the installation of supercapacitator, as well as enhancing energy efficiency of trolleybuses and existing infrastructure. Installation and startup of the supercapacitator took place in April 2014. The supercapacitator bank was located in the area of Wielkopolska Substation, which is a hilly terrain, therefore there is higher frequency of trolleybuses braking and giving recuperative energy back to the traction network. The bank "catches" this energy and stores it for later use by other trolleybuses. Reduction of energy consumption of the network section, where the supercapacitator is installed, comes to 12-20%.

Another important undertaking implemented by TCE is the ELIPTIC project, which aims at reducing energy consumption of public transport and related costs by optimising the use of existing infrastructure and electric vehicles fleet. Project partners will also investigate opportunities for further electrification of public transport in their cities (the project ends in May 2018). Using remote control and data acquisition software purchased within the project (costing approx. 25 000 EUR), TCE will re-configure 2 network sections from one-sided to two-sided power supply. This will help to increase efficiency of energy recovery from trolleybuses braking and thus reduce network electricity consumption. Thanks to the two-sided power supply the network will be also more energy stable (optimisation of energy balance and energy management). TCE is also planning the development - in cooperation with the University of Gdańsk - of two feasibility studies concerning further electrification of public transport system in Gdynia:

- "Possibilities of recharging electric vehicles connecting Tri-City agglomeration based on trolleybus infrastructure".
- "Replacement of diesel bus lines by extension of trolleybus network based on hybrid trolleybuses using batteries as the alternative power source (based on CIVITAS DYN@MO experience)".

Photo: Marcin Czapnik

Photo: Marcin Czapnik

FINANCING SCHEME

The EU project entitled "Development of environmentally friendly public transport in Gdynia" had the value of approx. 54 Mio PLN (approx. 12.5 Mio EUR) and was co-financed from the European Regional Development Fund within the Regional Operational Programme for the Pomeranian Voivodeship for 2004-2006 (with the co-financing rate of 50%). The project entitled "Development of environmentally friendly public transport in the Tri-City" had the value of approx. 100 Mio PLN (approx. 23.25 Mio EUR) and was also co-financed from the ERDF within the ROP for the Pomeranian Voivodeship (with the co-financing rate of 70%).

PROJECT RESULTS

The share of the environmentally friendly trolleybus transport system in the Gdynia's overall public transport system comes up to 25%. Implementation of energy efficient vehicles contributed to the reduction of electricity consumption by more than 20%, as well as to the improvement of the passengers comfort. Both new and rebuilt trolleybuses are autonomous, i.e. they don't need traction electricity at a 5-kilometer distance. In 2010 (before the investments co-financed from the EU) annual consumption of traction electricity amounted to 13 GWh and accompanying CO2 emission came to 11.7 Gg. After implementation of the project entitled "Development of environmentally friendly public transport in the Tri-City" in 2013 annual consumption of traction electricity decreased to 10.5 GWh, while accompanying CO2 emission decreased to 9.45 Gg. It can be thus calculated that annual electricity savings come up to 2.5 GWh (20%), while annual reduction of CO2 consumption comes up 2 250 tonnes.

In December 2012 the European Commission honoured Gdynia within the Access City Award contest for the transport system, which is friendly for people with disabilities. In 2013 the Interntional Union of Public Transport (UITP, **Union Internationale des Transports Publics**) recognised Gdynia's transportation system as the best one in Central and Eastern Europe. Another award - Leader of Regional Development - was granted by the Polish Agency for Enterprise Development during the II Polish Entrepreneurship Congress in Katowice in October 2014. Also in 2014 the European Commission honoured Gdynia with the prestigious Regiostars 2014 award for the project "Development of environmentally friendly public transport in the Tri-City". The project won in the category „CityStar – investments in urban public transport compliant with sustainable growth principle".

MORE INFORMATION

Marta Woronowicz
Project Coordinator and PR Manager
Trolleybus Communication Enterprise Sp. z o.o.
(Przedsiębiorstwo Komunikacji
Trolejbusowej Sp. z o.o.)
e-mail: m.woronowicz@pktgdynia.pl
phone: + 48 58 669 42 29

CAMPUS EVENSTAD, STOR-ELVDAL MUNICIPALITY
SHOWCASE FOR FUTURE BUILDING PROJECTS IN NORWAY

Sector: Renewable energy: sun, geothermal, biomass, energy efficiency

Timeframe: 2010 – 2020

Location: Stor-Elvdal, Hedmark, Norway


fot. Statsbygg

PROJECT BACKGROUND

Statsbygg is the Norwegian government's key advisor in construction and property affairs, building commissioner, property manager and property developer, often in close cooperation with local and regional authorities. Statsbygg has a strong environmental focus regarding Norwegian public buildings. Their contribution include **www.klimagassregnskap.no**, a free, web-based tool to calculate life cycle carbon footprint for building and construction projects. Statsbygg's long term goal is zero emissions; and 30 percent emission reduction from new buildings already by 2018.

Faculty of Applied Ecology and Agricultural Sciences at Hedmark University of Applied Sciences is located at Campus Evenstad. Statsbygg (building owner), cooperating with the University and local authorities, is now running one of the most innovative environmental projects in Norway.

PROJECT DESCRIPTION

Campus Evenstad has 250 students and 6000 square meter building area. The campus is now also developed to be a centre for renewable energy knowledge.

Multipurpose building "barn" has received an extensive renovation, with Norway's second largest solar plant on the roof. 276 photovoltaic modules produce a total of approx. 60,000 kWh annually.

The oil based energy centre is replaced with 300 kW pellets (biomass) boiler, delivering hot water to a 5000-liter storage tank supplying heating and domestic hot water. An electrical boiler (315 kW) delivers peak load on the coldest days. Biofuel via the district heating covers at least 80% of the heating demand, the rest is covered by electricity.

Old buildings, responsible for 40% of the energy use, are now replaced or renovated. A 4000 m^2 dormitory for 120 students is located in a new, module based building with passive energy standard. Sun energy collectors on the roof deliver domestic hot water.

The renovated administration building includes major environmental ambitions, with life cycle zero emission. Carbon emissions from production of materials, construction, operation and maintenance shall be compensated by production of local, renewable energy. Extensive use of wood in addition to reuse and recycling will give further reduction in carbon footprint.

PROJECT RESULTS

With the photovoltaic plant, the campus annually


fot. Statsbygg

saves about 18 tonnes of CO_2 and reduces power consumption from grid by 5%. Complete installed cost for is about 100,000 EUR. The plant contributed to improving the energy label of the building and gave experience with the installation and operation of photovoltaic plants.

The use of pellets as energy source is carbon neutral, because CO_2 released by burning wood is equivalent to the amount of CO_2 tied up in the tree's growth phase. In addition, using pellets is an energy efficient choice, due to high energy content and low moisture. This kind of plant needs less maintenance compared to other solutions based on biomass.

The new dormitory gives less use of energy for heating, and the sun collectors on the roof reduce energy use for domestic hot water.

In addition to the environmental gains, the campus – especially the ambitious administration building – will have an important educational function, both for the students and for visitors.


fot. Statsbygg

MORE INFORMATION

Contact Person:
Zdena Cervenka
Statsbygg
phone: +47 95191622
e-mail: zdena.cervenka@statsbygg.no

Online data on sun energy production:
www.sunnyportal.com/Templates/PublicPageOverview.aspx?page=aa73fe7d-0b27-4b4a-86b8-705551349a4&plant=225ab166-58fb-4816-8fa0-9e34e7377b3d&splang=en-GB

POLISH AND NORWEGIAN CITIES
together for climate and energy

MODERNISATION OF STREET LIGHTING IN JASŁO

Sector: Energy efficient lighting

Timeframe: 2014

Location: Jasło, Poland


Photo: Jasło City Hall

PROJECT BACKGROUND

Municipality of Jasło (approx. 36 000 inhabitants) is located in the north-eastern part of Poland, in Podkarpackie Voivodeship. It is an active member of the Association of Municipalities Polish Network "Energie Cités", as well as the Covenant of Mayors signatory since August 2015. Within the Priority Programme "Green Investment Scheme (GIS) part 6: Owl - Energy efficient street lighting", operated by the National Fund for Environmental Protection and Water Management, it implemented a project entitled "Modernisation of street lighting on the area of the city of Jasło" which was completed in 2014.


Photo: Jasło City Hall

PROJECT DESCRIPTION

The main objective of the investment was to reduce energy consumption and CO_2 emission, thus contributing to the environmental protection and mitigation of greenhouse effect, which has negative influence on the world's climate. An important precondition for modernising street lighting within the OWL programme was that the municipality leased from PGE Dystrybucja SA light poles located on its area (the company, seated in Lublin, is the owner of the lighting infrastructure).

The modernisation project consisted in the replacement of 1495 of old luminaires (out of 3512 existing) with the new, energy efficient ones. Moreover, intelligent lighting control system was installed, as well as the power limiters. Thanks to the latter new lamps consume less electricity when the road traffic is lower. Old luminaires - mostly mercury lamps - had large capacity (over 250 W), were outworn and often failed. New sodium luminaires have considerably lower capacity: 70, 100 and 150 W. For the long time they will not need intervention from the repair services, which will also significantly reduce maintenance costs.

112 lighting circuits were modernised and each of them was equipped with a box with power limiters and an intelligent control and remote monitoring unit. The investment's scope included whole city area. Installation of intelligent control and remote monitoring system enables the supervision and maintenance services to monitor performance of the lighting system. Responsible staff immediately receives information on all failures, disturbances,

Photo: Jasło City Hall

power shut downs by the electricity provider and interventions from the maintenance staff, which enables quick reaction and immediate removal of the failures.

FINANCING SCHEME

The investment cost amounted to 2 876 982 PLN. Necessary financial resources came from the subsidy (1,3 M PLN) and the loan (1,5 M PLN) that the city received from the National Fund for Environmental Protection and Water Management within the Priority Programme OWL 2012-2015. Self-governments, who applied for funding, could receive cost reimbursement up to 45% of the investment's total eligible cost, as well as separate loan covering up to 55% of the investment's total cost. Conducted modernisation of street lighting resulted in municipality's lower expenses for electricity and for the maintenance of the lighting system.

PROJECT RESULTS

Modernisation of street lighting reduced electricity consumption by 40%. As a result, its operation costs decreased by nearly 700 000 PLN per year. Reduction of electricity consumption also contributed to the reduction of CO2 emissions to the atmosphere by approx. 1200 Mg/year. The simple replacement of luminaires allowed already for the 30% reduction of installed capacity. Additionally, in consequence of the installation of power limiters, the power consumption is lowered during the night hours when the intensity of vehicle and pedestrian traffic is smaller. This results in 40% reduction of the demand for electricity from the grid and translates into the lower costs of is purchase. These costs not only take into account lower electricity consumption but also reduction of fixed charges. As a result, Jasło's expenditures were significantly lowered.

In 2015 CO2 emission came to 1 233 tonnes, which is 51% of the emission level from before the modernisation. Since it was estimated to achieve 46% reduction, the effect is even higher than expected, which proves that the investment was well planned and implemented.

Programme for monitoring the parameters and exploitation proccess

MORE INFORMATION

Municipality of Jasło
12 Rynek str.
38-200 Jasło, Poland
e-mail: urzad@um.jaslo.pl
phone: +48 13 448 63 00
fax: +48 446 29 76

More info (in Polish):
www.jaslo.pl/pl/news/1116-ton-co2-mniej-program-sowa-zako%C5%84czony

COMPREHENSIVE THERMAL RETROFITTING OF PUBLIC FACILITIES IN THE MUNICIPALITY OF KARCZEW

Sector: Energy efficient buildings

Timeframe: 2013

Location: Municipality of Karczew

Photo: City Hall in Karczew, school and pre-school building in Otwock Wielki - before and after thermal retrofitting

PROJECT BACKGROUND

Karczew (approx. 15 900 inhabitants) is a semi-urban municipality located in the Mazowieckie Voivodeship. It is the first municipality in the region that signed a Public-Private Partnership (PPP) agreement concerning thermal retrofitting of public facilities. 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.

PROJECT DESCRIPTION

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' esthetics and improve energy management using environmentally friendly solutions. 10 buildings were retrofitted, including schools, kindergartens and a health center. 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


Photo: City Hall in Karczew, Primary School No. 2 in Karczew - after thermal retrofitting

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.

FINANCING SCHEME

The value of the contract signed between the municipality of Karczew and the contractor - Siemens Sp. z o.o. company - amounted to 11 518 756 zł. (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 zł. (approx. 307 800 EUR). Capital repayment to the contractor will be done over a 14 -year period.

PROJECT RESULTS

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.


Photo: City Hall in Karczew, school and pre-school building in Sobiekursk - before thermal retrofitting

Photo: City Hall in Karczew, school and pre-school building in Sobiekursk - after thermal retrofitting

MORE INFORMATION

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

POLISH AND NORWEGIAN CITIES
together for climate and energy

WIND FARM AT THE OLD AIRPORT IN KOPANIEWO

Sector: Wind energy use

Timeframe: 2015

Location: Kopaniewo, Pomeranian Voivodeship, Poland


Photo: Małgorzata Hoch-Zwolińska

PROJECT BACKGROUND

Kopaniewo is located in the northern part of Poland, in the Pomeranian Voivodeship. At the area of the village there used to be a military airport, also called Łebień airport or Lędziechowo airport. It was occasionally used since the '90s and currently hosts a wind power plant.

PROJECT DESCRIPTION

The Polish Energy Group (**Polska Grupa Energetyczna** - PGE) is the country's largest energy sector company when considering the sales revenues and the generated profit. Thanks to the combination of its own fuel resources, energy generation units and distribution networks, the capital group guarantees reliable power supply to over 5 million of its customers. In December 2015 PGE launched operation of the "Airport" wind farm with the capacity of 90 MW. This is one of several (and at the same time the biggest) investments of the group in the renewable energy sector. It is also the biggest wind farm put into operation in Poland that year.

The wind farm consists of 30 Alstom ECO110 wind turbines, each having the nominal capacity of 3 MW, and the SCADA remote control system. Each turbine is equipped with the rotor of 110-meter diameter and was installed on the top of the 90-meter steel tower produced by GSG Towers. The company is part of the Gdańsk Shipyard Group and specialises in the production of highly-processed products for wind power industry. The PGE investment covers the area of 550 ha. Foreseen electricity production exceeds 200 000 MWh per year.

Integral part of the "Airport" wind farm is the 30/110 kV power station equipped with the 120 MVA transformer. The farm is connected to the PSE network through the unique, two-way cable line (110 kV of voltage and 40 km of length). Both the high-voltage and the medium-voltage cables used at the farm have been produced by Telefonika Kable factory located in Bydgoszcz.

The area of the farm (550 ha) includes over 9 kilometers of access roads connecting the new power plant with the neighboring "Wojciechowo" wind farm. The latter also belongs to PGE and has the capacity of 28 MW.


Photo: GK PGE


Photo: Małgorzata Hoch-Zwolińska

FINANCING SCHEME

The investment was implemented by the PGE Energia Odnawialna S.A., a company which is part of the PGE Capital Group, where it is responsible for the RES sector. The construction cost came to PLN 0,5 billion.

PROJECT RESULTS AND DEVELOPMENT PROSPECTS

Construction of the wind farm in Kopaniewo will help to reduce CO_2 emissions by approx. 235 000 Mg per year. After putting it into operation total installed capacity of all wind power plants owned by PGE reached 441 MW. After two other wind farms, which are currently under construction, will launch their operation ("Resko II" with the capacity of 76 MW and "Kisielice II" with the capacity of 12 MW) this amount will increase to 529 MW. And already now the capital group supplies wind-generated power to approx. 400 000 households.

PGE is also working on the project of the 1st offshore wind farm in Poland. In August 2015 it announced a call for tenders for the environmental assessment of the investment.


Photo: Małgorzata Hoch-Zwolińska


Photo: GK PGE

MORE INFORMATION

Marek Maciaś
PGE Energia Odnawialna
e-mail: marek.macias@gkpge.pl
phone: +48 22 433 1309
www.gkpge.pl

THERMAL RETROFITTING OF PUBLIC UTILITY AND RESIDENTIAL BUILDINGS IN KOŚCIERZYNA

Sector: Energy efficient buildings

Timeframe: 2005 – 2008 and 2012 – 2016

Location: Municipality of Kościerzyna, Poland


Photo: Jolanta Bork, Primary School No 1

PROJECT BACKGROUND

Kościerzyna (approx. 23 700 inhabitants) is located in the northern part of Poland, in the Pomeranian Vivodeship. The city is an active member of the Association of Municipalities Polish Network "Energie Cités". In 2011 it joined the Covenant of Mayors - bottom-up initiative for climate protection. In 2012 it formally adopted Sustainable Energy Action Plan until 2020 (SEAP) defining city's long-term vision, specific objectives and a set of planned measures supporting energy efficiency, RES use and air quality improvement. One of the actions foreseen in the SEAP is thermal retrofitting of public utility and residential buildings. To ensure its implementation Kościerzyna applied for and received funding from the National Fund for Environmental Protection and Water Management (within the KAWKA[1] programme). Supported project, named "KAWKA in Kościerzyna. Reduction of low-stack emissions through co-generation and thermal retrofitting of buildings", aims at adoption of corrective actions following directions set in the Air Protection Programme for the Kartuzy and Kościerzyna Zone.

PROJECT DESCRIPTION

First group of Kościerzyna's public utility buildings was modernised in the period 2005-2008. The scope of thermal retrofitting works included thermal insulation of external walls and ceilings, replacement of windows and doors, and modernisation of heating systems. In total 5 buildings were modernised, including public school complexes No. 1, 2 and 3, self-government kindergarten No. 7 and Kościerzyna's Community Centre. In the period 2012-2013 five more buildings were renovated with the support of the NFEP&WM granted within the Green Investment Scheme (GIS) programme. These were: primary school No. 1, primary school No. 2 (building A and building B), "Pooh Bear" kindergarten, "Rainbow three" kindergarten and social welfare centre. Another example of effective renovation combined with deep thermal retrofit is the Kashubian Entrepreneurship Incubator - its building was adapted for energy efficient exploitation thanks to the co-financing obtained from the Regional Operational Programme for Pomorskie Voivodeship for 2007-2013.

Since 2014 Kościerzyna is implementing another thermal retrofitting project co-funded from NFEP&WM, entitled "KAWKA in Kościerzyna. Reduction of low-stack emissions through co-generation and thermal retrofitting of buildings". In 2014 two municipal buildings were comprehensively modernised and in 2015 - next four. In 2016 it is planned to conduct thermal retrofitting works in 10 multi-family residential buildings (4 municipal buildings and 6 condominiums), which will be also

[1] Kawka (pol.) = Jackdaw (en.)

Photo: Jolanta Bork, Public Schools Complex No 1

connected to the municipal district heating network. It is foreseen that each condominium participating in the project will raise a loan for covering 35% of the investment costs concerning its particular building.

The scope of planned retrofitting works includes thermal insulation of external walls and roofs, replacement of windows in apartments and staircases, replacement of entrance doors and construction of central heating and warm usable water installations with the circulation system. Obligatory part of the project is organisation of educational & information campaign and development of the database enabling inventory of emission sources.

FINANCING SCHEME

Total costs of the project "KAWKA in Kościerzyna" came to 4.9 Mio PLN (approx. 1.14 Mio EUR). 1.7 Mio PLN was covered from the Voivodeship Fund for Environmental Protection and Water Management in Gdańsk (including loans granted to participating condominiums) and 2.2 Mio PLN - from NFEP&WM. Remaining amount - 1 Mio PLN - was covered from municipality's and relevant condominiums' own budgets.

PROJECT RESULTS

By improving buildings' energy efficiency, the project "KAWKA in Kościerzyna" will undoubtedly contribute to the reduction of low-stack emissions on the territory of the municipality. It will also help to increase citizens' environmental and energy awareness since the investment is accompanied by educational & information campaign.

Based on energy audit data it was calculated that the thermal retrofit of 14 buildings will reduce their heat consumption by 2088 MWh/year, while CO_2 emissions will decrease by 443 Mg/year.

Until the end of 2014 thermal retrofitting works (more or less expanded) were undertaken in 151 from 189 multifamily residential buildings administered by the municipality, housing cooperatives or condominiums.

The City of Kościerzyna is a prizewinner of the 2 editions of the Eco-City contest - the prize was granted in 2013 and 2015 within the category of "Energy efficiency in cities below 100 000 inhabitants". The city was also awarded by the Ministry of Environment for the project "Thermal retrofitting of public utility buildings", which was submitted for the contest "Green cities - towards the future" within the category of "Energy efficiency in construction".

DEVELOPMENT PROSPECTS

In the period 2016-2018 further thermal retrofitting works are planned in 18 public utility buildings located within the Kościerzyna's Functional Urban Area - including 8 buildings located on the territory of the city and 10 building located on the territory of the municipality. Existing documentation includes energy audits, building designs, detailed engineering designs, technical specification for the execution and acceptance of the construction works and cost estimates.

Photo: Jolanta Bork, Public Schools Complex No 2

MORE INFORMATION

Ewa Chmielecka
Head of the Development Department
Municipality of Kościerzyna
e-mail: fundusze@koscierzyna.gda.pl
phone: +48 58 680 23 38

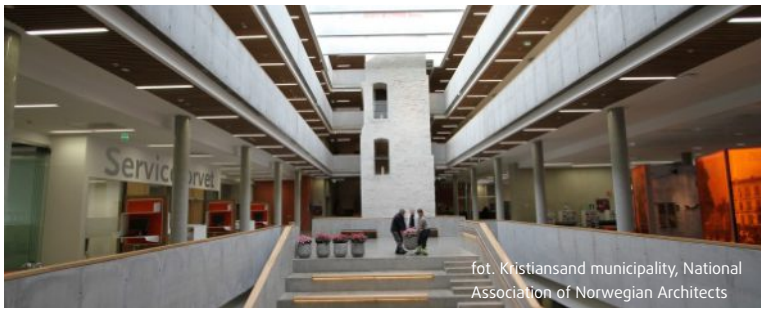
POLISH AND NORWEGIAN CITIES
together for climate and energy

CITY HALL QUARTER, KRISTIANSAND
LOW ENERGY OFFICE BUILDING IN THE OLD FIRE STATION

Sector: Energy efficiency in buildings

Timeframe: 2007 – 2014

Location: Kristiansand, Norway


fot. Kristiansand municipality, National Association of Norwegian Architects

PROJECT BACKGROUND

Kristiansand municipality wanted to establish a modern and progressive administration centre to collect and streamline administration and improve accessibility for residents

At the same time, the City Hall quarter is part of cultural heritage, especially the old fire station with the 25-meter fire tower and the other facades facing the main City Square had to be preserved. The project includes the transformation of buildings from both the early 1900s and office buildings from the 1970s, as well as new construction. Parts of the buildings were demolished and replaced. The project was developed in constructive interaction with the Cultural Heritage Management Office in Kristiansand and county conservator.

PROJECT DESCRIPTION

The new 1500 m^2 City Hall Quarter in Kristiansand accommodates 430 employees, with emphasis on good working conditions. Old, ineffective buildings are transformed into a new municipal administrative centre. The venerable brick facade of Kristiansand City Hall now hides a modern, climate-smart office environment that meets Kristiansand's future needs without breaking tradition from the past. Energy consumption is low, and environmentally friendly materials are used. The heat demand is covered entirely by hot-water heating, including heat recovered from the municipality's computer centre, which is established inside the new quarter.

The administrative centre is located in the city centre with perfect access to public transport. The centre has no parking spaces, but excellent indoor bicycle parking facilities and rental of electrical bicycles for the staff.

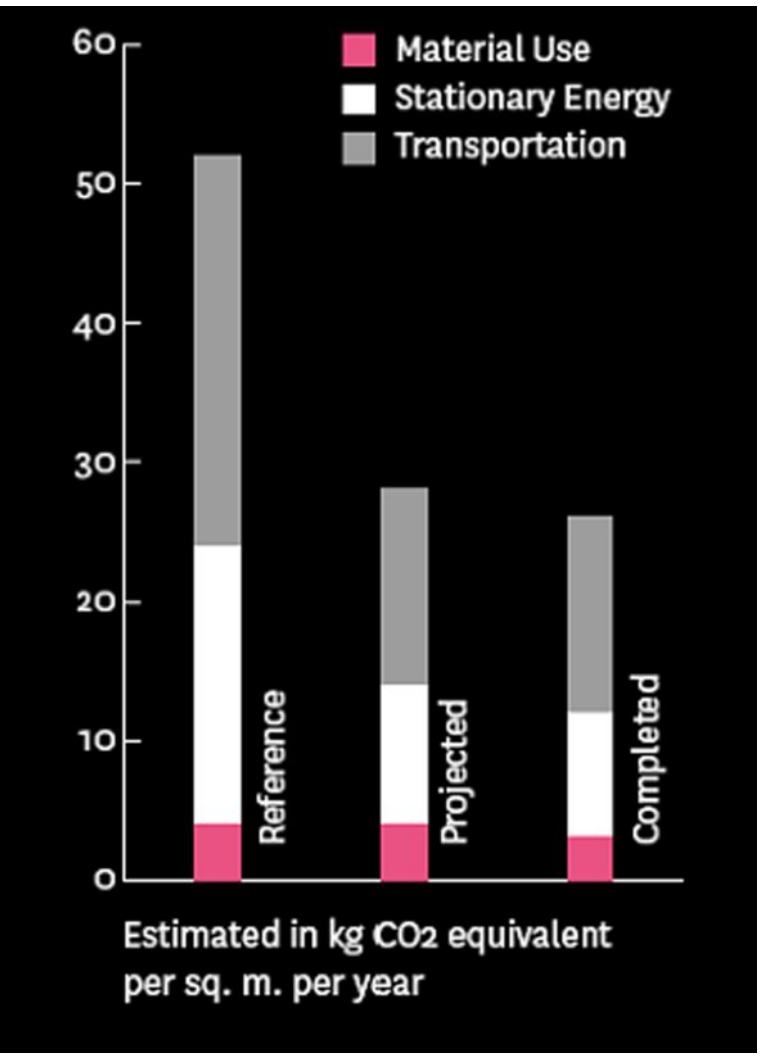
Key facts:

- Low-energy building, Energy performance certification standard B (dark green)
- Rehabilitation and transformation of an existing quarter
- Energy: remote cooling (seawater from the fjord) and water-base heating
- Material: reuse of building stock, environmentally sensitive demolition
- Transport in use: facilities for bicyclists, rental of electric bicycles

PROJECT RESULTS

Greenhouse gas emissions are reduced by 53%, due to use of less energy, and building materials with lower carbon footprint. The best results in terms of reduced greenhouse gas emissions were

fot.: Kristiansand municipality, National Association of Norwegian Architects



achieved within transportation, because employees that used to bring their cars, now choose more environmental friendly alternatives.

Heated floor space: 13,071 m^2

Energy consumption:
Net energy: 87 kWh/m^2/year
Delivered energy: 82 kWh/m^2/year

Energy Sources: Remote/local heating networks (covering 80% of the heating, ventilation and hot water energy needs), heat pump (water-water) cover the remaining heating needs. District cooling covers 100% of the cooling demand.

Estimated net energy:

Supplied energy, calculated:	82 kWh/m^2/year
Space heating:	8.8 kWh/m^2/year
Ventilation heating	5.7 kWh/m^2/year
Hot water (DHW)	5 kWh/m^2/year
Fans:	16.7 kWh/m^2/year
Pumps:	1.7 kWh/m^2/year
Illumination:	12.5 kWh/m^2/year
Technical equipment:	18.8 kWh/m^2/year
Ventilation Cooling:	8.9 kWh/m^2/year
Direct electricity delivered:	49.7 kWh/m^2/year
Electricity for heat pumps:	1.7 kWh/m^2/year
District heating delivered:	17.8 kWh/m^2/year
Other delivered energy:	4.1 kWh/m^2/year

Some of the old facades were not secure against freezing. The insulation thickness therefore had to be reduced; giving slightly less energy saving than what otherwise could have been expected.

MORE INFORMATION

Economic data (Municipal Bank of Norway):
www.kommunalbanken.no/en/lending/projects/projects/kristiansand-city-hall-quarter

CONTACT INFORMATION:
Arne Birkeland
Kristiansand municipality
phone: +47 90 92 41 82
e-mail:
arne.birkeland@kristiansand.kommune.no

POLISH AND NORWEGIAN CITIES
together for climate and energy

THE STAR SHAPED TALL BUILDING, KRISTIANSAND
UPGRADING SOUTHERN NORWAY'S COLDEST HOUSING CO-OPERATIVE

Sector: Energy efficiency

Timeframe: 2013 – 2015

Location: Kristiansand, Norway

PROJECT BACKGROUND

This 10-floor apartment building from 1965, containing 60 apartments, had a significant need for rehabilitation and maintenance. For example, there were considerable thermal bridges in the concrete structure that led to a large heating requirement. The co-operative also had environmental ambitions, including reduced CO_2 emission.

The Minister of Environment took part in the opening ceremony.

PROJECT DESCRIPTION

Since the building has a very visible location within the Kristiansand skyline, the architectural design of the rehabilitation was considered important.

Walls, floors and roofs were given extra insulation. The thermal bridges were identified using thermography and removed or minimized. The façades were checked for asbestos and the building was re-clad. Windows and doors were replaced and new glassed-in balconies were mounted without structural contact with the internal concrete structure. Balanced ventilation with heat recovery was installed and oil boilers replaced with district heating.

Wind is the most important microclimatic challenge in the area. Particular focus has been placed on use of wind-proof solutions and maintenance friendly materials in the project. Glassed-in balconies from outdoor spaces are protected from wind and weather. This increases comfort and the use of the balconies, as many of the apartments have a very good view.

Key words:

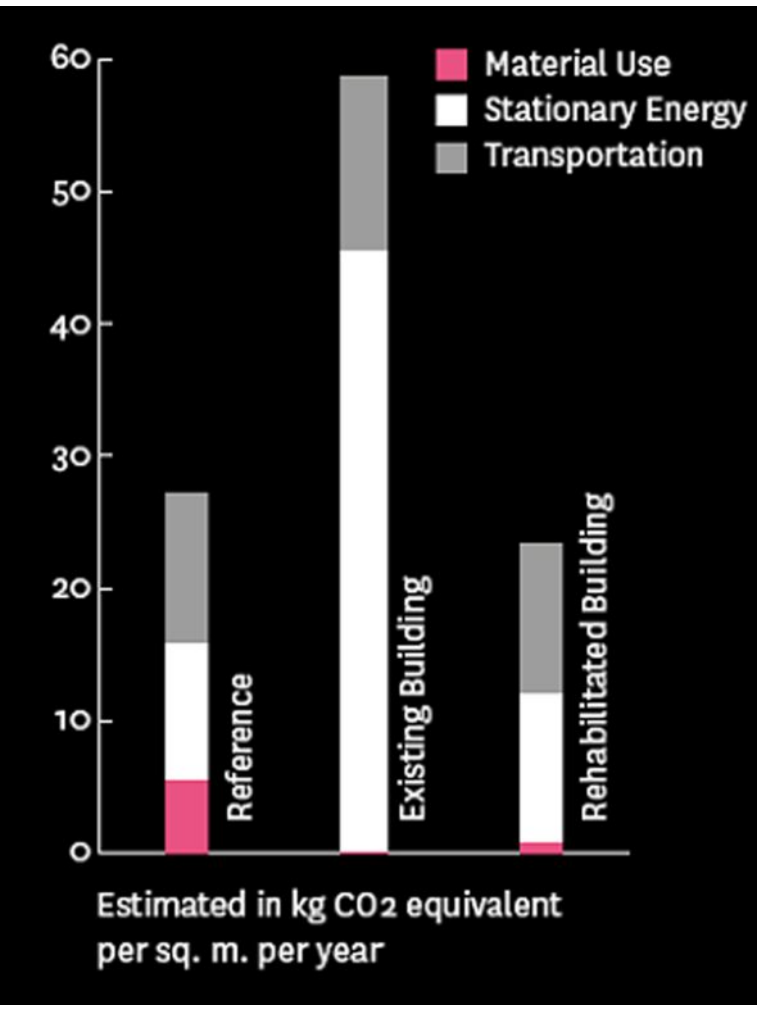
- Energy efficient rehabilitation
- Improving of standard of dwellings
- Result oriented co-operation between client, architect/engineers, contractors and users

PROJECT RESULTS

Livable area	4543 m^2
Heated floor space:	3750 m^2
Number of residents:	87
Glass proportion of floor space:	21.5%
Energy label:	B (Dark Green)

Energy consumption:
Net energy: 88 kWh/m^2/year
Delivered energy: 97 kWh/m^2/year (calculated)
Reduced from respectively 297 and 337 kWh/m^2 per year

fot. Stjernehus borettslag, Spiss Arkitektur & Plan AS, Sørlandet Boligbyggelag



Supplied energy (calculated):	95 kWh/m^2/year
Energy sources:	District heating, supplied with electricity
Space heating:	20.4 kWh/m^2/year
Ventilation heat:	3.7 kWh/m^2/year
Hot water (DHW)	29.8 kWh/m^2/year
Fans:	8.3 kWh/m^2/year
Pumps:	0.1 kWh/m^2/year
Illumination:	11.4 kWh/m^2/year
Technical equipment:	17.5 kWh/m^2/year
DELIVERED ENERGY:	
Direct electricity:	41.4 kWh/m^2/year
District heating:	59.8 kWh/m^2/year
Normalized thermal bridge:	0.11 (W/m^{2}K)
Specific fan power:	2 kW/(m^3/s)
Heat recovery efficiency	80%

In a housing co-operative, it can be difficult to reach agreement on expensive rehabilitations. The Stjernehus co-operative committee took the necessary time and energy to inform all the residents about the plans and gave them the opportunity to comment. The committee received full support and the process strengthened the sense of community in the co-operative.

MORE INFORMATION

CONTACT INFORMATION:
Odd Helge Moen
Sørlandet Boligbyggelag
phone: +47 48 19 00 76
e-mail: ohm@sorbbl.no

Buildings of the Future:
www.arkitektur.no/buildings-of-the-future

POLISH AND NORWEGIAN CITIES
together for climate and energy

PV PLANT AT THE ŻAR MOUNTAIN IN MIĘDZYBRODZIE ŻYWIECKIE

Sector: Solar energy use

Timeframe: 2015

Location: Żar Mountain, Międzybrodzie Żywieckie, Poland

Photo: Piotr Kania

PROJECT BACKGROUND

Żar is the mountain in the mountain rage of Beskid Andrychowski (eastern part of the Little Beskid belt), which rises over the Międzybrodzkie Lake. On the top of the mountain there is an upper reservoir of the pumped-storage hydroelectric power plant (Porąbka-Żar Power Plant), which belongs to PGE Energia Odnawialna and was put into operation in 1979. The high-head power plant, localised in Międzybrodzie Bialskie, has the capacity of 500 MW and the head of 440 m. It is the only Polish underground pumped-storage plant designed for regulating energy system during the peak and base loads. Short start-up time of the plant (180 seconds to start generation) also qualifies it for the intervention work.

The decision to build the plant on the Żar Mountain was based on its favourable topographic conditions: large head compared to the small distance between the reservoirs, as well as the possibility of using rehabilitated cascade of the Soła river.

PROJECT DESCRIPTION

On the top of the Żar Mountain in Międzybrodzie Żywieckie there is also the first 0,6 MW PV plant, which was put into operation by PGE in October 2015. The investment was carried out by the Maybatt company from Warsaw.

Żar PV plant, lying 740 meters above the sea level, is the highest situated PV installation in Poland. It comprises of 2 400 PV panels organised into 16 rows. Each of them has 250 W of capacity. The total surface of the panels comes to 3 500 m^2. Due to its localisation, the plant is protected by the special lightning protection installation composed of 200 masts, each having 4 meters of height.

It is estimated that PV plant on the Żar Mountain will generate minimum 550 MWh of electricity per year (gross value). The project fits into the PGE's business strategy, which foresees gradual diversification of energy generation sources.

Photo: Piotr Kania

Photo: Piotr Kania

FINANCING SCHEME

The investment was implemented by the PGE Energia Odnawialna S.A., a company which is part of the PGE Capital Group, where it is responsible for the RES sector. Construction of the PV plant on the Żar Mountain was co-financed from the subsidy granted by the Voivodeship Fund for Environmental Protection and Water Management in Katowice. Implementation of the project costed PLN 2,8 million. Approximately 24% of the qualified cost (PLN 624 thousand) was covered with the grant from the Fund.

WIĘCEJ INFORMACJI

Marek Maciaś
PGE Energia Odnawialna
e-mail: marek.macias@gkpge.pl
phone: +48 22 433 1309
www.gkpge.pl

POLISH AND NORWEGIAN CITIES
together for climate and energy

GEOTHERMAL HEATING PLANT IN MSZCZONÓW

Sector: Geothermal energy use

Timeframe: 1999

Location: Mszczonów, 58 Sienkiewicza str.

Photo: Geotermia Mazowiecka company

PROJECT BACKGROUND

In 1995 Geotermia Mazowiecka S.A. company was established to build and operate a geothermal heating plant in Mszczonów (Mazowieckie Voivodeship), as well as to assess the possibilities of obtaining co-financing for similar investments implemented in cooperation with national and foreign institution in neighbouring Skierniewice and Żyrardów. The main shareholders are the Voivodeship Fund for Environmental Protection and Water Management in Warsaw and in Łódź, municipalities of Żyrardów, Skierniewice, Mszczonów and Sochaczew, Hydrotrest SKANSKA S.A. company and the others. Company's activities resulted in 2000 in putting into operation the third Polish geothermal heating plant. It is located in Mszczonów, which has 6 000 inhabitants and lies south-west from Warsaw.

PROJECT DESCRIPTION

Municipality of Mszczonów was the initiator and the executor of the project, while the Mineral and Energy Economy Research Institute of the Polish Academy of Sciences, seated in Cracow, provided scientific supervision of the investment. The gas-geothermal heating plant in Mszczonów uses geothermal waters present in the Mesozoic sub-basins of the Polish Lowlands (Grudziądz/Warsaw Sub-basin and Szczecin/Łódź Sub-basin). The aquifer is located 1602 - 1714 m below the surface, in Lower Cretaceous sandstones, and the temperature of the formation water comes to 45°C. The water is exploited from the Mszczonów IG-1 well drilled in the 1970s and then reconstructed and adjusted to the geothermal water exploitation in the period 1996-1997. The geothermal water is exploited in a one-well system. Lack of necessity to pump the water back into the deposit significantly reduced the cost of the whole investment.

The maximum yield of water exploited using multi-level deep-well pump reaches 55 m^3/h, while the water temperature at outflow comes to 42,5°C. The geothermal heating plant in Mszczonów functions as a hybrid system using heat from geothermal waters, gas-fired boilers, absorption heat pump with the capacity of 2,7 MW and compression heat pump with the capacity of 1 MW. Thermal water extracted from the Mszczonów IG-1 well is first transported to the heat exchanger cooperating with the high-temperature boiler, where it absorbs heat from flue gases leaving the boiler (reducing their temperature below 58°C). The process is accompanied by the condensation of water vapour contained in flue gases. From the heat exchanger the water of 42°C is transported to the absorption heat pump, where - depending on the current need - it is being chilled to the temperature of 20-30°C. In the next step the water is fed into the fan water chiller. Heat energy transferred from water to air is used on site to heat the plant's building.

After being used for heating purposes, chilled geothermal water is directed to the nearby water

Photo: Geotermia Mazowiecka company

treatment station, where it is mixed with the quaternary water, treated and supplied to the municipal water distribution system as high-quality drinking water. Mszczonów's geothermal waters are unique in Europe due to their specific properties, including very low mineralisation level (below 0,5 g/dm^3). Other geothermal waters extracted from the similar depth and ranked as fresh waters were found so far only in a German city of Erding.

The total installed capacity of the plant reaches 8,3 MWt, including 3,7 MWt coming from the geothermal waters. In the heating season 38,2% of the heat supplied to the citizens is generated using geothermal energy. Annually, the gas-geothermal heating plant in Mszczonów produces 42 TJ of heat (including 15,6 TJ from geothermal source).

In order to increase the degree of geothermal waters usage it was decided to use them also for recreational purposes, which improved touristic attractiveness of Mszczonów. Since 2008 Mszczonów's thermal waters are used both for heating the premises and for supplying the swimming pool basins in the modern complex called „Termy Mszczonowskie".

FINANCING SCHEME

Heating plant in Mszczonów was constructed in 1999 within a targeted project co-financed by the State Committee for Scientific Research, EKOFUNDUSZ Foundation, Polish-German Cooperation Foundation and the Voivodeship Fund for Environmental Protection and Water Management in Warsaw and in Łódź. The total investment cost reached 10 749 000 PLN (approx. 2,5 Mio EUR). In 2011 the company implemented the project entitled "Construction of the heat recovery installation in the geothermal heating plant in Mszczonów". The investment of 1 879 000 PLN (approx. 437 000 EUR) was financed from the loan granted by the Voivodeship Fund for Environmental Protection and Water Management in Warsaw and from own funds.


Photo: Geotermia Mazowiecka company

PROJECT RESULTS

As a result of the investment the municipality of Mszczonów gained stable, modern and environmentally friendly heating system. The gas-geothermal heating plant replaced three obsolete boiler houses fuelled with powdered coal, which emitted 15 tonnes of NOx, 60 tonnes of SOx, 9 700 tonnes of CO2 and 145 tonnes of dust per year. Launching of the new plant enabled complete elimination of dust and sulphur compounds emissions. Carbon dioxide emission was reduced four times, while nitrogen oxides emission was decreased by 1 tonne per year. The investment contributed to the improvement of air quality in the city, as well as to the improvement of its citizens' wellbeing.

MORE INFORMATION

Geotermia Mazowiecka S.A.
9a Spółdzielcza str.; 96-320 Mszczonów
e-mail: geotermia@geotermia.com.pl
phone: +48 46 856 19 56

POLISH AND NORWEGIAN CITIES
together for climate and energy

INSTALLATION OF RES SYSTEMS IN PUBLIC UTILITY BUILDINGS AND PRIVATE HOUSEHOLDS IN NIEPOŁOMICE

Sector: Solar energy use

Timeframe: 2012 – 2016

Location: Niepołomice, Poland

Photo: St. Nowacki, Municipality of Niepołomice

PROJECT BACKGROUND

Niepołomice (over 26 000 inhabitants) is located in the southern part of Poland, in the Małopolskie Voivodeship. As a long-standing and active member of the Association of Municipalities Polish Network "Energie Cités" it was one of the first four Polish cities, which signed the Covenant of Mayors in January 2009. Since March 2011 Niepołomice is implementing its Sustainable Energy Action Plan, which foresees CO2 emission reduction by nearly 25% 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". The project was co-financed by Switzerland within the Swiss-Polish Cooperation Programme.

PROJECT DESCRIPTION

The overall objective of the project was to improve air quality and state of the environment on the territory of 6 neighbouring municipalities: Niepołomice, Wieliczka, Skawina, Miechów, Myślenice and Zabierzów (the two latter joined the project in 2015), as well as to improve health conditions and quality of life of their citizens. 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. 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).

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

Photo: St. Nowacki, Municipality of Niepołomice

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. 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) .

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.

Photo: St. Nowacki, Municipality of Niepołomice

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 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.

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 under 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 daily reduction of CO_2 emissions, which is recalculated into number of kilometers traveled (on the particular day and in total) and into amount of trees planted (on the particular day and in total). 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 to reduce energy costs and low-stack emissions significantly.

Photo: St. Nowacki, Municipality of Niepołomice

PROJECT RESULTS

Until present (April 2016) all planned solar systems (615) were installed on private houses located on the territory of the municipality. Also works related to the installation of heat pumps and PV panels in the indoor swimming pool were completed. The only part of the investment, which still needs to be finalized, is the installation of PV modules with the capacity of 150 kW and the surface of 950 m^2, which will supply with electricity the Niepołomice's Royal Castle.

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.

Photo: St. Nowacki, Municipality of Niepołomice

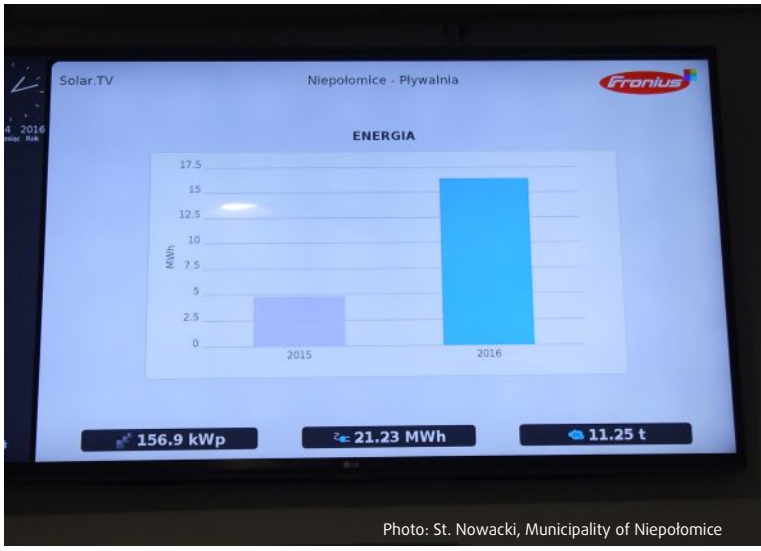


Photo: St. Nowacki, Municipality of Niepołomice

Photo: St. Nowacki, Municipality of Niepołomice

MORE INFORMATION

Stanisław Nowacki, project coordinator
Municipality of Niepołomice
5/2 Zamkowa str.; 32-005 Niepołomice
e-mail: st.nowacki@gmail.com
phone: +48 12 250 94 51
www.niepolomicesolary.eu

POLISH AND NORWEGIAN CITIES
together for climate and energy

OSEANA ARTS & CULTURAL CENTRE, OS
SUPPLIED WITH ENERGY FROM SOLAR CELLS AND THE FJORD

Sector: Solar energy, geothermal energy

Timeframe: 2009 – 2011

Location: Os municipality, Norway


fot. Grieg Architects

PROJECT BACKGROUND

Os municipality had a clear vision to create a vibrant and attractive cultural centre and create a signature building of high architectural quality and optimum energy and environmental solutions. This ambitious project resulted in Norway's first low energy cultural building. It received funding from Enova (state body) in order to be a model for other cultural buildings.

PROJECT DESCRIPTION

The new 5,700m^2 performance arts centre and art gallery has a roof inspired by the sail of a local boat type, which has been made in the district for more than a thousand years.

The facade and part of the roof is covered with multicrystalline solar cells (550 m^2), and the building is placed close to the fjord, where reflection from the sea gives additional energy.

Energy efficient building techniques are applied, and heat pumps collect energy from seawater. In addition, wind turbines were planned.

From outdoor area to art galleries and restaurant right through to the auditorium, advanced LED technology is used, giving low energy lighting with high quality.

The project is developed with "Integrated Energy Design - IED" where building design and other technical installations were integrated into an architectural and energy technical entirety.

The building was designed by Grieg Architects.

PROJECT RESULTS

The project was awarded the Norwegian "Building of the year" in 2011.

Heat pumps in the fjord reduce energy consumption by two thirds, from 1,125,000 kwh to 430,000 kWh per year.

Solar cells:

- Rated power: 63.5 kWp
- Solar Type: multicrystalline silicon
- Number of solar modules 363 a 175Wp
- Area: covering 550 m^2
- Estimated production: about 42,000 kWh / year

The center is financed through a public-private joint effort consisting of Os municipality, Hordaland County, Grieg Foundation, industry players and other private contributors. Art, culture, food, nature and outdoor activities are combined in an unprecedented manner.


fot. Grieg Architects

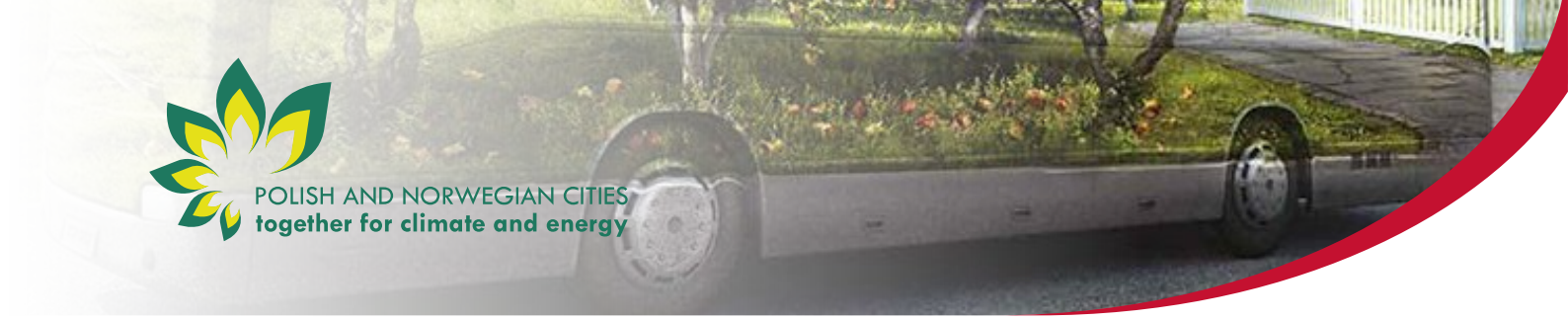

fot. Grieg Architects

MORE INFORMATION

Web site with contact details: www.oseana.no

Building Integrated Photovoltaics for Norway: www.bipvno.no/index.html

The solar cell plant's performance can be followed live here: www.sunnyportal.com/Templates/PublicPageOverview.aspx?page=643e83f3-bec6-447c-b947-2f5992f1c37f&plant=5dd51fc3-b7dc-467b-b3f4-ee6d6e78acd8&splang=en-US



RUTER#: FOSSIL FREE 2020, OSLO AREA
ALL PUBLIC TRANSPORT ON RENEWABLE ENERGY

Sector: Transport

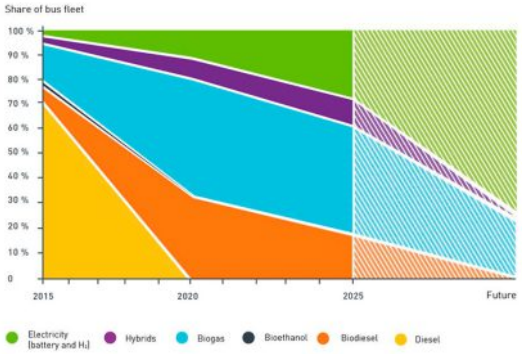
Timeframe: 2015 – 2020

Location: Oslo area, Norway

PROJECT BACKGROUND

Pollution, noise and health issues related to urban traffic is a concern for all large European cities. A growing population creates needs for a large scale, efficient and environmentally friendly public transport system. In Norway, the ambitions for public transport are high, and it is an agreed political goal that all growth in passenger traffic in major cities shall be met by public transport, cycling and walking. Handling traffic growth with environment-friendly mobility solutions is an important contribution to achieve Norway's climate goals and reduce local pollution. Stricter environmental requirements and new technological solutions are driving this process forward.

Ruter is responsible for transport services in Oslo and Akershus counties in Norway, serving 1.2 million people. In June 2015 the board of Ruter adopted an ambitious plan whereby Oslo and Akershus will have only low- and zero-emission buses that run on renewable energy by 2020 and for further developments up to 2025. Ruter's fleet currently comprises some 1,100 buses, 77 % of which run on diesel. In the future most of the buses will be electric and have the necessary driving range to be able to cover long distances. Ruter is also considering introducing electric boats on its services on the Oslo fjord.



The ambition of the public transport sector in Oslo and Akershus is to use only renewable energy in 2020. This calls for wide-ranging changes to the bus fleet and to ferries in the region. Ruter's aim is to introduce the most effective long-term solutions as quickly as possible.

Currently, Ruter's view is that electrical busses and boats are especially promising. They are therefore looking into testing a large number of electric busses and associated infrastructure in regular service during 2016-20, and are now initiating a collaborative phase where they identify partners and concretize ambitions and plans for testing of electric buses.

PROJECT RESULTS

With the introductions of EURO I-VI requirements, significant environmental gains have been achieved, including reductions in local emissions (particulate matter (PM) and nitrogen oxides (NOx)). However, greenhouse gases (GHG, most critical is CO_2) are not part of the EURO emission requirements. To improve local emissions even further and to reduce fuel consumption as well as GHG-emissions, increased usage of new bus and boat technologies is needed.
Electric infrastructure maturity is still low, and further standardization is required. Biodiesel, biogas


fot. Ruter

and bioethanol infrastructure solutions have high technical maturity and are already installed in the Oslo region.

Ruter wishes to contribute to speed up commercialization and adoption of zero-emission solutions for public transport both in Norway and in Europe. This will result in a reduction in environmental impact, less noise and higher energy efficiency in public transport. Ruter's goal is for public transport to continue to be the most environmentally friendly choice, even when in emissions from private cars become low. Becoming fossil fuel free will result in better public transport services in the region, with innovative solutions and reliable, comfortable and quiet vehicles. This will help the capital region to grow into a healthy, green and attractive place to live and work.

MORE INFORMATION

Ruter's web site:
www.ruter.no/en/about-ruter/reports-projects-plans/fossilfree2020/
Read more:
- First battery electric bus test in Oslo and Akershus are under preparation
- Plan ready for transition to running exclusively on renewable energy in 2020
- Fossil Free 2020 and testing of electrical buses
- Renewable energy powertrain options for Ruter, a report for Ruter by Roland Berger Strategy Consultants

	Bus technology maturity level 2015	Commercial ready in 2020	Infrastructure maturity 2020	Fuel/energy availability in 2020	Reduced local emissions vs. Euro V diesel	Reduced WTW CO_2 emissions towards conventional diesel	Energy consumption	TCO Index 2020
Biodiesel	●	✓	●	✓	◕	◕	High	98-102
Bioethanol	◕	✓	●	(✓) 1)	◕	◕	High	103-108
Biogas	●	✓	●	(✓) 1)	◕	◕	High	108-114
HEV	◕	✓	●	✓	◕	◕	Medium	98-104
PHEV	◔	(✓)	◕	✓	◕	◕	Medium/low	114-127 3)
Overnight	◔	(✓)	●	✓	●	● 2)	Low	108-121
Opportunity	◔	(✓)	◕	✓	●	● 2)	Low	110-122
Fuel cell	◔	(✓)	◕	(✓) 1)	●	● 2)	Medium	132-151

● High ○ Low ✓ Available (✓) Partly available

1) Capacity not sufficient for whole fleet 2) Renewable electricity, excluding CO2-impact from battery production which is significant 3) PHEV with opportunity charging

Summary of analysis results by technology towards 2020[3]

POLISH AND NORWEGIAN CITIES
together for climate and energy

DEICHMANSKE MAIN LIBRARY, OSLO
PASSIVE ENERGY BUILDING WITH TRANSLUCENT FAÇADE

Sector: Energy efficiency

Timeframe: 2009 – 2018

Location: Bjørvika, Oslo, Norway

fot. Lund Hagen Architects

PROJECT BACKGROUND

Deichmanske main Public library is planned in Bjørvika and will be built according to ambitious environmental standards. The library will have high architectural quality, and be functional and innovative in its use of future-oriented climate solutions. This will be a creative, visible, and accessible people´s library and meeting place for culture. The library will reach many user groups through new technology and new services, with a special focus on children and the young.

PROJECT DESCRIPTION

Ambitions for the new library include 50 percent reduced carbon emissions compared to today´s standard. The pre-project calculations show a combined reduction of emissions of 38 percent, and the rest is likely to be obtained through an ambitious mobility plan with practically no car use.

The building, planned to fulfil passive energy criteria, has a compact form. Ventilation is supplied via the floor structure in the second to fifth storeys, thus reducing the need for fan energy. Since ventilation air is distributed along the concrete in the floor structure, the thermal mass of the building is utilised and temperature fluctuations are reduced.

The same is true for the extensive use of exposed concrete ceilings. The concrete floors are cooled with built-in warming and cooling pipes in the concrete of the roof and floor, allowing ventilation air quantities to be reduced. Automatic external solar screening will be used to reduce the buildings cooling needs, and energy-efficient IT equipment will be required. The project is based on a district energy network for Bjørvika, which will supply the building with 100 percent energy for heating and cooling needs.

Pre-project phase calculations of greenhouse gas emissions from material use show low emissions from the chosen materials, when compared to similar buildings. A series of initiatives are underway to reduce the emissions further, among others the use of low-carbon cement, recycled steel reinforcement and recycled steel in the pile foundations. The façade consists of a composite solution with a three-layer glass with an internally positioned sunscreen. Between the glass panels there are tubes of 10 mm thick glass fibre reinforced plastic composite insulated with rock wool. Alternative façade solutions are also being evaluated to reduce greenhouse gas emissions. The floor slabs will be concrete with surfaces of natural stone, surface treated concrete and technical flooring. Interior walls are planned with recycled drywall on wooden studs. Wood based panels are also being considered.


fot. Lund Hagen Architects

PROJECT RESULTS

Gross area: 19,970 m^2
Heated area: 19,260 m^2

Greenhouse gas calculations (tons CO2 equivalents)

	Reference	Project	Completed	Operational
Energy	17.2	6.4	–	–
Material Use	28.3	14.2	–	–
Transport	60.4	11.4	–	–

Delivered energy: 71 kWh/m^2/year (calculated)
Energy label: Label A
Net energy: 75 kWh/m^2/year – passive house
Estimated energy delivered: 80 kWh/m^2/year
Energy sources: Heat pump water-water (heating/ DHW)

The main focus of a library is, of course, cultural. But the environmental benefits will also be very visible to the users, including learning possibility for young people.


fot. Lund Hagen Architects

MORE INFORMATION

Project blog with contact details:
www.blogg.deichman.no/nyedeichman/in-english/

Future Built:
www.futurebuilt.no/prosjektvisning?lcid=1033&projectID=217300

POLISH AND NORWEGIAN CITIES
together for climate and energy

GRENSESVINGEN 7 (EPA), OSLO
REHABILITATION OF OFFICE BUILDING FROM THE 1980s
HALVED CARBON EMISSIONS

Sector: Energy efficiency

Timeframe: 2012 – 2014

Location: Helsfyr, Oslo, Norway

fot. Jhonny Syversen, FutureBuilt

PROJECT BACKGROUND

Although not a municipal building, this type of building is relevant for bigger municipalities. It houses the Oslo branch of the national environmental protection agency (EPA). In addition, it is always interesting to see how the state environmental bureaucrats perform themselves.

PROJECT DESCRIPTION

The house, completed in 1986, is transformed into one of Norway´s most climate-friendly rehabilitated office buildings, with energy class A and an "excellent" classification in the BREEAM-NOR environmental certification system. The new 8th floor meets passive house standard. The building is located near the Helsfyr public transport hub, and has good facilities for indoor bike parking with amenities for washing and maintenance of bicycles as well as a changing area. It is next door to Fyrstikktorget, a pleasant area with a good variety of services.

The new top floor re-uses the original steel structure, but is entirely rebuilt as a highly insulated and modern building structure. The outer walls on the rest of the building got 150 mm internal additional insulation and a damp proof membrane for improved air tightness. The cold bridges in the building are partially eliminated and partially improved. The windows are replaced with as few mullions as possible. This gives better daylight penetration in addition to limiting the heat loss from the windows. The glass has automatic control systems for solar screening, with user-controlled switches for opening and closing the screens. Decentralised ventilation in each floor lowers energy consumption noticeably, while also freeing up the top floor for office space. The ventilation system is demand controlled, including night cooling when necessary. A rotating heat recovery unit with an efficiency of 80 % is also being installed.

The primary energy source consists of two reversible air to water heat pumps. The waste heat from the cooling unit in the server room is also used by heat exchanging with the heat pump and domestic hot water system. Space heating is primarily supplied by the ventilation system. At night the ventilation system has the capability of recycling air to maintain room temperature.

The existing building was designed and executed with durable and robust materials in the structure and facades. The brick façade contributes well to relate the building to the historic buildings in the


fot. Jhonny Syversen, FutureBuilt

area. Retaining the existing concrete structure, the original stairwells and the majority of the brick façade results in a large resource saving and reduced greenhouse gas emissions for the project.

PROJECT RESULTS

Heated area: 16,373 m^2
Number of users: 700

Greenhouse gas calculations (tons CO_2 equivalents)

	Reference	Project	Completed	Operational
Energy	14	–	8	–
Material Use	5.1	–	2.5	–
Transport	30.8	–	17.9	–

Energy label: A
Classification of heating system (% renewables): light green
Net energy: 98 kWh/m^2/year
New floor: 87 kWh/m2/year - passive house
Estimated energy delivered: 82 kWh/m^2/year (Ns3031)
New floor: 75 kWh/m^2/year - passive house
Energy sources: Heat pump air-water (primary load space heating, ventilation and DHW), district/ local heating system (peak load)
Room heating: 19.7 kWh/m^2/year
Ventilation heating: 8.3 kWh/m^2/year
Domestic hot water: 5 kWh/m^2/year
Fans: 7.7 kWh/m^2/year
Lighting: 12.5 kWh/m^2/year
Technical equipement: 34.4 kWh/m^2/year
Ventilation cooling: 10 kWh/m^2/year
Specific fanpower 1.23 kW/(m^3/s)
Heat recovery efficiency 84 %


fot. Jhonny Syversen, FutureBuilt

MORE INFORMATION

FutureBuilt:
www.futurebuilt.no/prosjektvisning?lcid=1033&projectID=254887

POLISH AND NORWEGIAN CITIES
together for climate and energy

FROGNER STADIUM, OSLO
SPORTS FACILITIES WITH COMMON ENERGY SOLUTIONS

Sector: Energy efficiency

Timeframe: 2014 – 2017

Location: Frogner, Oslo, Norway

PROJECT BACKGROUND

For more than a hundred years the Frogner stadium has attracted competitors and ordinary people for outdoor skating. Among the most famous users was the figure skater Sonja Henie who trained here in the 1930's. The new skating hall along the stadium will be named after her.

PROJECT DESCRIPTION

In addition to a new ice and multi-use hall, the project includes a common energy solution for the whole sports and activity centre, including Frogner (outdoor) stadium and Frogner swimming pool. An ice rink for figure skating, short-track and sledge hockey and a multi-use hall will be part of the new development along with a café. The facility will be an important addition to the recreational facilities of the area.

The plan for the facility is to make the halls subterranean with a roof that is incorporated in the green park space above. The roof area can function as a recreation area, a tribune facility, green space and a location for solar cells.

The common energy solution for the whole sports and activity centre including outdoor stadium, park and swimming pool will reduce the total energy requirement by at least 30 percent, compared to comparable facilities.

Low carbon strategy for the projects includes

- Re-use of the surplus heat from the ice machines and the swimming pool
- Central location near public transport and improved facilities for cyclists
- Plus-house standard for the new buildings
- 30 percent reduced energy requirement for the entire Frognerpark facility
- Shared use of the space
- Low carbon materials
- Green roof ensures efficient land use and storm water safety (adaptation to climate change)

PROJECT RESULTS

30% reduction in energy use, 50% reduction in greenhouse gas emissions.

Still in an early phase, detailed results are not yet available. Significant gains related to carbon emissions and energy efficiency are prerequisites.

MORE INFORMATION

Future Built web site:
www.futurebuilt.no/prosjektvisning?lcid=1033&projectID=265049

CONTACT PERSON:
Simen Bakken
phone: +47 908 57 994
e-mail: simen.bakken@kid.oslo.kommune.no

Existing Frogner stadium:
www.frognerstadion.no

Existing swimming facility:
www.oslo.kommune.no/natur-kultur-og-fritid/svommehaller-i-oslo/frognerbadet

POLISH AND NORWEGIAN CITIES
together for climate and energy

USE OF MODERN BIOMASS BOILER FOR HEAT AND ELECTRICITY GENERATION IN PŁOŃSK DISTRICT HEATING COMPANY

Sector: Biomass use

Timeframe: 2005 – 2007

Location: District Heating Company, Płońsk, Poland

Photo: Dariusz Marczewski

PROJECT BACKGROUND

Płońsk (approx. 23 000 inhabitants) is a county town located in Mazowiecke Voivodeship. Until 1992 the city was supplied with heat by local district heating plant operating within the structures of the Regional District Heating Enterprise in Ciechanów. Since January 1992 newly established Płońsk District Heating Company (PEC - **Przedsiębiorstwo Energetyki Cieplnej**) took over responsibility for heat supply, exploiting one central thermal plant and 14 local boiler houses using coal and coke mixture as a fuel. The latter have been withdrawn from exploitation as a result of air pollution reduction - implemented by the city. In consequence one heat source was left - the Central Thermal Plant. Its operator, PEC in Płońsk, is constantly working to reduce air pollution and follow global energy generation trends by implementing wide-scale environmentally friendly investments.

PROJECT DESCRIPTION

Since 2005 till 2007 PEC in Płońsk was implementing an investment entitled "Modernisation of the district heating system in Płońsk". Modernisation works were conducted in two stages and included replacement of approx. 8 000 linear meters of pipelines with the new pre-insulated ones, as well as construction of new knots (15 single-function knots and 14 double-function knots). But the most important part of the project was the installation of a new steam biomass boiler with the capacity of 10,2 MW in the Central Thermal Plant. The boiler generates 14 tons of high-pressure steam per hour with the steam pressure amounting to 40 bars. Installation of the boiler was accompanied by the installation of a steam turbogenerator with the capacity of 2,08 MWe and the whole infrastructure necessary for co-generating heat and electricity, including automatic monitoring and control devices, pipelines, fittings, fuel storage and feeding system, storage sheds for wood chips, hot water preparation unit, dedusting installation, ash handling system, exhaust extractors and steam heating network supplying AGRIKO plant (DN 150/80 and L = 260 linear meters). Moreover, area around the CHP plant was recultivated.

The main fuel used by the plant are the wood chips (coming among others from the energy crops). Over 70% of thermal energy and 100% of electric energy is produced from biomass. The new biomass boiler includes special technological solutions which reduce emissions from the wood combustion. In order to eliminate soot and carbon oxides the combustion gases are kept long in the boiler and the amount of air delivered for the combustion process is precisely regulated (using lambda probe readings and regulation of the rotations of draught fans). Secondary air injection minimises carbon oxides emissions and


Photo: Dariusz Marczewski

facilitates the afterburning of volatile and combustible components of the exhume gases. Emission of dust, on the other hand, is limited by using efficient dedusting devices (multicyclone and pulse dust collector) installed behind the boiler.

Technical correctness of the system consists in the reduction of the source's thermal power from 50,6 MW to 36,8 MW (technological parameters of the boiler room and dimensions of the network are adapted to the consumers' energy demand). High degree of automation of the thermodynamic processes and their monitoring allow for efficient energy management and obtaining positive environmental results.

FINANCING SCHEME

Total cost of the investment (excluding the cost of investment servicing and liquidation of fixed assets) came to 33 625 000 PLN (≈ 8 406 250 EUR). 33,5% (11 300 000 PLN ≈ 2 825 000 EUR) was covered with the subsidy from the EcoFund and further 53% (17 825 000 PLN ≈ 4 456 250 EUR) with the loan from the National Fund for Environmental Protection and Water Management. Remaining 13,5% of the cost (4 500 000 PLN ≈ 1 125 000) was paid from the municipal budget.

PROJECT RESULTS

Project implementation allowed for significant reduction of air pollution emission coming from the coal dust combustion, including reduction of GHG emissions. Achieved environmental effect includes:

CO_2 emission reduction - 35 000 Mg/year, i.e. 77,2%
SO_2 emission reduction - 144 Mg/year, i.e. 63,8%
NOX emission reduction - 54 Mg/year, i.e. 63,3%
Dust emission reduction -151 Mg/year, i.e. 76,7%
CO emission reduction - 29,8 Mg/year, i.e. 19,3%
Soot emission reduction - 4,8 Mg/year, i.e. 76,5%
B(a)P emission reduction - 0,14 Mg/year, i.e. 98,6%
Slag and ash production reduction by 51%.

What is more, the investment resulted in more efficient use of primary energy embedded in the fuel, which was possible thanks to the introduction of co-generation of heat and electricity. This also helped to reduce energy generation cost and decrease heat transmission losses. Reducing amount of equipment installed outside the building, on the other hand, contributed to the decrease of noise levels.
Implementation of the investment had positive impact not only on the state of natural environment and the quality (reliability) of heat supply, but also on the quality of life of Płońsk inhabitants. PEC company managed to reduce energy price by approx. 10% and currently people pay less for heat delivery that inhabitants of neighbouring cities. Therefore, heat energy is more affordable for them.

Another proof of project's efficiency is that the municipality managed to obtain financing for such a big and complicated undertaking. Its implementation helped to gather useful experience concerning co-generation of heat and electricity using biomass fuel, which may be of use for other municipal district heating plants still combusting coal dust. Therefore, Płońsk investment may become a kind of "catalyst" for the development of CHP plants in Poland.

In 2006 the project of construction of a biomass-fueled CHP unit in Płońsk received prestigious Energy Globe award for the best Polish project in the area of sustainable energy. The award was handed to Płońsk representatives in the seat of the European Parliament in Brussels in 2007.

MORE INFORMATION

Przedsiębiorstwo Energetyki Cieplnej w Płońsku Sp. z o. o. (District Heating Company Ltd. in Płońsk)
e-mail: pecplonsk@mail.lcs.net.pl
phone: +48 23 662 33 88, 662 49 37

Aleksandra Murawska, Inspektor
Inspector for Technical and Environmental Issues
e-mail: aleksandra.murawska@o2.pl
phone: +48 23 662 33 88, ext. 23

POLISH AND NORWEGIAN CITIES
together for climate and energy

BIOGAS PLANT WITH THE CAPACITY OF 0,2 MW AT THE WASTEWATER TREATMENT PLANT IN SIEMIATYCZE

Sector: Biogas use

Timeframe: 2013 – 2015

Location: Kościuszki str., Siemiatycze, Poland

Photo: Marcin Jakimczuk

PROJECT BACKGROUND

Siemiatycze (approx. 15 000 inhabitants) is located in the southern part of the Podlaskie Voivodeship. Since 2016 the city is a member of the Association of Municipalities Polish Network "Energie Cités". 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. The project was completed in May 2015 and the biogas plant officially launched its operation in June 2015.

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.

PROJECT DESCRIPTION

The biogas plant generates approx. 1 200 - 1 600 m^3 of biogas per day. It is later combusted in the co-generation unit producing electricity and heat. Nominal electrical output of the installation comes to 190 kW, while thermal output amounts to 240 kW. Electricity generated is used for the wastewater treatment plant's own purposes, i.e. for powering equipment used in sewage sludge and wastewater treatment processes. Heat, on the other hand, is used for technological purposes, i.e. for heating the digesters and the technological building.

The biogas plant is composed of the 2 air-tight digesters. Each of them has the diameter of 13 m, height of approx. 15 m and capacity of 2 100 m^3. The biogas storage tank has the capacity of 1 040 m^3.

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


Photo: Marcin Jakimczuk

low-pressure tank. Then, through the pressure pump, biogas is transferred from the tank to the energy co-generation 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.

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).

PROJECT 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 resources 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.

The project entitled "Efficient disposal of sewage sludge through its use for the purpose of electricity and heat co-generation" implemented in Siemiatycze's wastewater treatment plant was nominated for the prize in the contest "Top municipal investments from Eastern Poland" carried out in 2015.

MORE INFORMATION

Przedsiębiorstwo Komunalne Spółka z o.o.
in Siemiatycze
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

POLISH AND NORWEGIAN CITIES
together for climate and energy

ZIELONY PUNKT

EDUCATIONAL GREEN POINT IN SŁUPSK

Sector: Energy education

Timeframe: Since September 2015

Location: Słupsk


Photo: City of Słupsk

PROJECT BACKGROUND

Słupsk (approx. 93 000 inhabitants) is located in the northern part of Poland, in the Pomorskie Voivodeship. Its ambition is to become a new-generation green city, which combines innovativeness, green economy, social justice and environmental and climate protection. In order to achieve these targets, Słupsk introduces new standards in municipal investments and institutions, actively participates in various cooperation networks, including Association of Municipalities Polish Network "Energie Cités" and "More Than Energy" movement, as well as implements innovative educational and social actions. Within these priorities and in cooperation with relevant institutions and social organisation, the city opened so called Green Point. It is an educational point for the citizens, which launched its operation in September 2015.

PROJECT DESCRIPTION

Green Point was created on the initiative of Robert Biedroń, the Mayor of Słupsk. It is the first in Poland educational & information point providing all interested citizens with free advice in the area of environmental protection, energy conservation and related benefits (including possible financial savings). The citizens can learn there, among others, how to reduce energy consumption by changing light bulbs, how to obtain energy from renewable sources, where to look for funds for replacement of old boilers with more ecological heat sources and how to reduce heating bills.

Advisory services are provided in the stationary Green Point, in the Słupsk Centre for Non-Governmental Organisations and Social Economy and in the seats of housing cooperatives, condominiums, companies, non-governmental organisations, municipal institutions and universities. Green Point's employees participate in condominiums' meetings, reaching citizens with the most important information concerning city's environmental policy and actions. They also co-organise trainings focusing on energy saving, possibilities of using renewable energy sources and segregation of recyclable materials. During the presentations and lectures, the employees use "educational kits", including e.g. traditional bulb, LED bulb, fluorescent lamp, wattmeter, small solar lamp and educational leaflets. Information on environmentally friendly ways of saving energy were also provided in all new council flats.

Green Point also engages in coordination of actions undertaken by different municipal units and social organisations. It cooperates with local schools, which joined the 50/50 energy-saving project, as well as co-organises celebrations of the Earth Day, the Earth Hour and the European Sustainable Development Week.
Among the Green Point's partners, there are the Employment Agency, the Heinrich Böll Foundation in Warsaw, the Citizen Initiative Centre in Słupsk and the Green Institute in Warsaw.

ZIELONY PUNKT

FINANCING SCHEME

Funds for launching the project were obtained together with the city's partner - Citizen Initiative Centre - from the Heinrich Böll Foundation seated in Warsaw. The County Employment Agency financed half-year labour costs of 5 employees hired in the Green Point. The Voivodeship Fund for Environmental Protection and Water Management covers part of the labour costs of one employee within the "Graduate" programme. It is planned that further funds will be obtain from cooperation programmes, like e.g. INTERREG programme.

PROJECT RESULTS

During the first four months of the Green Point's operation its employees reached approx. 2 500 citizens. Their educational work helped in raising their environmental awareness, as well as the awareness of municipal institutions, non-governmental organisations and entrepreneurs. They learned more about practical energy-saving and resources-saving solutions, which generate profits and improve the quality of everyday life. Green Point's activities also support promotion and better understanding of the principles of sustainable development, as well as contribute to the achievement of the objectives specified in the Słupsk's Low-Emission Development Programme - a document, which sets directions of the city's sustainable development.

Photo: City of Słupsk

DEVELOPMENT PROSPECTS

Establishment of the Green Point was an innovative project, which fits into current European programmes and thus has significant development prospects. It is planned to widen the scope of its activities, both by increasing the number of advisory points in Słupsk (e.g. establishing them at the cultural centres and educational facilities) and by establishing cooperation with other cities in Poland (e.g. with Ustka, which together with Słupsk forms a twin-city) and in other countries (with partner cities or within the Union of Baltic Cities).


Photo: City of Słupsk

MORE INFORMATION

Beata Maciejewska, Mayor's Plenipotentiary for Sustainable Development and Green Modernisation of the City
e-mail: b.maciejewska@um.slupsk.pl
phone: +48 59 848 84 53

Green Point
e-mail: ekodoradca@um.slupsk.pl
phone: +48 609 293 221
www.slupsk.pl/zielonypunkt

POLISH AND NORWEGIAN CITIES
together for climate and energy

EV AMPERE, SOGNEFJORD
THE WORLD'S FIRST ZERO EMISSION ELECTRICAL CAR FERRY

Sector: Transport

Timeframe: 2012 – 2015

Location: Sognefjord area, Norway

fot. Rune Opheim and Fjellstrand shipyard

PROJECT BACKGROUND

Passenger and car ferries in Norway are normally operated by ship-owners winning bids from municipalities, counties and/or the national (state) road administration.
This project is the result of a competition launched by Norway's Ministry of Transport and Communications in 2011 to develop an environment-friendly ferry for providing service on the link between the two villages. Norled won the competition, which granted the company the concession rights to operate in the route through to 2025. The new vessel established the viability of operating electric-powered ferries in 50 ferry routes within Norway and beyond.

PROJECT DESCRIPTION

The advanced vessel operates on a 5.7 km crossing in the Sognefjord between the villages of Lavik and Oppedal, and is part of the E39 highway. It is the World's first of this size.

The ferry is designed as a catamaran with two aluminium hulls. It is 80 m long and 21 m wide. It accommodates up to 120 cars and 360 passengers. Compared with traditional steel, aluminium hulls significantly reduce weight; the ship is only half as heavy as a conventional ferry.

LED lighting, solar panels and a heating, ventilation and air conditioning (HVAC) system with a waste heat recovery system are featured on board for low-energy consumption. Electric instant water heaters are also featured on board.

The ferry has two onboard 450 kW electric motors, one of them driving the thrusters. The propulsion system allows an operating speed of 10 knots. The lithium-ion batteries with an overall output of 1,000 kWh and a weight of 10 tonnes power the motors. The batteries are recharged during the 10 minutes loading and unloading time of each trip from the charging stations located at each shore and directly from the local hydroelectric-powered grid at night. A 260 kWh battery is also located at each shore to give fast power supply to the vessel while it recharges.

PROJECT RESULTS

In 2005 the introduction of five natural gas (LNG) fuelled 212 car ferries in Western Norway reduced NOx-emissions equal to emission from 100,000 average cars. Today ferries and busses all over the country run on LNG and biofuel. The next step now is electrification. Electric busses and ferries are now introduced in transportation systems all over Norway.

foto: Rune Opheim and Fjellstrand shipyard

The new environment-friendly ferry on the Sognefjord annually replaces the use of one million litres of diesel and offsets 570 t of carbon dioxide and 15 t of nitrogen oxide emissions compared to conventional ferries in service on the same route. The Ampere was granted the esteemed "Ship of the Year" award in an international trade show in September 2014.

Hybrid and plug in hybrid ferries are now introduced in more ferry and boat connections. The next 100 % electrical ferry will operate from 2017. Internationally, these projects set the course for carbon-free shipping.

MORE INFORMATION

YouTube video:
www.youtube.com/watch?v=a6Lp-qV9ZJU-
World's first zero emission electrical car ferry

Ship technology database:
www.ship-technology.com/projects/norled-zerocat-electric-powered-ferry/

SIEMENS presentation:
www.siemens.com/innovation/en/home/pictures-of-the-future/mobility-and motors/electromobility-electric-ferries.html

Energy system fact sheet:
www.corvusenergy.com/marine-project/mf-ampere-ferry/

Maritime fact sheet (Fjellstrand ship yard):
www.fjellstrand.no/flyers/flyer_1696.pdf

"The Tesla of the sea" (article):
www.na-weekly.com/featured/the-tesla-of-the-sea/

POLISH AND NORWEGIAN CITIES
together for climate and energy

HUSABØRYGGEN, STAVANGER
PASSIVE ENERGY, SHELTERED HOUSING

Sector: Energy efficiency

Timeframe: 2008 – 2012

Location: Hundvåg, Stavanger, Norway

PROJECT BACKGROUND

The project is initiated to give sheltered housing (care homes), for which Norwegian municipalities are responsible. Spatial plan requires the use of wood as the main material for building in this area. The municipality also wanted a high level of energy efficiency. The site is part of a larger developmental project in this district.

PROJECT DESCRIPTION

The project includes 24 dwellings, divided into three separate areas: two for residents with mental disabilities and one for residents with psychiatric illnesses. Based on an analysis of the microclimate, the building is located at the Northern end of the site – in order to provide shelter from the intensive Stavanger wind, and to make space for a sunny garden to the South.

The building meets passive energy standard, is constructed with a compact volume and has a total of 350 mm insulation. The loadbearing structure floor slabs and roofs are made of cross-laminated timber panels. Also the exterior cladding is wooden. There are strict requirements for using environmentally friendly materials with environmental labelling and life cycle considerations.

Design was made in accordance with the principles of accessibility for all, including simple orientation through the clear organisation of functions, and conscious use of contrasting colours. Common areas are equipped with audio induction loops and acoustic measures have been taken in common areas and corridors.

Husabøryggen is centrally located, close to public transport. Charging facilities for electric cars and bicycles are included.

PROJECT RESULTS

The project, completed through a shared contract, is a model project for Enova, and as well as a pilot project in the national "Cities of the Future" programme.

Passive energy standard, energy performance certification standard B

Heated floor space:	2984 m^2
Energy consumption:	93.9 kWh/m^2/year
Delivered energy:	67.4 kWh/m^2/year
Primary energy source:	Heat pump
Secondary energy source:	Electricity

Using timber instead of non-renewable construction materials represents an important step towards reducing global warming. The role of forests as

'carbon sinks', whereby the wood stores carbon as long as the tree is alive or is used in a structure, is expected to become increasingly important in the future.

The outdoor area at Husabøryggen Sheltered Housing is shaped like a modern garden of the senses. It is a natural extension of the sheltered housing's common recreational areas and enriches everyday life for both residents and staff.

MORE INFORMATION

Project web site:
www.arkitektur.no/husaboryggen-medical-homes

CONTACT INFORMATION:
Espen Svendsen
Stavanger municipality
Operation & Energy Department
phone: +47 51 50 74 09
e-mail: espen.svendsen@stavanger.kommune.no

POLISH AND NORWEGIAN CITIES
together for climate and energy

PREIKESTOLEN MOUNTAIN LODGE, STRAND MUNICIPALITY
LOW ENERGY USE, BASED ON RENEWABLE SOURCES

Sector: Renewable (geothermal) energy, energy efficiency

Timeframe: 2008 – 2010

Location: Høllesli, Strand, Norway

PROJECT BACKGROUND

The Norwegian Trekking Association (in short DNT) is Norway's biggest outdoor activities organisation. For some 140 years, they have been working to promote trekking and to improve conditions for all who enjoy the country's broad range of outdoor attractions. This is non-profit activity, in close cooperation with local authorities.

A new Mountain Lodge was needed at the trail-head for Preikestolen, "the Pulpit" – a characteristic mountain formation jutting out above the Lysefjord.

PROJECT DESCRIPTION

Preikestolen fjellstue is an environmentally friendly mountain lodge, containing 28 bedrooms, café, restaurant and conference facilities. Universal design gives accessibility for all.

The structure is based on prefabricated solid timber elements. This system has been stretched to its utmost limits both in terms of geometry and in terms of structural spans.

Compact building form. South orientated glazing /windows. Well insulated building envelope with few cold bridges. Combination of passive house and low energy windows. Low air leakage external envelope. Balanced ventilation with a combination of rotating plate heat recovery and plate exchanger. Heat pump connected to nearby water source (water-water). Remaining heating demand on cold days met by environmental friendly wood oven ("Hypocaust oven").

Pure, high quality materials throughout. Large amount of untreated surfaces (reduced chemical usage). Dowelled massive timber elements, without use of glue. Recycled newspaper insulation (cellulose insulation). Wood fibre plate sheathing boards. 'Fire seal' (metal louvres which close air passages when exposed to high temperatures) mounted behind the timber facade to reduce spread of fire (thereby avoiding impregnation of facade with fire retardant). External cladding made from 100% heartwood. Slate and solid timber floors. Untreated concrete floor finish in wet rooms. Bathroom walls made from glass, kitchen walls from steel. Fireplace plasters with lime and horse manure. Environmentally certified windows (Nordic Swan mark).

PROJECT RESULTS

Gross area:	1290 m^2
Energy sources:	Heat pump (water-water) and wood stove.

Estimated net energy:	164 kWh/m^2/year (NS3031)
Estimated energy delivered:	111 kWh/m^2/year (NS3031)
Room heating:	19 kWh/m^2/year
Domestic hot water:	30 kWh/m^2/year
Fans:	35 kWh/m^2/year
Lighting:	37 kWh/m^2/year
Technical equipment:	6 kWh/m^2/year

Using timber instead of non-renewable construction materials represents an important step towards reducing global warming. The role of forests as 'carbon sinks', whereby the wood stores carbon as long as the tree is alive or is used in a structure, is expected to become increasingly important in the future.

Preikestolen fjellstue has won national architectural awards and become internationally famous.

MORE INFORMATION

Association of Norwegian Architects:
www.arkitektur.no/preikestolen-mountain-lodge?lcid=1033&ecoromo=5cc355f4-61ab-43e8-aa80-0dd5acf4eacc

The Norwegian Trekking Association:
www.ut.no/hytte/3.1865/

KVAMSTYKKET KINDERGARTEN, TROMSØ
PASSIVE ENERGY CHILDCARE CENTRE

Sector: Renewable (geothermal) energy, energy efficiency

Timeframe: 2008 – 2012

Location: Tromsø municipality, Norway

PROJECT BACKGROUND

More stringent energy efficient building regulations demand continual improvements to construction solutions. Arctic climate in the far north of Norway implies additional challenges. Tromsø municipality therefore wanted to be in the forefront, taking part in the national development programme "Cities of the Future".

Kvamstykket Kindergarten (childcare centre) was one of the first completed pilot projects in the National Buildings of the Future programme. Passive energy standard, accessibility for all, renewable energy and contextual architecture have been some of the focus areas in the project. Constructing a passive building such as this involves many challenges. For example, the shell must be as airtight as possible to avoid moisture and maximise energy efficiency.

PROJECT DESCRIPTION

The kindergarten has six bases, of which one has the knowledge capacity to receive refugee children. The indoor and outdoor areas are oriented towards the South in order to collect sparse sunlight in spring and autumn season. The rooms are flexibly organised to facilitate shared use and overlap, as well as the possibility of changes to room divisions over time.

The site lies within Tromsø's concessionary area for district heating, but the infrastructure is not yet in place. As an alternative to district heating a geothermal heat pump has been installed, with an electric boiler for stand-by and peak loads.

The building was one of the first to use a new kind of passive energy wall including pressure-proof mineral wool. To monitor this construction, moisture and temperature sensors are installed in the structure. After two years, no critical issues were found, but the measurements indicated need for minor improvements, that now have been conducted.

Key facts:

- Passive energy standard
- Energy performance certification standard A
- Geothermal heat pump
- Low-emission materials
- Flexible use and floor plans

PROJECT RESULTS

Area:	1150 m^2
Energy Sources:	Heat pump (primary)
Estimated net energy:	68 kWh/m^2/year

(calculation based on the warmer Oslo climate).

Supplied energy is calculated: 53 kWh/m^2/year
(calculation based on the warmer Oslo climate).

Space heating:	25.2 kWh/m^2/year
Hot water (DHW):	10 kWh/m^2/year
Fans:	10.4 kWh/m^2/year
Pumps:	1.4 kWh/m^2/year
Illumination:	15.7 kWh/m^2/year
Technical equipment:	5.2 kWh/m^2/year

Measured energy consumption in 2014 is 103 kWh/m^2 (gross area). The municipality believes that it is possible to improve this further.

MORE INFORMATION

Buildings of the Future booklet:
www.arkitektur.no/buildings-of-the-future

Fact sheet (Rockwool):
www.rockwool.no/inspiration/u/2011.case/2133/kvamstykket-barnehage?lang=da

CONTACT INFORMATION:
Svein Karoliussen
Tromsø Municipality
phone: +47 90 73 79 80
e-mail: svein.karoliussen@tromso.kommune.no

POLISH AND NORWEGIAN CITIES
together for climate and energy

BRØSET, TRONDHEIM
A NEW ECO-FRIENDLY WAY OF LIVING

Sector: Community energy projects

Timeframe: 2009 – 2020

Location: Trondheim, Norway

PROJECT BACKGROUND

Brøset, four kilometres outside Trondheim City Centre, is a former agriculture and hospital area. Its location and topography makes the area a valuable resource for urban development, in accordance with the municipality's densification policies. The city wanted a forward-looking district where an environmentally friendly lifestyle is encouraged.

PROJECT DESCRIPTION

A new urban district for about 4000 people (approx. 1800 dwellings) is being developed. The area will also have three kindergartens, an elementary school and a health and welfare centre. The land use plan, adopted in 2013, is based on a parallel commission, where four interdisciplinary teams presented their visions. The results from the parallel commission are among Norway's most interesting examples of how new sustainable districts can be planned and developed.

Each resident will be responsible for a maximum of three tonnes of CO_2 emissions per year. The average today is between eight and eleven tonnes. To ensure this, the plan makes the functions needed in daily life available without use of cars. This implies relatively high utilization in residential areas, though with extensive public green structures. Green corridors and a central park are both important for recreation and floodwater treatment. The transport system gives priority to pedestrians, cyclists and public transport, rather than private cars. With twice as many dwellings as parking spaces, the parking coverage is about 1/3 of the current norm in Trondheim.

Planned waste system incudes individual measuring and prizing, stimulating to more sorting and less waste. Local recycling and reuse workshops will be established.

Life cycle analysis regarding CO_2 emissions will be required for all buildings, including production of materials, construction, operation, maintenance, demolition and waste management.

Prerequisites for detailed planning imply a climate neutral district, energy consumption lower than specified in national technical regulations, and extensive use of energy from renewable sources. Sum of stationary energy use shall annually be equal to the supply from local renewable energy sources, including sun and geothermal energy.

Local storm water management will be in open systems. In addition, a high proportion of green surfaces will infiltrate and delay water from heavy rain, reducing future expected flood problems.

PROJECT RESULTS

The area is not yet developed, but the land use plan implies:

- Passive energy standard for all new buildings, and energy performance certification standard A (dark green)
- Maximum three tonnes of CO_2 emissions per resident per year
- Environmentally friendly lifestyle
- Designing for pedestrians, bicyclists and public transportation
- Efficient adaption to climate change

In addition to being useful for the Brøset area and Trondheim municipality, the ideas from the four parallel commissions have inspired planners and developers all over the country.

MORE INFORMATION

Ministry of the Environment, Cities of the Future (2009):
www.regjeringen.no/en/topics/municipalities-and-regions/by--og-stedsutvikling/framtidensbyer/the-participating-cities-/trondheim/a-new-city-of-the-future/id548223

Association of Norwegian Architects:
www.arkitektur.no/buildings-of-the-future

CONTACT INFORMATION:
Ole Ivar Folstad
Trondheim Municipality
phone: +47 95 26 37 88
e-mail: ole-ivar.folstad@trondheim.kommune.no

POLISH AND NORWEGIAN CITIES
together for climate and energy

KJØPMANNSGATA, TRONDHEIM
NEW LIFE TO WHARF BUILDINGS FROM THE 1700s

Sector: Energy efficiency

Timeframe: 2014 – 2016

Location: Trondheim City centre, Norway

PROJECT BACKGROUND

Kjøpmannsgata 11 is one of many empty storage buildings from the 1700s along the Nidelva River. The building is not listed, but like the other wharf buildings, it has great cultural and historical value. This is a typical building type for the nation's coastal towns. Preservation through reuse is a relevant topic. In Trondheim alone 20.000 sq. m. of waterfront storage buildings are empty and many are dilapidated.

Trondheim's citizens have a strong relationship to the old wharves. These historical buildings are an important part of the cityscape. The wharves have been there for more than 200 years and should be there for another 200. New functions should both preserve the historical qualities and meet the needs of the future.

There is an ongoing public discussion concerning what kind of uses should be allowed. Establishment of dwellings in combination with business on the ground floor are among the options discussed. However, not everyone wants to establish dwellings in the wharf buildings, partly because it could lead to significant changes to the building fabric.

PROJECT DESCRIPTION

The project explores different alternatives for the use of the wharf buildings in Trondheim.

In addition to examining how well suited Kjøpmannsgata 11 is for mixed uses, the project will investigate how a modern construction can interact with the existing building fabric in a respectful and architecturally interesting way. The result will satisfy today's standards for environment design, accessibility for all, and fire safety.

Studies will generate new understanding and knowledge about which of the wharves are empty. Trondheim Municipality has, together with the Business Association in Trondheim, begun a vitalisation project for the Kjøpmannsgata wharves.

PROJECT RESULTS

The wharf buildings have a unique location in the heart of Trondheim, and reuse could enrich the urban environment in the city centre. The urban environment, tourism and climate adaptation will all benefit from finding new uses for existing buildings and revitalising the area.

With "everything" within walking distance, more use of these building could lead to less car traffic and related reductions in carbon emissions. Energy solutions will contribute with additional environmental achievements.

Environmental benefits:

- Low energy class 1
- Preservation through rehabilitation
- Prefabricated timber
- No parking spaces
- Public area and enriching of the urban environment

MORE INFORMATION

CONTACT INFORMATION:
Berit Andersen
Nidarholm Invest AS
phone: +47 95 75 02 26
e-mail: berit@nhinvest.no

Buildings of the Future:
www.arkitektur.no/buildings-of-the-future

POLISH AND NORWEGIAN CITIES
together for climate and energy

ÅSVEIEN SCHOOL, TRONDHEIM
PASSIVE ENERGY STANDARD, LOW CARBON EMISSIONS

Sector: Energy efficiency in buildings

Timeframe: 2013 – 2015

Location: Byåsen, Trondheim, Norway

fot. Carl-Erik Eriksson

PROJECT BACKGROUND

Due to insufficient capacity, high costs and poor environmental performance the old Åsveien School needed replacement. The local politicians demanded high environmental performance, and the project has been part of the national program "Buildings of the Future" requiring at least 50 per cent reduction in greenhouse gas emissions.

The new building accommodates 630 pupils, a center for 20 autistic children and a local cultural and sports center (multipurpose hall). More rooms are flexibly arranged so that they can be made available to different user groups in evenings and weekends.

fot. Carl-Erik Eriksson

PROJECT DESCRIPTION

Even with significantly larger area than the old school, the energy consumption in the new one is reduced to a quarter. Parts of the building's heating needs are met by a geothermal heat pump with ten wells at a depth of 200 meters. Built according to "passive energy standard" with energy performance certification standard A (dark green).
The building has extensive use of timber, reducing the greenhouse gas emissions from building materials with more than 40 per cent compared to a traditional concrete construction. Loadbearing structures and internal walls are constructed using cross-laminated timber panels, and the façades are clad with slow-growing heartwood pine.
Spatial efficiency indoor and parking restrictions combined with measures to promote walking, bicycling and use of public transport help reducing energy use and carbon footprint.

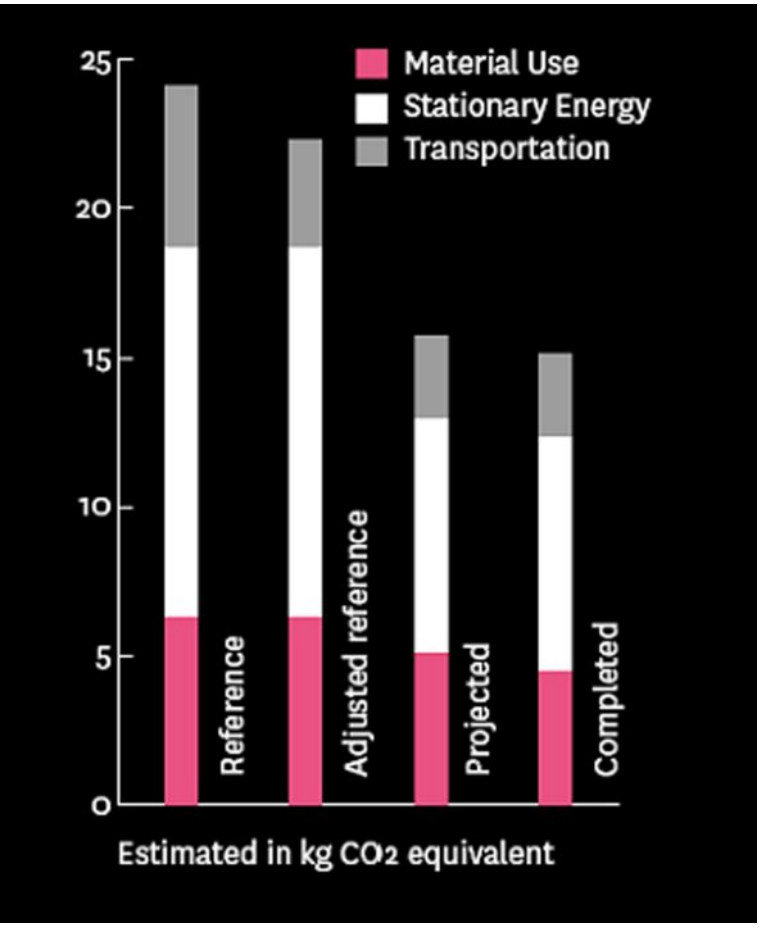
Storm water management with rain gardens and dams is one of the measures of adaption to climate change.

Owner: Trondheim Municipality

Architect: Eggen Arkitekter AS

Funding: Mainly within ordinary budgets, though with contributions from national programs

PROJECT RESULTS



Heated area:	8790 m^2
Energy label:	A (Dark Green)
Energy consumption: Net energy:	65 kWh/m^2/year.
Delivered energy:	57 kWh/m^2/year
Space heating:	6.3 kWh/m^2/year
Ventilation Heat (heating coils):	3.8 kWh/m^2/year
Hot water (DHW):	10.1 kWh/m^2/year
Fans:	6.5 kWh/m^2/year
Pumps:	0.7 kWh/m^2/year
Light:	8.3 kWh/m^2/year
Technical equipment:	8.8 kWh/m^2/year
Ventilation Cooling (cooling coils):	0.8 kWh/m^2/year

Other results: Better indoor air quality. Better adaption to climate change. Reduced car traffic to/from school – good for environment and preventing traffic accidents.

Local Community Centre established in addition to ordinary school functions. Economic and environmental gains due to intensive use – one building instead of two.

Old school demolished with high level of building material recycling.

MORE INFORMATION

See the new school being built in 12 minutes (YouTube):
www.youtube.com/watch?v=YbaDtToZZk4

Contact person:
Randi Lile
Trondheim municipality
Development unit
phone: +47 92 86 18 21
e-mail: randi.lile@trondheim.kommune.no

POLISH AND NORWEGIAN CITIES
together for climate and energy

MODERNISATION OF STREET LIGHTING IN THE MUNICIPALITY OF TRZEBIELINO

Sector: Energy efficient lighting

Timeframe: 2012

Location: Trzebielino, Poland

Photo: Philips Lighting Poland

PROJECT BACKGROUND

Trzebielino (approx. 3 800 inhabitants) is located in the central-western part of the Pomorskie Voivodeship. It is the first municipality in Poland where 100% of street lights are LEDs. The decision to modernise the street lighting was caused by significant amounts of money paid for electricity, dissatisfaction of citizens and low level of safety resulting from turning off the lights during the night hours (between 1:00 a.m. and 5:00 a.m.). The important contributors were also the high costs of lighting maintenance, its low quality and foreseen rise of electricity price. The modernisation project implemented in Trzebielino was a result of good cooperation of two companies - Energa Oświetlenie Sp. z o.o. and Philips Lighting Poland - which in June 2011 went into strategic alliance aiming at implementation of energy-saving lighting technologies in municipalities and industry.

PROJECT DESCRIPTION

In August 2012 Energa Oświetlenie Sp. z o.o. modernised 354 luminaires installed at the area of Trzebielino. 218 of them were replaced with new Selenium Led luminaires produced by Philips company. New lamps have the capacity of 55 W and 73 W. In case of remaining 136 luminaires, after the thorough inspection it was decided to replace existing lights with another energy efficient LED lamps. Over half of the old luminaires were ineffective and obsolete mercury luminaires with the capacity of 250 W and 125 W. New luminaires were equipped with Dynadimmer controllers, preprogrammed devices changing light brightness, which allow for further 30% of energy consumption reduction. The newest LED technology generates artificial light in a much more efficient way, giving better lighting with lower costs.

FINANCING SCHEME

Modernisation of street lighting in Trzebielino was conducted using an ESCO scheme, which consists in financing investments from the financial savings achieved as a result of new solution implementation. ESCO also often means third-party financing (TPF) and can be described as an optimum combination of two important components, essential for successful implementation of a modernisation project: guaranteeing necessary financial resources and ensuring professional support and technical service. By deciding on the cooperation within the ESCO scheme, the municipality received a service of complex modernisation and maintenance of street lighting provided by Energa Oświetlenie Sp. z o.o. The final investment cost came to 296 000 PLN and didn't put additional burden on municipal budget as it will be repaid from the energy savings over


Photo: Philips Lighting Poland

a 4-year period. The payment for the modernisation works is done in a form of higher exploitation and maintenance costs paid to the operator of the lighting system. The monthly cost concerning modernisation of one luminaire comes to 17,42 PLN.

PROJECT RESULTS

New street lighting is not only energy efficient and environmentally friendly, but also more comfortable for the citizens than the yellow sodium light. White light generated by LED lamps makes the areas around seen as brighter and looking more natural.

After the lighting modernisation also the citizens' sense of security increased as the municipality gave up turning off the lights during the night, which was necessary before due to the high expenditures on energy. Still, LED technology that was used makes it possible to reduce light brightness during late night hours which has generated further savings. Moreover, the places that were considered before by the citizens as dark even with the lights on, now are considered as well lit. Another important benefit of LED lights is their long lifecycle. Local authorities do not expect any major problems with the street lighting system for at least next 15 years.

In 2011 street lighting consumed approx. 162 000 kWh of energy (with the lights off between 1:00 a.m. and 5:00 a.m.). In 2013, after the modernisation, it consumed approx. 120 000 kWh (with the lights on whole night). In 2011 the municipality paid for lighting over 111 000 PLN per year, while after the modernisation this amount was reduced to 59 500 PLN, which means that the energy costs were reduced by 46,7%. In 2011 the expenditures for electricity constituted 61,7% of the municipality's total operational costs, while in 2013 this share was lowered to 44,26% of total operational costs.

Before the replacement of old street lamps with LED ones energy intensity of one light point came to 0,16 kW. Now it is 0,07 kW. Also the average cost of electricity consumption per one luminaire was reduced by more than half - from 264 PLN per year to 118 PLN per year. Capacity demand, on the other hand, was decreased from 56 kW to 29 kW. Thanks to the financial savings achieved as a result of lighting modernisation, the municipality is installing additional light points. In 2013 their total number increased by 31 new luminaires.

For its pioneer investment the municipality of Trzebielino, who is the first municipality in Poland with LED-only street lighting, received special certificate of "100% LED municipality". The certificate is granted by the companies Energa Oświetlenie Sp. z o.o and Philips Lighting Poland to these self-governments, who decided to increase their energy efficiency by installing energy efficient LED lighting.


Photo: Philips Lighting Poland

MORE INFORMATION

Wojciech Grzybowski,
Subinspector for environmental protection and aid funds
e-mail: w.grzybowski@trzebielino.pl
phone: +48 59 85 80 223

Municipality of Trzebielino
Trzebielino 7a, 77-235 Trzebielino
e-mail: sekretariat@trzebielino.pl
www.trzebielino.pl

CONSTRUCTION OF GEOTHERMAL HEATING PLANT IN UNIEJÓW

Sector: Geothermal energy use

Timeframe: 2000

Location: Uniejów

Photo: Maciej Zakrzewski

PROJECT BACKGROUND

Uniejów (approx. 3 000 inhabitants) is located in the north-western part of the Łódzkie Voivodeship, along the Warta river. In 1978 it was discovered that the municipality has deposits of geothermal waters. In the 1990s the deposits were carefully examined to check the possibility of using the waters for heating, recreational and therapeutic purposes. In 1999 the Voivodeship Fund for Environmental Protection and Water Management in Łódź and the Municipality of Uniejów established a company "Geotermia Uniejów", which one year later started the construction of the heating system using geothermal energy. In 2001 first consumers were supplied with heat generated by the new plant. Since 2006 - thanks to the construction of a peak-demand/supporting boiler house fuelled with wood chips - "Geotermia Uniejów" is the first Polish geothermal heating plant using only renewable energy sources.

PROJECT DESCRIPTION

Geothermal heating plant in Uniejów uses geothermal waters located approx. 1,9 - 2,0 km below the surface, in the Lower Cretaceous sandstones. The deposits are characterised by artesian conditions and the pressure of the flowing well comes to 2,6 atm. Exploited waters have low mineralisation level (8 g/dm^3) and the temperature at outflow reaching 68°C. Heat is recovered in a closed system, using one producing well (Uniejów PIG/AGH-2) and two injection wells (Uniejów PIG/AGH-1 and Uniejów IGH-1). The first well was drilled already in 1978 and then reconstructed in 2005. Two remaining wells were drilled in the period 1990-1991.

Thermal water in Uniejów is extracted using deep-well pump, thanks to which it was possible to increase the yield to 120 m^3/h and maintain suitably high pressure. This in turn prevents release of gases dissolved in the water. After being transported through the set of filters, geothermal water is directed to the heat generation unit, where it transmits the heat to the district heating water through two-grade heat exchangers. As a result of the process the temperature of the thermal water decreased to approx. 40-45°C. In the next stage chilled water is used for other purposes or pumped back into the deposit using one or two injection wells.

The heating plant in Uniejów works in a bivalent system. When external temperatures are low (-2°C and below) the district heating water is additionally heated up to 56–70°C by a peak-demand/supporting boiler house. In the boiler house there are two automatic boilers with the capacity of 0,9 MWt, equipped with multi-cyclones, fans and fuel feeders. The boilers are fired with wood chips with the 50% moisture content. They replaced previous, oil-fired boilers. The decision on the change of fuel was made due to the rising oil prices in 2006. As a result, currently the heating plant in Uniejów doesn't use any conventional energy source - only renewables (geo-thermal energy and biomass). The total capacity of the


Photo: Jacek Krupnik

Uniejów's plant comes to 7,4 MWt, including 3,2 MWt coming from the geothermal waters, 1,8 MWt coming from biomass-fired boilers and 2,4 MWt coming from oil-fired boilers (kept as a reserve source). Total annual heat sale reaches approx. 19861,64 GJ, including 17875,48 GJ generated using geothermal energy.

The customers of the Uniejów's heating plant are mostly individual households, housing cooperatives, public utility buildings, companies and tourism & leisure facilities managed by Termy Uniejów. "Geotermia Uniejów" satisfies demand for heating and warm usable water of approx. 70% of the citizens connected to the 13-kilometer geothermal district heating network.

Uniejów's geothermal waters are chloride-sodium waters with some contents of fluorine, iodine and metasilic acid. Since 2002 - due to their thermal and chemical properties - they are used also for therapeutic purposes - in prophylaxis and treatment of musculoskeletal, respiratory, circulatory system, neural system, alimentary system and skin diseases. In 2012 Uniejów obtained the status of health resort as the first city in the Łódzkie Voivodeship. Balneotherapeutic treatments can be taken, among others, in the seat of "Geotermia Uniejów" company and the natural therapy centre "Uzdrowisko Uniejów Park". The facilities offer inhalations and pearl baths in natural geothermal water (which are advisable for those suffering of rheumatic and musculoskeletal diseases, skin changes, allergies, varicose veins, insomnia, neurosis, states of emotional tension and nerve inflammation). Approx. 5 m^3/h of thermal water is used for balneo-therapeutic purposes.

Moreover, since 2008, geothermal waters are used to supply swimming pool basins in the leisure facilities located on the territory of Uniejów. Baths in curative seltzer water are offered in "Termy Uniejów", "Medical SPA Lawendowe Termy" hotel, "Uniejów eco Active & Spa" hotel and "Uzdrowisko Uniejów Park" centre. Approx. 10-15 m^3/h of thermal water is used for leisure purposes. Geothermal water is also supplied to the blocks of flats built by PGK "Termy Uniejów" company.

An unusual element of the whole Uniejów's enterprise is using thermal water to heat the turf of the football ground and the walking paths in the park around the castle. Also interesting are fountains and vats with hot water, which help in city's promotion and use part of the thermal water from the heating processes. Another attraction are thermal graduation towers, which enable inhalation of air rich in mineral compounds. The composition of Uniejów's geothermal water also makes it possible to use it for consumption purposes - drinking therapies, bottling, production of juices and dishes, e.g. soups, etc. Since 2015 the water is used locally for pickling cucumbers and in the future it is planned to include in the offer also other vegetables.

FINANCING SCHEME

Construction of the geothermal heating plant with the peak-demand/supporting heating source (oil-fired boilers) in Uniejów was co-financed by the Voivodeship Fund for Environmental Protection and Water Management in Łódź. The co-financing reached 11,5 Mio PLN (approx. 2,7 Mio EUR), while the total investment cost came to 17 Mio PLN (approx. 3,95 Mio EUR). In order to make the exploitation of available geothermal waters possible, it was also necessary to reconstruct the producing


Photo: Janusz Tatarkiewicz


Photo: Jacek Krupnik

well, which was done in 2000 with the financial support from the National Fund for Environmental Protection and Water Management. The support granted reached 1,2 Mio PLN (approx. 0,3 Mio EUR) in the period 2000-2001 and 2,5 Mio PLN (approx. 0,6 Mio EUR) in the period 2004-2005. Biomass-fired boilers, which replaced oil-fired ones, were co-financed by the Ekofundusz Foundation. The co-financing came to 0,8 Mio PLN (approx. 0,2 Mio EUR).

PROJECT RESULTS

Exploitation of geothermal waters in Uniejów contributed to the improvement of the quality of local environment, energy security and citizens' comfort. Geothermal heating plant replaced conventional coal-fired boiler houses. Additionally, in 2006, oil-fired boilers working as a peak-demand/supporting heating source were replaced with modern and economical biomass-fired boilers, which enabled complete liquidation of dust emission and reduction of emission of other pollutants, including CO_2 (reduction by 81,9%), CO (reduction by 80,5%) and NO_2 (reduction by 80,3%). Implementation of the whole investment not only had positive influence on the air quality within the city, but also gave the municipality a stable and independent district heating system using local energy sources.

Multiple possibilities of using available geothermal waters led to further investments, which resulted in the creation of new jobs. The city now has modern leisure and balneo-therapy facilities with the wide offer for the customers. Also the environmental awareness of the citizens and the tourists interested in the operation of the geothermal heating plant was increased. This was achieved thanks to the additional activities undertaken by "Geotermia Uniejów" company.

DEVELOPMENT PROSPECTS

In the future „Geotermia Uniejów" plans further expansion of the district heating network, as well as finding new applications for the available geothermal water. Due to its composition, physico-chemical properties and medicinal properties, it is possible to use it in alternative treatment methods, for production of cosmetics and for consumption purposes.

Photo: Jacek Krupnik

MORE INFORMATION

Jacek Kurpik
President of the Board
Geotermia Uniejów im. Stanisława Olasa Sp. z o.o.
e-mail: geotermia@op.pl
phone: +48 63 288 95 20

POLISH AND NORWEGIAN CITIES
together for climate and energy

THERMAL RETROFITTING OF THE NATIONAL LIBRARY IN WARSAW

Sector: Energy efficient buildings

Timeframe: 2012 – 2015

Location: National Library,
213 Niepodległości str., Warsaw, Poland

Photo: the National Library

PROJECT BACKGROUND

Warsaw (over 1.7 Mio inhabitants) is the capital of Poland and the main city of the Mazowieckie Voivodeship. It is also the biggest city in the country located in its central-eastern part. Warsaw is an active member of the Association of Municipalities Polish Network "Energie Cités" and one of the first Polish signatories of the Covenant of Mayors, which joined this initiative already in 2009. In 2011 the city developed and adopted its Sustainable Energy Action Plan until 2020.

The National Library in Warsaw is the central and the biggest Polish library, as well as the most important humanities-oriented scientific repository. It is the main archive of Polish literature, national bibliographic agency, research institute and an important methodical center supporting other libraries in Poland. The library occupies a complex composed of the three units connected with internal gardens. It is located at 213 Niepodległości street, in the Ochota quarter.

PROJECT DESCRIPTION

Thermal retrofitting of the library was possible thanks to the funds from the Green Investment Scheme (GIS) managed in Poland by the National Fund for Environmental Protection and Water Management (NFEP&WM). Warsaw applied for and received funding within the 1st call for proposals announced under the priority programme "Part 5 - Energy management in the facilities of selected public finance sector entities". Supported project, entitled "Energy management in the buildings of the National Library" foreseen the modernisation of the whole complex.

The National Library was built in the period of the Polish People's Republic, often from poor-quality material, therefore its buildings required replacement of the most of the elements and installations. In the years 2012-2013 thermal retrofitting works were conducted in 12 buildings (A1-A6, B, B1, C, D, E and F). Scope of the works included thermal insulation of 13 000 m^2 of external walls and flat roofs and replacement of 6 000 m^2 of windows. The façades could not have been insulated from the outside due to their structure (curtain façades) and the necessity to preserve original proportions of buildings. The insulation material used were the Multipor insulation boards, which have good insulation properties and are easy to mount on the walls. Installation of mineral boards from the inside brings many benefits: possibility of heating up the building fast, reducing energy bills (approx. by 50% per year), increasing building users' comfort, improving microclimate in the interiors and ensuring safe and durable insulation. The retrofitting works included also modernisation of the central heating systems


Photo: the National Library

consisting in the replacement of vertical and horizontal pipelines (approx. 20 000 m), replacement of approx. 1 100 radiators and installation of measurement units. Moreover, approx. 12 400 luminaires were replaced with new ones with energy efficient light bulbs. This activity was accompanied by the modernisation of the installation and replacement of lighting boards.

Another project proposal was submitted within the 2nd call for proposals announced under the GIS priority programme "Part 5 - Energy management in the facilities of selected public finance sector entities". It received funding and - as a result - ventilation and air conditioning systems were modernised in the library's main building at Pole Mokotowskie (building C). The scope of modernisation works conducted in the period 2014-2015 included replacement of electrical and tele-technical installations and introduction of BMS covering air conditioning system, ice water unit and district heating substation. The aim of the BMS is to integrate different installations existing in the library's building and to manage and optimise their operation. Modernisation of ventilation and air conditioning systems in building C was completed in May 2015.

FINANCING SCHEME

Main thermal retrofitting works were conducted in the period 2012-2013 within the project "Energy management in the buildings of the National Library" co-financed from the Green Investment Scheme. The scheme was launched to fund environmental projects using financial resources obtained by Poland through the sale of excessive Assigned Amount Units (AAUs) assigned to the country under the International Emission Trading scheme. These resources can be used only for environmental protection purposes related to the reduction of GHG emissions (so called "greening"). The investment implemented in the National Library was funded using money coming from the sale of AAUs to the Japanese entity named NEDO – New Energy and Industrial Technology Development Organization, operating on behalf of the Japanese government. The investment received the highest co-financing from all the projects supported within the agreement signed with NEDO. The total cost of the modernisation works came to approx. 26.6 Mio PLN (approx. 6.18 Mio EUR). Co-financing from the NFEP&WM reached 20.7 Mio PLN (approx. 4.81 EUR). Nearly 4 Mio PLN (approx. 0.9 Mio EUR) was covered from the budget of the Ministry of Culture and National Heritage and the remaining amount was covered from the National Library's own funds.

Modernisation of ventilation and air conditioning systems in building C was also financed by the NFEP&WM within the Green Investment Scheme, priority programme "Part 5 - Energy management in the facilities of selected public finance sector entities" (2nd call for proposals). The total investment cost included in the grant agreement came to 5.3 Mio PLN (approx. 1.2 Mio EUR).

Photo: the National Library


Photo: the National Library

PROJECT RESULTS

Conducted retrofitting works significantly improved thermal conditions of the walls and reduced heat losses. Installed mineral insulation boards improved microclimate in the interiors, which was very important for ensuring adequate comfort of the building users. After the renovation, buildings' appearance is accordant with the original assumptions of the modernist project from 1963 (during the construction in the period of the Polish People's Republic these assumptions could not have been completely implemented). Now, the National Library is a good example of Polish modernist architecture from the 60s - functional and environmentally friendly.

Thermal retrofit of the 12 buildings occupied by the library contributed to the reduction of CO_2 emissions by 2 278 Mg/a (nearly 50% decrease), while reduction of heat consumption reached 19 717 GJ/a (66.2% decrease). The investment brought not only environmental benefits, but also economic ones as it reduced library's electricity and heating bills.

Modernisation of ventilation and air conditioning systems in building C, conducted in the period 2014-2015, should result in further CO_2 emission reduction amounting to 2 262 Mg/a.


Photo: the National Library


Photo: the National Library


Photo: the National Library

MORE INFORMATION

National Library
213 Niepodległości str.
02-086 Warszawa
e-mail: dyrektor@bn.org.pl
kontakt@bn.or.pl
phone: + 48 (22) 608 29 99

Artur Galiński
Head of the Investment and Repair Unit
e-mail: a.galinski@bn.org.pl
phone: + 48 (22) 608 23 71

POLISH AND NORWEGIAN CITIES
together for climate and energy

VETURILO – THE WARSAW PUBLIC BIKE

Sector: Sustainable transport

Timeframe: from 2012

Location: Capital City of Warsaw

Photo: Municipal Roads Administration, Warsaw

PROJECT BACKGROUND

The Capital City of Warsaw, which is a member of the Association of Municipalities Polish Network "Energie Cités" since 2010, aspires to the title of "green metropolis". As such, it aims at ensuring high quality of life for the citizens combined with sustainable development and environmental protection. As a Covenant of Mayors signatory, in 2011 the city adopted "Sustainable Energy Action Plan for Warsaw until 2020".

One of the areas of intervention envisaged in the action plan is transport. Some of the tasks, including promotion of cycling, were also described in the document entitled "The Transportation System of Warsaw: Sustainable Development Strategy up to the year 2015 and successive years".

The reason for introducing municipal bike rental service Veturilo was the need to reduce vehicle traffic and to create conditions for switching from private cars to clean and ecological mode of transport, complementing public transport in the central part of the city. Due to its large popularity and thanks to the financial support from the Warsaw's districts, the system was expanded to cover also non-central areas. Today, Veturilo bikes are available in 15 districts.

Warsaw's cycle routes network covers a total length of 457 km. It is complemented with one-way streets, where cyclists are allowed to ride both ways and streets, where speed limit for cars doesn't exceed 30 km/h.

PROJECT DESCRIPTION

The bike rental service is available since August 2012. The cycling season lasts from the 1st of March till the 30th of November. 3 000 bikes located in over 200 stations are at citizens' disposal. Except for the traditional, single-track bikes for adults, from 2015 the users can also rent tandem bikes and small bikes for children from 4 to 6 years old (Veturilko).

An unquestionable advantage of the system is that it is user-friendly. In order to rent a bike, a person needs to register in the system and make the initial payment of 10 PLN (approx. 2.5 EUR). The bikes are electronically locked to the station and are released after pressing the "rental" button at the terminal. To return the bike it is enough to enter it into electric lock. Closing the lock is confirmed with a beep and the system registers the vehicle return.
The bikes are also equipped with a clamp with digital lock, which can be used to secure the bike during a stop outside the station or when there are no free bike stands available at the station.
Additional facility for the user is the special mobile phone application (Nextbike), which helps to find the nearest bike rental station, check the number of available bikes and rent a bike.
The cost of renting a bike varies depending on the time of rental. For up to 20 minutes it is free of charge. After that time, following fees are charged: from 21 to 60 minutes - 1 PLN (approx. 0.25 EUR), second hour - 3 PLN, third hour - 5 PLN, fourth hour and each subsequent - 7 PLN.

Photo: Municipal Roads Administration, Warsaw

FINANCING SCHEME

The project was funded from the municipality's own budget. The contract signed with the system operator (Nextbike company) on the 15th of May 2012 is binding until the end of 2016. It covers the service of launching, handling and maintenance of the Veturilo bike rental system in a way that would enable each user to rent a bike for a fixed price. The contract determines provider's monthly fee, which is paid out regularly during the contract's duration. The revenues from the system's operation (i.e. charges paid by Veturilo users) go to the municipality's budget and are used to finance further investments in cycling infrastructure.

PROJECT RESULTS

In the period from the 1st of August 2012 till the end of cycling season in 2015 the system registered nearly 375 000 users and a total of 6.7 Mio bike rentals. These numbers indicate that the Warsaw's public bike is one of the seven biggest bike rental systems in Europe.

An average time of single bike rental is 27 minutes. In 2015 a record number of rentals was achieved on the 11th of April and reached 15 955 rentals. The most active system user rented a bike 1 101 times, which gives approx.4.4 rentals per day.

Photo: Municipal Roads Administration, Warsaw

Implementation of the Veturilo system contributed to reduction of negative environmental impact of the Warsaw's transport system, including reduction of low-stack emissions.

DEVELOPMENT PROSPECTS

In September and October 2015 the municipality carried out public consultations aiming to learn more about inhabitant's expectations towards further development of the public bike system. The feedback gathered will be used to develop relevant development concept.

In 2016 Warsaw plans construction of approx. 75 km on new cycle routes, which will increase the comfort of both Veturilo system users and other cyclists. Majority of the new routes will be built in connection with the implementation of the participatory budget for 2016, which will be used to finance 42 projects supporting cycling selected by the citizens. It is also worth to mention that the city budget for 2016-2017 foresees approx. 130 Mio PLN (approx. 30 Mio EUR) for investments in cycling infrastructure.

Moreover, within the Integrated Territorial Investment (ITI) instrument financed from the EU funds and included in the Regional Operational Programme for Mazowieckie Voivodeship, it was planned to construct new and modernise existing cycle routes serving communication purposes - both in Warsaw and in several neighbouring municipalities. The investment shall be completed by 2023. The expansion of the cycling system means the development of the coherent cycling network and the construction of the accompanying infrastructure, e.g. bike parks.

MORE INFORMATION

www.veturilo.waw.pl
www.transport.um.warszawa.pl/ruch-rowerowy/veturilo

POLISH AND NORWEGIAN CITIES
together for climate and energy

SMALL HYDROPOWER STATION WITH THE CAPACITY OF 75 KW IN WOLICA

Sector: Water energy use

Timeframe: 2013

Location: Wolica


Photo: Enerko Energy

PROJECT BACKGROUND

The dam located in Wolica (village near Kielce), at the 10 kilometre of the Black Nida river, was used for economic purposes for over 160 years. The oldest confirmed mentions of the structure come from the 19th century and concern a wooden mill powered with twin breastshot wheels. During the mill's modernisation in 1932 a modern Francis turbine with the capacity of 32 HP was installed. In 1995, following the nationalisation decree, the mill was taken under the state ownership and nearly completely devastated. After 25 years it was possible for the rightful owners to buy the mill building back and restart its operation, which continued until 2001, when the flood destroyed part of the equipment. The need for conducting necessary repairs, as well as progressing economic changes, induced the owners to transform the mill into small hydropower station (SHS). The works included fundamental renovation of the Francis turbine and reconstruction of the turbine cage. Two years later the SHS in Wolica was equipped with additional propeller turbine with the vertical shaft and the capacity of 26 kW, which was placed in a siphon chamber. That is how the plant had been operating until 2013, when modernisation works started.

PROJECT DESCRIPTION

Modernisation of the hydropower station included disassembly of the original station's building and both turbines, construction of the reinforced concrete trough for the Archimedes screw and a cage of the Kaplan turbine, reconstruction of the feeding canal and installation of an intake pipe. The feeding canal structure and the turbine cage serve as a footing for the new SHS building. In order to ensure architectural cohesion with the neighbouring closed-down mill, the building's façade was covered with natural limestone. Building's corners, window openings and door openings were surrounded with a brick, also corresponding to the mill. The renovation works didn't cover the dam (made from reinforced concrete and steel) and the stone spillway. The key stage of the works was the installation of new turbines. Previous hydroelectric generating sets didn't use the full potential of the Black Nida river, therefore the owner decided to replace them with new devices: Kaplan turbine and Archimedes screw turbine, which are better adapted to the local hydrological conditions. They have the capacity of 45 and 30 kW respectively and are adjusted to work with a 2.2-meter waterfall. Achieved torque is transmitted to asynchronous generators through toothed gears (two-stage unit for the Kaplan turbine and three-stage unit for the Archimedes screw turbine). Generated electricity is fed into the electrical grid through the transformer station.


Photo: Andrzej Pallich

Few ways of controlling hydroelectric generating sets were foreseen in Wolica's SHS - manual control mode allows for starting up any of the two turbines or of both of them simultaneously. Automated control mode allows for starting them up in an optimal way - the system was programmed assuming that the Archimedes turbine will work at low flow, Kaplan turbine will work at medium flow and both of them will operate together, when the water flow is close to maximum. Both the Kaplan turbine and the Archimedes screw turbine cooperate with modern control systems. Additionally, among others for research purposes, the plant was equipped with the inverter system enabling smooth change of the generator's rotational speed, which allows for reaching higher efficiency of the generating set at specific hydrological conditions. Depending on the settings on the operating panel, the inverter can work either with the Kaplan generating set or with the Archimedes one.

The technical concept of the enterprise was prepared by the RES Institute, which also conducted full formal and legal procedure, which ended with obtaining the construction permit. The Enerko Energy company designed, delivered and started up the hydroelectric generating sets (including mounting bearing, installation of elements transmitting drive and installation of generators). The company was also responsible for the production and delivering of the elbow intake pipe and the screw valve, as well as for the construction of the hydropower plant's building and the electrical connection.

Installation of two turbines with different construction and characteristics, which were tailor-made for the plant, made it possible to increase plant's annual production from 180 MWh to 270 MWh. The plant can supply with electricity nearly 160 households and thus allows to reduce hard coal consumption by approx. 130 tonnes per year.

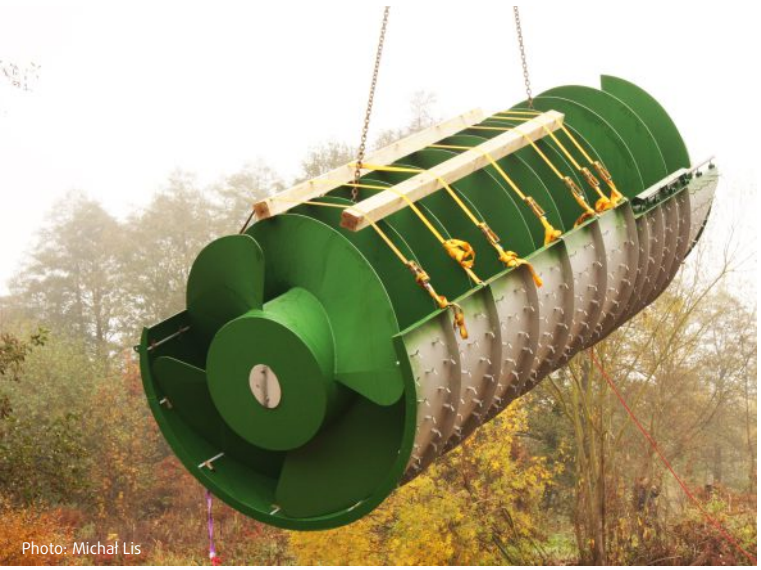


Photo: Michał Lis


Photo: Michał Lis


Photo: Andrzej Pałucki

PROJECT RESULTS

Small hydropower station in Wolica not only generates clean energy, contributing to the reduction of air pollution, but also has positive impact on local hydrological conditions by raising groundwater level over the dam. Increasing so called "small retention" helps to improve biodiversity and to minimise negative impact of the dry weather periods, which are especially bothersome for the agriculture. The hydropower plant also decreases the bottom erosion over the dam. According to the provisions of the permit required by the Water Law Act, the owner of the SHS is obliged to maintain the river bed in a good shape, both within the object and in its nearest neighbourhood. These activities help to keep the river bed clean and to secure the scarps, which reduces the threat of flooding neighbouring areas during high water. SHS in Wolica also works as a "river vacuum cleaner", which catches all anthropogenic waste carried by the river. It is worth to mention that the Archimedes screw turbine is friendly for the fish, which is a result of its low rotational speed, open and pressure-free construction, large working areas filled with water and low level of turbulence.

Small hydropower station in Wolica is also one of the tourist attractions on the Black Nida kayak route.


Photo: Enerko Energy

DEVELOPMENT PROSPECTS

Important arguments for the development of small hydropower plants were given by the study conducted within the RESTOR Hydro project, which ended in 2015. Within the project 6 thousand of different types of dams and old water mill installations were identified on the territory of Poland. They are potential locations for future investments in SHSs.


Photo: Enerko Energy

MORE INFORMATION

Łukasz Kalina, Head of the Development Department, Instytut OZE Sp. z o.o.
41a Skrajna str., 25-650 Kielce, Poland
e-mail: kontakt@instytutoze.pl
phone: +48 41 301 00 23
www.instytutoze.pl

Enerko Energy Sp. z o.o.
e-mail: kontakt@enerko.pl
phone: +48 41 301 00 27
www.enerko.pl

Polish Association for Small Hydropower Development – participant of the RESTOR Hydro project
1 Królowej Jadwigi str., 86-300 Grudziądz, Poland
e-mail: biuro@trmew.pl
phone: +48 56 464 96 44
www.trmew.pl
www.restor-hydro.eu/pl

www.togetherforclimate.eu