A LOW-EMISSION ECONOMY STARTS WITH MUNICIPALITIES

A Handbook for Polish Municipalities

Imprint

This handbook was produced as part of the project “Exploring new opportunities for the Polish-German cooperation on low-emission strategies”.

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Pictures	Cover: Urząd Miejski Kisielice Page 10/11: dioch/shutterstock.com Page 26/27: astering_Microstock/shutterstock.com Page 44/45: Gyuszko-Photo/shutterstock.com Page 70/71: Michelangelus/shutterstock.com
Design	www.stoffers-steinicke.de
Available online at	www.low-emission-project.pl

Disclaimer: The analysis, results, and recommendations are those of the authors only and do not represent the German Federal Ministry for the Environment (BMUB) and the Federal Environment Agency (Umweltbundesamt, UBA).

A project of:

adelphi

KAPE

Supported by*:

Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety

Umwelt Bundesamt

* This project was funded by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety with means of the Advisory Assistance Programme for Environmental Protection in the Countries of Central and Eastern Europe, the Caucasus and Central Asia. It was supervised by the German Federal Ministry for the Environment (BMUB) and the Federal Environment Agency (Umweltbundesamt, UBA).

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A Handbook for Polish Municipalities

Ministry of Environment of the Republic of Poland

Ladies and Gentlemen,

Economic transformation towards an increasingly efficient use of natural resources and low emissions of GHG and other airborne pollutants has become one of the key challenges of our time. Despite all the uncertainties and controversies surrounding the future prognosis of socio-economic development, it is clear that we will be increasingly exposed to the adverse effects of climate change and the unavoidable loss of natural resources. That is why we must undertake actions that will embark us on a low-carbon development pathway, actions which will safeguard economic growth while respecting environmental boundaries and that will reduce exploitation of natural resources while ensuring desired quality of life and new jobs. A low-emission economy lays the foundation for sustainable development.

From the moment we began our economic and political transformation, Poland has embarked on the path of low-emission modernisation. I anticipate that we will firmly stay on it. A thorough transition to a market economy, together with the modernisation of our key sectors, has resulted in a 30 per cent reduction in greenhouse gas emissions. Levels of other air pollutants were reduced to an even greater extent. To give an example, in Poland we reduced particulates by 80 per cent, sulphur dioxide by 70 per cent and around 40 per cent of nitric oxides. However the biggest challenge is still in reducing emissions of the PM10 particulate coming from the households and transport sector (respectively 88 per cent and 6 per cent of PM10's share of pollutants) that negatively affect air quality. At the same time, we are systematically improving air quality and reducing pollution as a result of programmes and measures undertaken at the voivodeship and local level. In 2011 the limits for PM10 were exceeded in 42 zones, but two years later, in 2013, this occurred in only 36 out of 46 zones.

Notwithstanding, over the course of recent years the dynamic trend in reductions of GHG and other pollutants has evened out. With great effort, including financial initiatives, we have significantly modernised the energy and industry sectors, which now place much less of a burden on the environment than before. The forceful process of progressive urbanisation and the development of the transport sector have somewhat stalled the positive trends in emissions reductions. In particular we have observed adverse effects in the area of air quality, which in the majority of polish cities does not meet the required standards. This poses a serious threat both to the environment and human health, mainly due to emissions from small-scale sources (so-called low-emission fuel burning sources) and car transport. This detrimental phenomenon occurs mainly in urbanised areas. That is why complex activities that foster the development of a low-emission economy by authorities at the local level are becoming increasingly important. Here I would like to emphasise that well-planned action on the issue of low- emission economies not only brings about measurable ecological effects but also contributes to lowering energy bills, boosting economic development and employment levels.

A simple look at the statistics proves the importance of the role played by cities. In Poland currently 23.3 million people

live in cities. This means 61 per cent of Poles are urban dwellers. At the same time we have witnessed exponential growth in the amount of personal car use. The situation faced by the local authorities in their efforts to pursue the development of low-emission economies has been recognised and acknowledged. The National Fund of Environment Protection and Water Management and voivode funds have launched a number of priority programmes aimed at encouraging the development of renewable energy sources, energy efficiency and low-emission ecological public transport. The Fund has also financed preparations for low-emission economy development projects by local authorities. Submitting such a project is a prerequisite for local authorities wanting to access the EU funds dedicated to decreasing the intensity of industrial emissions by 2020.

This low-emission economy guidebook will likely be useful in assisting Polish local authorities, particularly cities, in planning and implementing their low-emission initiatives. It contains exemplary solutions in low-emission public transport, energy efficiency and renewable energy sources, all of which have been implemented in big cities, smaller towns and rural areas both in Germany and in Poland. It also comprises an extensive array of presently available sources of funding dedicated to the above-mentioned ends – most of them available as part of the National Fund of Environment Protection and Water Management and voivode funds.

I sincerely hope that this guidebook will be a source of inspiration for local governments in pursuing low-emission development and will help to navigate the complex system of funding sources. I would like to thank our German partners for this initiative and the financial support that enabled us to publish this guidebook. We hope to continue the fruitful cooperation between Poland and Germany, not only on the national, but also on the local level. Let us not forget that good global solutions for climate change have local roots.

Maciej H. Grabowski
Minister of Environment

German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)

Close and constructive cooperation between Germany and Poland is a crucial component of a united Europe. Good neighbourly relations between our countries have clearly intensified in recent decades – at political, economic and civil society level.

As German environment minister I am particularly pleased that our two national ministries, the German Länder and the Polish voivodeships have been working together closely for many years in the field of environmental protection. In recent years we have also established a lively exchange of experience on climate action, renewable energies and energy efficiency.

I attach great importance to this as we are facing huge climate challenges worldwide that we will have to tackle together. Good collaboration at all political levels is essential in this regard.

Municipalities are crucial players in the fight against climate change. In addition to implementing climate action measures, it is often municipalities that disseminate information about climate change through local information exchange and direct contact with the public, enabling targeted action and encouraging engagement.

German and Polish municipalities are facing similar challenges. Limited budget funds mean that many municipalities have to solve the problem of creating financial scope for local climate action. Against this background the German Environment Ministry supported the drawing up of a handbook for local climate action containing examples of success stories from German municipalities and practical tips in times of budget restraints. By clearly outlining the framework conditions for successful financing and implementation, the handbook supports municipalities in taking over particularly effective climate action measures.

Many Polish municipalities are also very interested in increasing their appeal as a business location through climate action and measures to improve air quality, and in easing the burden on their budgets by reducing energy costs and raising local value added.

This is why I am delighted that the Environment Ministry has supported the development of this new handbook for Polish municipalities. It has been produced on the basis of a lively, cross-border exchange between German and Polish municipalities and provides the information that Polish municipalities have requested. In cooperation with our Polish partner KAPE, particularly positive examples from Germany and Poland were identified and presented. This handbook aims to demonstrate scope for action for implementing climate action measures that have already proven successful in other towns and districts.

I hope that you will be inspired by the positive dynamics of the exchange contained in this handbook and wish you an interesting read.

Federal Environment Minister Barbara Hendricks

Association of Rural Municipalities of the Republic of Poland
Association of Polish Cities

Ladies and Gentlemen,

This year we are celebrating the 25th anniversary of the rebirth of the local government system in Poland. From the perspective of 25 years of operation, it can be concluded that local governments have strongly contributed to the success of the Polish transformation. Positive changes have taken place in both urban and rural areas. Residents have the possibility of taking part in decision-making on important issues for their municipalities, including the allocation of the local budget. As a result of their extensive development activities, municipalities have become catalysts of innovation. This trend has been enhanced by the dissemination among other municipalities of already-successful solutions, which are then creatively adapted to their specific realities.

Currently, as a member of the European Union, Poland is on the verge of transitioning to a low-emission economy. This process will require the absorption of EU funds, which should be considered as a tool for achieving the goal and not the goal itself. In this transformation process the role of local governments is also going to be significant. An important element in developing a low-emission economy is establishing a community of citizens who consciously manage their property while engaging the largest possible number of local residents. Municipalities, as those entities which create a new quality of life and build civic society, are best suited to implement this process.

Undoubtedly of critical importance for sustainable development is the invention of new solutions, dissemination of knowledge and sharing of experience. The promotion of good practices and networking between local communities is the best way to effectively support the transition to a low-emission economy while simultaneously building the social capital. Leading local government organisations in Poland support this transition process and thus recommend this manual which describes, inter alia, selected good practices developed by local governments in Germany. The development of a low-emission economy at the local level, with an appropriately formulated strategy of action, may become a driving force for further improving Polish local governments.

Paweł Tomczak
Director of the Office, Association of Rural Municipalities of the Republic of Poland

Andrzej Porawski
Director of the Office, Association of Polish Cities

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INTRODUCTION

Dear reader,

We have the pleasure of presenting to you the handbook for Polish municipalities entitled "A low-emission economy starts in municipalities". This handbook has been prepared by a team of experts representing the Polish National Energy Conservation Agency (KAPE) and the Berlin-based think tank for policy analysis and strategy consulting adelphi. The handbook has been developed as part of the KAPE & adelphi project on "Exploring new opportunities for the Polish-German co-operation on low-emission strategies". The aim of the project was to facilitate the exchange of experience and the development of new fields of cooperation between Poland and Germany in the area of energy and climate policy.

The European Union has determined the strategic directions and goals for the development of a low-emission and resource-efficient economy and has set ambitious targets to reduce greenhouse gases (GHG) emissions as well as other air pollutants, increase the clean energy production and improve energy efficiency.

A low-emission economy encompasses activities in the areas of renewable energy, energy efficiency, sustainable mobility and smart urban development, as well as waste management and waste water treatment. Municipalities are key players in achieving a transition in all these sectors. They do not only act as planners, initiators, investors, producers, and end-users, but they also provide role-model solutions for local businesses and citizens.

The focus of this handbook is on low-emission strategies related to the reduction of carbon dioxide emissions and other GHG. At the same time it acknowledges the challenge for Polish municipalities in reducing emissions of other pollutants that affect human health and the environment - such as particulates, sulfur and nitrogen compounds. A major challenge for Polish municipalities is to reduce the emissions that come from the household sector. Currently, almost 50 per cent of households in Poland use solid fuel heating (mainly coal and wood), and 40 per cent extract heat from district heating. This handbook therefore also presents synergies between climate and air protection measures as part of local low- emission strategies. Thus, a number of the good practice cases in this handbook also showcase the successful reduction of air pollutants from communal sources and private houses (pol. "niska emisja"), such as in the cases of Bielsko Biała, Niepołomice, Kisielice and the promoted KAWKA-programme (as highlighted with the city of Jelenia Góra).

One of the main challenges in encouraging local governments to get involved in sustainable development is the belief that such activities would only increase the financial burdens of municipalities. Local low-emission economy activities are still too often associated with additional expenses and risks connected with undertaking pioneering investments. A key message of this handbook is that there are not only environmental benefits to gain from local low-emission activities, but also comprehensive economic gains for Polish local governments. Such potential lies in the broad range of low-emission economy activities and solutions – those that generate savings due to lowering the operating costs of municipal facilities or those that bring profits for municipalities through the development of dispersed energy generation based on renewable energy sources (RES). Furthermore, the measures used by municipalities in attaining a low-emission economy result in a better quality of life for their citizens, e.g. ensuring better water and air quality or effective multimodal public transport.

From a municipal perspective, the transition to a low-emission economy is a big challenge that requires careful planning in order to exploit the available synergies. Necessary investments usually need to be financed both from public and private sources, including the private sector and

Effects of placing municipalities on a pathway towards energy-efficiency and low-emission development are:

- Decreasing the demand for primary energy in territorial government entities,
- Reducing greenhouse gas (GHG) and pollutant emissions,
- Increasing the use of local clean energy resources,
- Improving local energy security and decreasing the dependence on fossil fuels,
- Creating local employment opportunities and strengthening local economies and
- Increasing innovative solutions at the local level.

citizens, while specific knowledge, expertise and practice is necessary for a successful transition. Against this background, this handbook showcases a number of model solutions and good practices for how Polish and German municipalities contribute to the development of a low-emission economy through climate mitigation and air quality. The case studies convey ideas and inspire replication of similar actions, stimulating both investments and activities that can be implemented under tight budgets and may even generate additional investments.

The following chapters of this handbook will give an overview of different financing and implementing techniques used in local low-emission strategies. Successful examples of good practice from Poland and Germany illustrate and support each chapter.

The next section (Chapter 1) presents the reader with the available systems for financing from public sources – through subsidies, grants and loans, as well as self-financing for reducing emissions, increasing energy effectiveness and improving air quality. Besides describing options through domestic programmes such as the National Fund for Climate Protection and Water Management (including the priority programmes such as KAWKA, LEMUR, Bocian and Prosument), the handbook also informs Polish municipalities about the main conditions with regard to the most effective use of EU funds in the 2014-2020 perspective. Special emphasis is given to funds allocated to the Thematic Goal 4 "Transition to a low-emission economy in all sectors".

Chapter 2 focuses on supporting the development of a low-emission economy on the municipal level by leveraging private funds through third party financing (TPF) and contracting (TPC). The development of public-private partnerships (PPP) is presented as one promising direction, where Polish municipalities can look for private partners with appropriate capital and know-how from the range of Energy Performance Contracting and Energy Delivery Contracting projects. A practical tool for improving energy efficiency is also the ESCO formula, by which local governments do not have to assign funds for investments, and can repay the financial obligations through guaranteed savings. Due to the lack of disposable funds in the budgets of the majority of Polish municipalities, a co-operation with private partners by entering into PPPs can be an option enabling the full potential offered by the EU funds, especially taking into account the support for PPPs from European Investment and Structural Funds during the 2014-2020 perspective.

Low-emission strategies linked to the involvement of local stakeholders, such as the participation of citizens and cooperation with local companies, are presented in chapter 3. One potential direction for Polish-German co-operation that is favourable for the development of a low-emission economy at the local level is to take into account the adaptation of the Polish energy market to models such as energy co-operatives that are actively functioning on the German market and are based mainly on photovoltaic, biomass and wind energy in appropriate devices.

Low-emission economy planning as a tool for local development is covered in chapter 4. While summarising the main messages of the handbooks, it shows that low-emission economy planning should be included as a strategy for local development as it brings ecological and economic benefits. Thanks to the National Fund for Environmental Protection and Water Management, the municipalities have had the possibility to gain subsidies for the development of local plans for a low-emission economy. Best practices included in this chapter explain how the formulation of a local energy policy and the employment of municipal energy managers bring benefits many times exceeding the respective costs occurred.

This handbook addresses all Polish municipalities, independent of population size, level of economic development, and economic and social characteristics. This leads to a necessary differentiation of needs and problems to be solved as well as to a variety of solutions offered for implementing measures in the field of low-emission economy development and climate protection. A dialogue-oriented process involving municipalities and experts from both countries was used to select a broad spectrum of good practices implemented by various Polish and German municipalities for this handbook - from a metropolis with a population of close to two million people to villages with only a few thousand inhabitants.

Ladies and Gentleman! A low-emission economy starts with municipalities – starting with yours!

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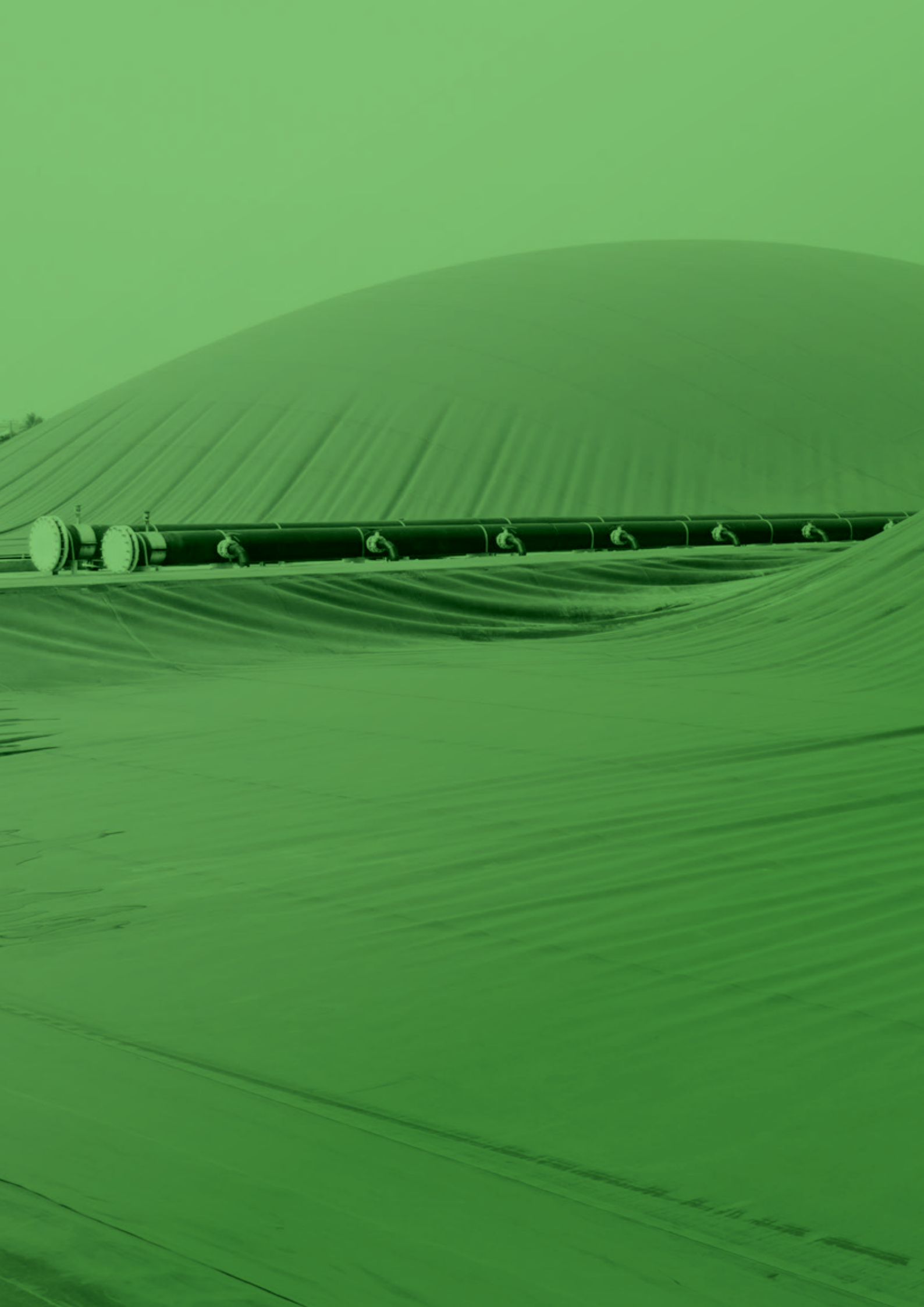


Chapter 1

Seeking access to finance

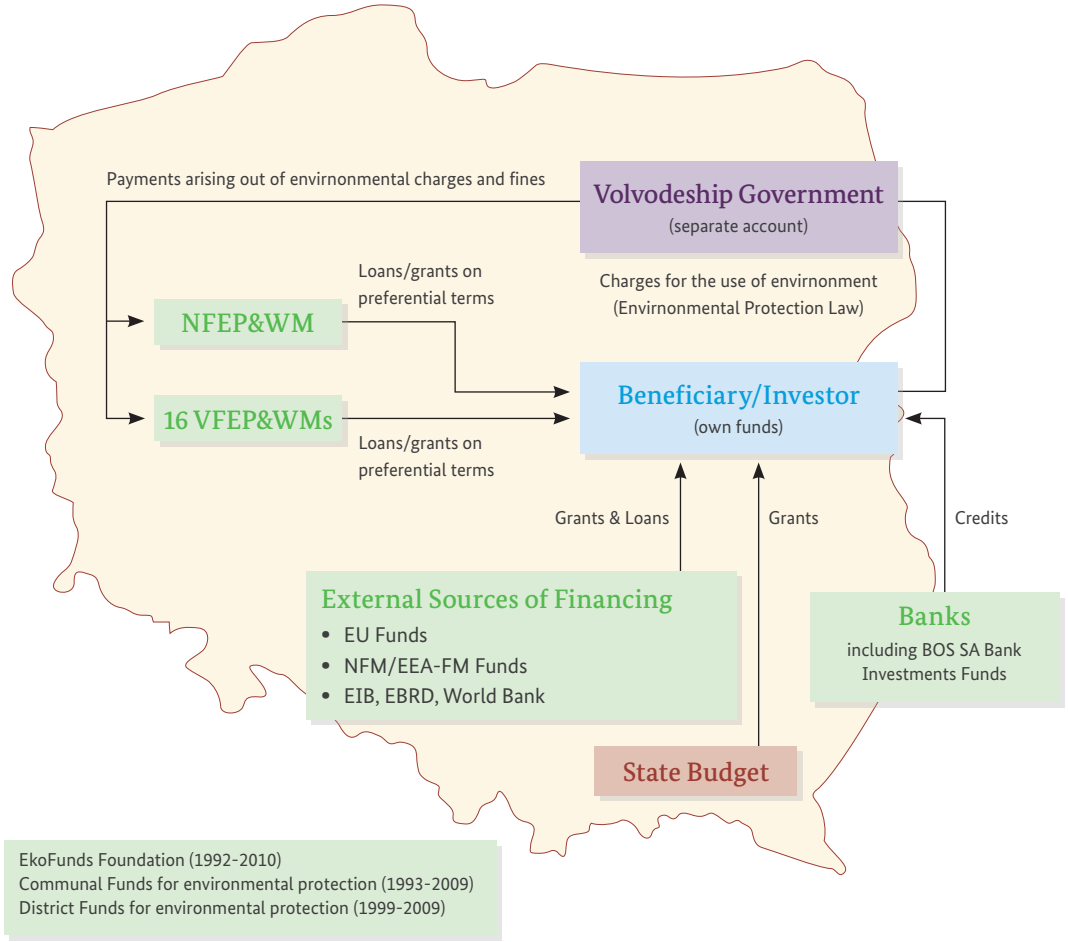
Achieving the transition to a low-emission economy involves raising the funds required to implement projects. Often there are not enough resources in municipal budgets, making it necessary to access other sources of finance such as grants, subsidies, loans and preferential credit loans dedicated to such investments. Funding sources at the EU level and on a national level constitute important means for raising a large part of the funds necessary to implement projects in low-emission development.

Seeking access to finance

A low-emission economy is one in which growth is achieved as a result of integrating all aspects of the economy around modern infrastructure, technologies and practices with low or zero emissions.

Within the framework of a low-emission economy municipalities, buildings, transportation, industries and agriculture use energy and materials efficiently, rely on low-emission or zero energy sources and manage their waste so as to minimise emissions and achieve circular resource flows[1]. The transition to a low-emission economy requires a lot of effort, starting from inventing new concepts and technical solutions for local development to raising the respective funds required for the implementation of projects. Substantial investment layouts may be needed in implementing new innovative solutions. While some municipalities are able to finance such investments from their own budgets, there are often not enough financial resources to face this challenge without accessing other sources of finance. Against this background, in the coming years a number of grants, subsidies, loans and preferential credit loans dedicated to such investments will become available to Polish municipalities.

The system and main sources of financing environmental protection in Poland



Source: www.cop19.gov.pl/

1 While carbon dioxide (CO_2) is the most important GHG in terms of quantity, other emissions have been converted to a carbon dioxide equivalent (CO_2eq). Low-emission terminology thus embraces the total amount of GHGs (methane...), not only carbon dioxide.

Funding on the EU level

Large amounts of this funding stem from the EU level. Namely, under the Multiannual Financial Framework for 2014-2020 Poland will receive EUR 82.3 billion for the implementation of the cohesion policy and approx. EUR 32.1 billion for the implementation of the Common Agricultural Policy, thereby becoming the largest beneficiary of the cohesion policy and the 5th beneficiary of funds for agricultural programmes.

Within the Multiannual Financial Perspective 2014-2020, funds will be allocated to activities that fall within the objectives of the Europe 2020 Strategy. In particular, the allocation for Poland under the Cohesion Policy Objective 1 "Investment for Growth and Jobs" to the Thematic Objective (TO) 4 "Supporting the shift towards a low-carbon economy" amounts to EUR 8.1 billion. Transitioning to a low-emission economy is one of the priorities for the use of European funds in the 2014-2020 perspective. This means a significant increase in EU support for the use of renewable energy, improvement of energy efficiency, low-emission urban transport and solutions in the field of smart power grids in Poland.

Six national Operational Programmes will be implemented in Poland, including one supra-regional programme for Eastern Poland and 16 Regional Programmes (including one programme for the Mazowsze Province of Poland – Polish: województwo mazowieckie, developed according to separate principles). Under the Common Agricultural Policy and Common Fisheries Policy, two national-level programmes will be implemented. The Rural Development Programme (RDP) will implement measures within the priority Promoting resource efficiency, supporting the shift towards a *low-carbon* and *climate resilient economy* in *agriculture*, *food* and *forestry sectors*.

Funds for activities related to the transition to a low-emission economy are available as part of the Operational Programme Infrastructure and Environment 2014-2020[2], as well as those activities that are part of the Regional Operational Programmes[3] (ROP) and the Rural Development Programme[4] (RDP). The budget of the Operational Programme Infrastructure and Environment (OP IE) amounts to EUR 27.5 billion (i.e. PLN 114.9 billion) from the European Funds. The main beneficiaries of the new OP IE 2014-2020 will be public bodies including local government entities and entrepreneurs, especially large companies. Funding for smaller projects should be sought in the ROP. In their case, of particular importance will be the involvement of local governments and the indication of directions for the use of the funds.

Selected investment priorities of the EU OP IE

I. OP IE priority axis "Lowering emissions of the economy" is implemented within the TO 4, including the following investment priorities:

- promoting the production and distribution of energy derived from renewable energy sources;
- promoting energy efficiency and renewable energy use in enterprises;
- upporting energy efficiency, smart energy management and renewable energy use in public buildings and in the housing sector;
- developing and implementing smart distribution systems that operate at low and medium voltage levels;
- promoting low-emission strategies for all types of territories, particularly in urban areas, including the promotion of sustainable multimodal urban mobility and adaptation measures to mitigate the impact of climate change;
- promoting the use of high-efficiency cogeneration of heat and power based on useful heat demand.

III. OP IE priority axis "Development of transport infrastructure that is environmentally-friendly and significant on the European scale" is implemented within the TO 4, including the following investment priority:

- promoting low emission strategies for all types of territories, particularly in urban areas, including the promotion of sustainable multimodal urban mobility and adaptation measures to mitigate the impact of climate change.

2 www.pois.gov.pl/
3 www.regionalne.gov.pl/
4 www.minrol.gov.pl/

It is important for municipalities to note that to receive support within OP IE 2014-2020 under the investment priorities 4.3 and 4.5 of Thematic Objective 4 will require meeting the support criterion i.e. the preparation of relevant planning documents (low-emission economy plans), which should be related to the local energy security documents.

Regional governments, directed by the marshals of the provinces (voivodeships) will be responsible for managing over EUR 4.5 billion allocated to development of a low-emission economy at the local level. The allocation of the funds, depending on the voivodeship, varies from 15 to 30 per cent.

Allocation of funds for transition to low-emission economy in Regional Operational Programmes (as of August 2014)

	Voivodeship	Allocation of funds [mln EUR]	Share in ERDF[5] [%]
1	Śląskie	745	29.73
2	Lubelskie	396	24.63
3	Pomorskie	296	22.00
4	Dolnosląskie	356	21.97
5	Podlaskie	181	26.65
6	Podkarpackie	311	20.42
7	Wielkopolskie	352	19.95
8	Warmińsko Mazurskie	247	19.82
9	Kujawsko Pomorskie	272	19.80
10	Świętokrzyskie	193	19.58
11	Małopolskie	380	18.33
12	Łódzkie	290	17.86
13	Zachodniopomorskie	194	16.85
14	Mazowieckie	255	16.51
15	Opolskie	103	15.06
16	Lubuskie	98	15.00

Source: Związek Stowarzyszeń Polska Zielona Sieć

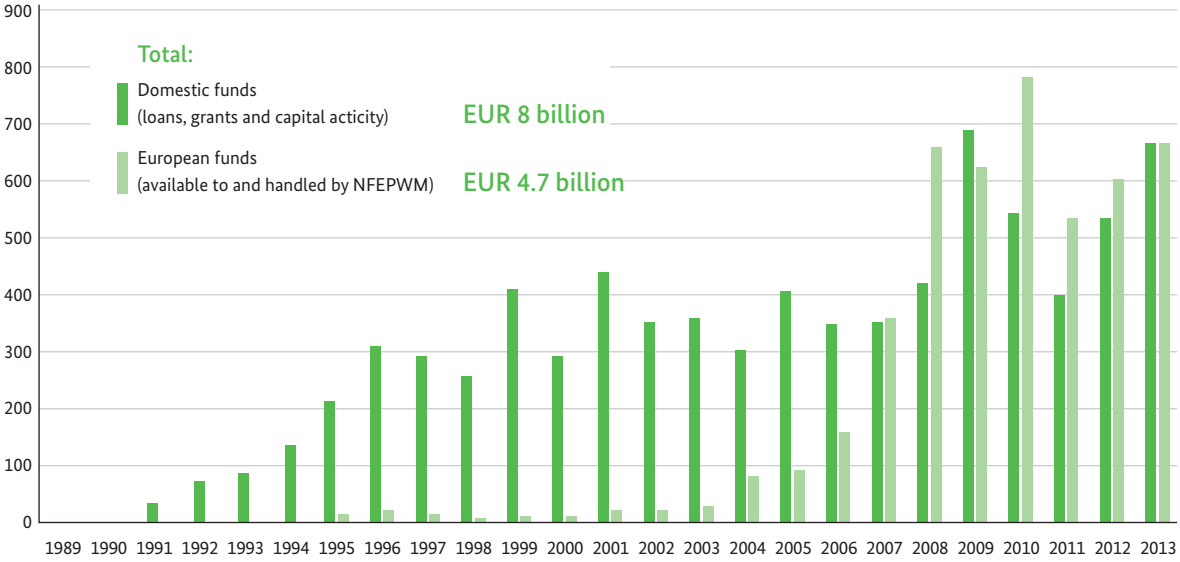
Funding by the National Fund for Environmental Protection and Water Management

A significant source of funding for climate protection projects undertaken by local governments is the National Fund for Environmental Protection and Water Management (NFEP&WM, Polish: Narodowy Fundusz Ochrony Środowiska i Gospodarki Wodnej – NFOŚiGW). The NFEP&WM was established in 1989 as a result of the regime transformation in Poland. In cooperation with voivodeship funds for environmental protection and water management, it is the pillar of the Polish system for financing environmental protection. The basis of the National Fund's operation as a legal person is the Act on Environmental Protection Law.

In the years 1989-2013 the National Fund co-funded environmental projects – for municipalities, enterprises and physical persons – with the amount of approx. EUR 4.7 billion.

5 ERDF – European Regional Development Fund

Financing environmental protection and water management by NFEP&WM in 1989-2013 (million Euro)



Source: www.nfosigw.gov.pl/en/financing-environmental-protection/

Selected effects of projects concluded in 1989-2013

Annual CO_2 emission reduction or avoidance	↓	12 million tonnes
Number of public buildings wich underwent thermal efficiency improvement	↑	2,376
Number of sewage treatment plants, wich were built or reconstructed	↑	2,742
Stream of sewage treated daily in those plants (above)	↑	8.4 km³
Number of waste treatment plants, wich were built or reconstructed	↑	96
Amount of waste treated every year (including recycling)	↑	over 2 million tonnes

Source: www.nfosigw.gov.pl/en/financing-environmental-protection/

The basis of accepting and considering applications for co-financing in the National Fund are priority programmes which determine the principles for granting support and criteria for selecting projects to be financed. In the majority of programmes, the competition formula for evaluation of complex projects is used. The management of the NFEP&WM's finance by priority programmes guarantees a transparent, objective and impartial process of granting co-funding. Under the priority programmes of the NFEP&WM there are financial instruments which may be used directly by Local Government Bodies, as well as mechanisms targeted at entrepreneurs, housing associations, housing cooperatives and individual persons. Municipalities may promote such programmes within their territories and support different entities in applying for funding allocations.[6]

Currently, the NFEP&WM offers over ten priority programmes in the field of low-emission development. The programmes aim to reduce the air-borne pollutants and emissions of GHG, primarily carbon dioxide, through the funding of projects in the fields of renewable energy sources, GHG mitigation, energy efficiency improvement, sustainable transport and air quality improvement. Funding for such investment projects may be allocated in the form of grants or preferential loans.

NFEP&WM priority programmes relating to low-emission economy

- Priority programme: Improvement of air quality
- Priority programme: Improvement of energy efficiency
- Priority programme: Support for distributed renewable energy sources
- Priority programme: Green Investment Scheme (GIS) in which the funds come from the sale of surplus AA units (Assigned Amount Units) in the UN Emissions Trading System, and from other funds of the NFEP&WM, and
- Priority programme: Rational waste management.

EU directives impose a number of obligations on municipalities, especially with regard to public buildings. In particular, starting from the end of 2018, all newly built public edifices will have to comply to so-called Nearly Zero Energy Buildings standards. Building on experiences of German municipalities and of Polish pilot projects paired with displaying financial benefits connected with the exploitation of related energy savings in public buildings will allow Polish municipalities to benefit from the experiences of German partners; starting with the design, through the construction process, and ending up with outfitting furnishing the nearly zero energy public buildings.

Taking into account the information above, of particular attention to local governments should be the LEMUR programme (focused on energy efficiency in buildings), which was launched in 2013 by the NFEP&WM, offering financial support to make public buildings more energy efficient. Support is available, among others, to public finance sector entities and entities providing public services within the responsibilities of local government units which are not entrepreneurs. The LEMUR programme will be implemented in the period 2013-2022. Applications may be submitted within the deadlines announced by the Fund while the call for applications is continuous[7].

Financial support under the LEMUR programme may be granted to investment projects involving the design and construction of new public buildings and collective housing buildings which meet certain energy efficiency criteria. The LEMUR programme offers financing in the form of grants of up to 20 per cent, 40 per cent or 60 per cent of the cost of developing the building's design documentation, depending on the energy efficiency class of the designed building, and in the form of loans of up to PLN 1,200 per m^2 (for class A) and to PLN 1,000 per m^2 (for class B and C) of usable floor area of the building's rooms with adjustable air temperature (the loan may then be subject to remission at 30 per cent, 50 per cent or 70 per cent, depending on the energy efficiency class of the designed building).

6 All programmes offered by the National Fund for Environmental Protection and Water management are specified and described on the NFEP&WM www.nfosigw.gov.pl/oferta-finansowania/

7 www.nfosigw.gov.pl/oferta-finansowania/

Both the grant amount and the proportion in which the loan is cancelled depend on the energy efficiency improvement achieved due to applied non-standard solutions. They also depend on the achieved reduction of the seasonal space heating indicator, and on the achieved primary energy demand indicator. Energy efficiency classes of buildings and the proportions of loan cancellation are shown in the table below.

Conditions to be met to obtain funding under the LEMUR programme

Building's energy class (after the standard improvement)	Reduction of building's usable energy demand in relation to reference buildings (in %)	Reduction of building's primary energy demand in relation to applicable requirements (in %)	Co-funding of building's design documentation development (in %)	Proportion of loan cancellation PLN/m² of usable floor area
A	≥60	≥20	up to 60	720
B	≥45	≥15	up to 40	400
C	≥30	≥10	up to 20	200

Another source of funding, important for local governments with regard to climate protection projects, are the Voivodeship Funds for Environmental Protection and Water Management. The main task of this funding is to allocate financial resources to projects that contribute to sustainable development in the region through, inter alia, improving the state of the environment in the region, ensuring the environmental safety of the residents, protecting the natural values of the region and counteracting climate change. The funding is available in the form of grants, loans or subsidised interest rates on commercial loans.

In order to implement projects aimed at climate mitigation, local governments may also apply for preferential loans offered, among others, by Bank Ochrony Środowiska (the Bank for Environmental Protection)[8].

Examples of good practices

Energy efficiency and Renewable Energy Sources (RES) are the main pillars of a low-emission economy. In this context, the good practice case from the Polish municipality of Charsznica acts as an example of the effective use of public funds by a local government in order to contribute to improving the energy efficiency of local infrastructure. Moving to sustainable transport, we introduce the Polish city Gdynia as a role model for the development of public transport using technological developments to maketrolleybuses not only more comfortable for passengers, but also to reduce emissions and noise while improving their economic feasibility.

In the next few years, foundations for the development of a low-emission economy will also be laid by the construction of nearly zero energy buildings. In this context, we point at the Demonstration Centre for Renewable Energy Sources in the city of Bydgoszcz, providing the basis for the application of RES in other public buildings in Polish municipalities, while also serving the education of new professions that will be needed in a low-emission economy.

The good practice case Herten shows how the city has successfully undertaken the structural changes from an economy based on coal extraction to a centre of innovative technology, providing important experience for the transition to a low-emission economy for municipalities with a post-industrial perspective.

8 Current bank offers are presented on the bank website www.bosbank.pl.

Charsznica: A street lighting system's modernisation within the programme SOWA

"We are pleased with the programme named SOWA launched by the NFEP&WM which gave us the opportunity to finance the street lighting modernisation investment. We recommend other municipalities to apply to NFOSiGW programmes supporting a low-carbon economy for local governments and we see the need for developing this kind of support for municipalities. We hope that the projects that are included in our Low Carbon Economy Plan will find financing from programmes including acceptable financial mechanisms for local governments. It is necessary to develop such mechanisms i.e. for thermomodernisation projects in family buildings"

Mateusz Peroń, Charsznica Community Hall

The **Charsznica** municipality is a good example for the effective use of public funds in order to contribute to improving energy efficiency of local infrastructure. The case of Charsznica shows how in turn this not only brings financial savings for the municipal budget but also a reduction of GHG emissions.

Charsznica is a rural municipality located in the northern part of the Małopolska Province (Polish: województwo małopolskie) in the Miechów county (Polish: powiat miechowski). The municipality consists of 18 villages with 8,000 residents in an area of approx. 78 km² of which over 80 per cent is farmland. Because of its agricultural character the municipality has no significant industrial entities. Residential, commercial and production buildings in the municipality are heated with local heat sources which differ in terms of used fuel (coal, coke, wood, electricity or gas).

In 2013, the Charsznica municipality applied for funding for an investment project consisting of the modernisation of its street lighting system within the First Competition held under the priority programme "The Green Investment Scheme", Part 6: Energy-saving street lighting – SOWA – (Systemy Oświetlenia W Aglomeracjach), organised by the National Fund. The goal of the programme is to reduce or avoid carbon dioxide emissions through funding projects that improve the energy efficiency of street lighting systems. The funding is awarded in the form of a grant of up to 45 per cent of eligible costs. There is also the possibility to apply for funding in the form of a loan of up to 55 per cent of eligible costs. The terms of funding are:

- CO_2 emission reduction by at least 40 per cent as a result of the project.
- CO_2 emission reduction by at least 250 mg/year as a result of the project.

The programme's beneficiaries are local government entities which have a legal title to manage the street lighting infrastructure covered by the project.

The following types of projects are eligible for funding:

1) Street lighting system modernisation (including replacement of light sources, luminaries, ballasts, power cables and poles; installation of new lighting points within the modernised lighting systems, if their installation is necessary to meet requirements specified in the European Standard EN 13201);
2) Installation of intelligent control devices for lighting systems;
3) Installation of control systems for power reduction and supply voltage stabilisation.

The municipality's application was positively evaluated and Charsznica was allocated funding in the form of a combination of a grant (45 per cent) and a loan (55 per cent) for the cost of the project "Modernisation of the street lighting system in the municipality of Charsznica". The interest rate for the loan is the WIBOR (Warsaw Interbank Offered Rate) 3M floating rate – 150 baseline points (annual equivalent rate) but no less than 3 per cent. Interest rates are due to be paid on quarterly basis. The first repayment takes place at the end of a quarter, following the previous quarter when the first tranche was paid.

In the fourth quarter of 2014, the municipality successfully completed the task. The total investment cost was approx. PLN 2.3 million.

The project consisted of the modernisation of 1,011 street lights (mainly with mercury and incandescent lamps) out of 1,107 already-existing lights in the municipality; 96 lights were left non-modernised as they were still in good condition.

As part of the investment, the following types of lamps have been installed based on local light demand, technical supply conditions and cost analysis:

- Sodium lamps 70 W: 775 items / 100 W: 42 items
- LED lamps 59 W: 184 items / 117 W: 10 items

- In addition, 67 intelligent control units with astronomical clocks including GPS systems have been installed in order to adjust the required light intensity necessary for light comfort and security of traffic and inhabitants, and thereby save a substantial amount of energy.

The implemented project will have measurable economic and environmental effects for the municipality: according to the lighting system's audit which was the key technical document attached to the application for funding, the project will reduce annual electricity consumption by approx. 60 per cent, operating maintenance costs by approx. 62 per cent per year, and carbon dioxide emission reduction by approx. 400 tonnes (60 per cent) per year. Other issues to be taken into account for the whole economic picture are the higher investments costs as compared with standard incandescent lamps and the fact that the new lamps will have a longer lifetime.

The municipality of Charsznica is currently developing a low-emission economy plan to further pursue its development towards a low-emission economy.

Take-Away Messages

✓ The costs of outdated street lighting are a heavy burden on municipal budgets. Modernisation can lower electricity consumption and maintenance cost by approx. 60 per cent - thereby easing the budget of the municipality and lowering GHG emissions at the same time.

✓ The lighting system's audit is the key technical document attached to the application for funding that determines the scope of lighting modernisation. Therefore it should be performed by an experienced company that will provide optimal and tailor-made solutions for the municipality.

✓ In order to apply for SOWA funds a municipality has to possess the title to use street lighting within the area of the project to be implemented. In such cases it is worth municipalities considering applying for funds from NPEW&WM following the example of the Charsznica municipality.

Key Data

Financing:
Grant and loan from NFEP&WM

Duration:
2014
Estimated CO_2 savings:
400 tonnes per year
Costs:
PLN 2.3 mln

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Landscape of Charsznica

Source: Charsznica City Hall

Gdynia: Development of public transport as a role model for other Polish cities

"Technical and economic parameters are important for the Trolleybus Transport Company in its use of rolling stock and it has to make sure that the innovations introduced are cost-effective. Yet it should be remembered that what matters most to us is the level of citizen satisfaction."

Marek Stępa, Deputy Mayor of Gdynia for development issues, Gdynia Municipal Office

Gdynia is a city on the Baltic Sea, with a population of about 248,000. The city is attractive for tourists because of its well-developed sailing infrastructure and its location among large forests (including the Tricity Landscape Park and the Kępa Redłowska nature reserve) which cover over 45 per cent of the municipality's area. The city protects its natural resources and landscape by implementing various pro-environmental measures, including activities aimed at reducing energy consumption and CO_2 emissions.

Technological developments have helped to revolutionise trolleybus transport, making trolleybuses more comfortable for passengers, reducing their noise pollution and improving their economic feasibility for Przedsiębiorstwo Komunikacji Trolejbusowej – PKT (the Trolleybus Transport Company). Modernization began in 2004 in the framework of the project "Proecologic development of public transport in Gdynia", for which PKT gained co-financing from ERDF Integrated Regional Development Operational Programme (the overall costs of the project amounted to 53.95 mln PLN). In the years 2007-2013 further modernization of the trolleybus system was made. 70 per cent of the eligible costs, amounting to 98.65 mln PLN, were received from the ERDF ROP for the Pomeranian Voivodship. Since 2012, a consortium of PKT, Municipality of Gdynia (Roads and Greenery in Gdynia), University of Technology in Gdańsk and the University of Gdańsk, realizes a project in the framework of CIVITAS II PLUS (funded by the 7th European Committee Framework Programme). The total cost of the project is 13,41 mln EUR (including 805,200 EUR for implementation of a part of the project by the Municipality of the City of Gdynia). The company currently operates 85 vehicles, of which 32 have Li-Cd batteries. Vehicles with these batteries can travel a distance of 5 km without needing to consume electricity from an overhead contact line. Starting from May 2015, the trolleybus company will debut two technologically advanced vehicles with Li-Ion batteries; these vehicles will be able to cover a distance of 20 km without power from an overhead contact line. In a bold move, a new trolleybus line will be launched whose route includes roads without any overhead contact lines at all.

Apart from investing in rolling stock, Przedsiębiorstwo Komunikacji Trolejbusowej also devotes resources towards improving the traction infrastructure. In the past few years, five traction substations were modernised and four new substations were built. Recently, an advanced step was taken to increase the energy efficiency of the overhead line. In another recent innovation, the electricity generated by a braking trolleybus vehicle can now be recovered and used by the following vehicle, thanks to the installation of a supercapacitor storage device in one of the traction substations. The recuperation process takes place when the vehicle is braking and its engine switches to generator mode. The accumulated surplus power can be "consumed" at a later stage by other vehicles, for instance during a temporary power shortage. Over 50 per cent of the PKT rolling stock is currently equipped with the recuperation modules, thus enabling power to be returned to the network. The projects are intended to significantly reduce energy consumption and manage it in a rational way. From 2009 to 2014, the trolleybus system's electricity consumption was reduced by 23 per cent while maintaining the same number of kilometres per vehicle.

Gdynia is taking all possible measures to diversify the fuel mix used in its public transport. The municipal project "CNG[9] – green transport in Gdynia" was preceded by a number of activities aimed at gathering knowledge and learning from the experience of other public transport companies operating compressed natural gas buses. A study tour was taken to a CNG bus depot in another country where CNG bus tests were carried out.

In the period 2007-2012, the municipal transport company Przedsiębiorstwo Komunikacji Miejskiej (PKM) in Gdynia increased the number of operated CNG buses from 5 to 14 (by the end of 2012.) The resulting savings amounted to PLN 3,916 million. In that period, the buses travelled a joint distance of 4,932 million km and the emissions of

9 CNG – Compressed Natural Gas

harmful substances were reduced by about 809 tonnes. Compared with conventional (diesel-powered) buses, the reduction of noise pollution was considerable, and the following reductions in the emission of toxic substances were calculated:

- nitrogen oxides (NO_x) by 50-80 %,
- carbon dioxide (CO_2) by 20 %,
- carbon monoxide (CO) by 60-80 %,
- particulate matter (PM10) by approx. 99 %,
- aldehydes by approx. 70 %,
- aromatic hydrocarbons by about 90 %.

In subsequent years the reductions improved even more because in 2013 two new articulated buses were added to the fleet of CNG buses, which reduced CO_2 emissions by a further 915 tonnes per year. The buses were financed from municipality own resources and a VFEP&WM loan.

The last year was very significant, as in December 2014 the PKM company equipped 15 more vehicles with CNG installations. In addition, the company's application to the Gazelle project was approved, which enabled the co-funding of 10 hybrid buses fuelled with CNG, amounting to 90 per cent of the total project costs (15 mln PLN). The cost of purchasing CNG buses amounted to 14.07 mln PLN. The investment was financed with grant from the ERDF under the ROP for the Pomeranian Voivodship for 2007-2013 (7.035 million PLN), loan from the VFEP&WM in Gdansk (6.6 mln PLN) and the Company's own funds (435,000 PLN).

As a result of these activities, the PKM in Gdynia currently operates 92 buses, out of which 31 (including 16 articulated vehicles) are fuelled with CNG.

Trolleybuses in Gdynia

Source: Picture by Małgorzata Rutkowska (1st place in interregional photography competition "My trolejbus, my city", held in 2012)

Take-Away Messages

- ✓ It is worth noting that in a trolleybus with Li-Ion batteries, the battery charging time is less than one hour. Thanks to the reduced battery size, the vehicle may transport seven passengers or more.
- ✓ In preparation for the acquisition of CNG buses by a municipal transport company, the PGNiG company should begin constructing CNG filling stations in the city.
- ✓ The purchase price of a gas-powered bus is higher when compared to a diesel-powered bus, but over the years the difference has decreased. Currently, the difference is about PLN 150,000 but due to lower fuel costs the investment is recuperated in less than three years. A bus with a diesel engine covers a distance of 100 km at the price of PLN 193. In the case of a CNG bus the cost is PLN 154.4. The difference is PLN 38.6/100 km, which equals a 20 per cent saving.

Key Data

Financing:
Municipal budget, IROP, ROP, EU 7th Framework Programme, NFWP&WM, VFEP&WM, Gazelle project, PKT and PKM own resources

Duration:
Since 2004

Estimated CO_2 savings:
4,000 tonnes in the period 2004-2014

Costs:
PLN 186 mln

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Bydgoszcz: Demonstration Centre for Renewable Energy Sources

"The DC RES is located in the Bydgoszcz Secondary School of Mechanical Engineering No. 2, because we have adopted the bottom-up approach. Pupils will be educated here in a sort of "real laboratory" in professions involving techniques for devices and systems for renewable energy sources. They will also be trained in other professions demanded on the labour market, such as mechatronics specialists, CNC (Computer Numerical Control) mechanics, plastics mechanics, and electricians. It is they who will be the verifiers of such solutions."

Rafał Bruski, President of the city of Bydgoszcz

The city of Bydgoszcz is an urban municipality located in the Kujawsko-Pomorskie Province of Poland (Polish: województwo kujawsko-pomorskie) with a population of about 359,000. When implementing initiatives contributing to the development of a low-emission economy, the city seized numerous opportunities by participating in projects co-financed by the EU.

As part of the implementation of the EU project "Demonstration of energy efficiency and use of renewable energy sources in public buildings" (which is co-financed by the European Regional Development Fund under the Central Europe Programme), Bydgoszcz built the Demonstration Centre for Renewable Energy Sources (DC RES) which opened in 2014. With this initiative, the city aims to promote energy efficiency and the development of passive public buildings, in which thermal comfort can be reached both in winter and during summer with an extremely low conventional energy input.

The building of the Demonstration Centre for Renewable Energy Sources (DC RES) has an area of 367.26 m². The requirements for such buildings include the necessity to limit heat demand to no more than 15 kWh/m²/a and primary energy demand to 120 kWh/m²/a.

The Demonstration Centre in Bydgoszcz is open to the public and serves as a reference point demonstrating what kind of energy savings are possible with state-of-the-art technology. It has been designed for testing and verifying the potential of energy saving solutions in a real-life context.

The aim of the centre is to present solutions for passive building construction, promote energy efficiency in buildings as well as the use of renewable energy sources. To achieve these aims, the equipment and technologies typical for a passive house remain open and visible to the visitors.

Moreover, achieved energy savings are presented for visitors using computer visualisations on displays. The centre is equipped with an automatic HVAC (Heating, Ventilation, Air Conditioning) system with data collection and reporting modules, e.g. inside and outside temperature, humidity, atmospheric pressure, wind direction and speed, sunlight and atmospheric precipitation.

The building process of the centre was preceded by the Common European Sustainable Building Assessment (CESBA) which analysed the building's accessibility, access routes and the possibility of benefitting energetically from local conditions. As it is designed for didactic purposes, the building was built within the campus grounds of the Secondary School of Mechanical Engineering Nr. 2 in Bydgoszcz. The school provides education in the field of RES systems construction and installation, among other fields, making it an ideal fit with the DC RES which offers the possibility of carrying out practical training based on the systems installed in the centre.

The DC RES in Bydgoszcz is one of the most modern public buildings in Poland with regard to energy efficiency. Among others, it uses the following innovative solutions:

1. A system of renewable electrical energy sources which includes:
   a. 100 photovoltaic panels, each producing 80 Wp of power, and
   b. one wind turbine with vertical rotor that produces 3.0 kWp power.
2. A reversible heat pump for heating and cooling the building which supplies installations in the inner walls with high thermal inertia, as well as heating and cooling fan coil units and the central ventilation system.
3. Exterior walls of silicate bricks isolated in the standard process of passive buildings.
4. Hybrid outside lamps and vacuum solar collectors and a mechanical ventilation system for heat recovery (recuperation) with a ground heat exchanger, which has a high efficiency rating. It produces energy savings for air heating ventilation in winter and for cooling in summer.
5. Tunnels in the ceiling that allow access to daylight.

6. A green roof (so-called inverted roof), which is ecologically designed and improves the overall appearance and image of the municipality.

In 2014 the DC RES received the "Eco-laurel" award from the Polish Chamber of Ecology in the category of ecological education and became the laureate of the main award in the category "energy efficiency in buildings" in the contest "Green Cities – into the future" organised by the Ministry of the Environment.

Building of Demonstration Centre for Renewable Energy Sources

Source: Own resources of Bydgoszcz City Hall

Take-Away Messages

- ✓ When designing and implementing activities concerned with enhancing energy efficiency, promoting renewable energy sources and reducing emissions of pollutants, Polish local authorities can participate in international EU programmes that offer both co-financing and the possibility of exchanging good practices with other organisations across Europe.
- ✓ Demonstrating the potentials of high-end efficiency technologies in a small space can inspire both users as well as experts. Public buildings are usually much bigger than the DC RES but the transfer to other municipalities or home owners of the technologies put into practice in Bydgoszcz has the potential to induce substantial ecological effects and facilitate the implementation of the Energy Performance of Buildings Directive (EPBD).
- ✓ The choice to locate the centre in a school that teaches the profession of RES mechanics creates valuable synergies for carrying out practical training using the installed systems. In such a way, the centre and school not only support each other but also make an important contribution to local and regional education about RES.

Key Data

Financing:
European Regional Development Fund (ERDF) as well as the city's own resources

Duration:
October 2011-September 2014
Estimated saving of CO_2 equivalent:
12.9 tonnes per annum (compared to a traditional building of similar area complying to current building and technical requirements)
Costs:
PLN 4.05 mln (without movable equipment), including funding from the European Regional Development Fund (ERDF): PLN 1.62 mln.
City budget: PLN 2.42 mln.
Total demand for primary energy:
E_p = 40.15 kWh/m² per annum.

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Herten: Structural transformation of a former industrial area

"Herten is an example of a successful structural transformation from an industrial area to a strong and climate-friendly economy. If this is possible in Herten, it is possible anywhere."

Dr. Babette Nieder, Managing director of Hertener Beteiligungsgesellschaft

The German city of Herten (62,000 inhabitants), situated in the north of the Ruhr area, had been one of the biggest coal producers in Europe. The last coal mine was closed in 2008 and now Herten is undergoing a structural change, transforming itself from a former industrial area into a climate-friendly municipality. By the year 2020, CO_2 emissions should be reduced by 91,000 tonnes (base year 2006). Herten is one of 19 cities in Germany to receive government funding for trying to reduce their energy consumption by 50 per cent and CO_2 emissions by more than 80 per cent by 2050. This is the goal articulated in the local strategy "Climate Concept 2020+" (Klimakonzept 2020+).

Due to its industrial history, Herten also faces demographic problems, such as an ageing population, as well as a high unemployment rate. Thus, the Climate Concept 2020+ focusses on climate protection that is cost/benefit efficient, while increasing the quality of life of inhabitants and strengthening the local economy and competitiveness of companies in and around Herten. Climate protection in buildings as well as in the areas of mobility, energy supply and economic activities is intended to be achieved in cooperation with local actors, especially private companies and scientific institutions.

Thanks to the participation of these stakeholders, Herten is implementing its concept successfully so far. The energy efficiency policy in Herten is carried out by the Public Services (German: Hertener Stadtwerke), which is owned by the city. Climate protection has a longer history in Herten: in 1997 the Hertener Stadtwerke and RVR (an organisation of the 53 cities of the Ruhr area), in cooperation with 300 citizens participating through the so-called "Hertenfonds", created a corporation (German: GmbH) called "Ruhrwind" and built the first wind turbine on a mining dump.

What makes the case of Herten unique is hydrogen power. In 2009, a hydrogen competence centre, h2herten, was opened in the former coal mining area of Ewald. It is the first local application centre for hydrogen and fuel cell technology in Germany, owned by the company for technological development of the city of Herten. The centre offers 1,800 m² for offices and 1,200 m² for engineering spaces, which are adapted to the requirements of the hydrogen and fuel cell technology sector. Many renowned German and international companies have already settled there.

The key element of the project is a wind turbine connected with an energy-complementary system on a hydrogen basis. The system generates energy by the electrolysis of hydrogen and is also able to store and then convert the hydrogen via a fuel cell/combustion engine hybrid system into electricity again. h2herten's energy needs are met using regenerative energy only, independently from the national grid.

With its development in the area of fuel cell technology and hydrogen energy, Herten aspires to become a leading international specialist in this area and to serve as a testing and demonstration platform. Companies can also use the system for their own test series, as the system also runs in a remote mode (German: Inselbetrieb).

The application centre h2herten was involved in a project of the European Agency, HYCHAIN MINI-TRANS. The aim of the project was to introduce hydrogen as an alternative fuel in transportation.

h2herten had built the following infrastructure for HYCHAIN:

- qualification and information centre
- filling station for buses
- headquarters for project management, PR and dissemination

The application centre is accompanied by the so-called Blue Tower (German: "Blauer Turm"), a privately-funded power plant that generates a hydrogen-rich product gas out of biomass. This project is in its initial phase and should be fully implemented in 2016. With an installed capacity of 13 MW, a production of 150 m³ of hydrogen per hour and 37,500 MWh of electricity, the plant will meet the demand of 12,000 households.

In addition to Herten's focus on hydrogen and as part of its overall climate concept, the inhabitants of Herten can

get advice on modernising buildings, as well as architectural designs for renovating houses that belonged to the coal mines, and a programme to test their heating system. This programme is sponsored by the Hertener Stadtwerke and the local public bank and the companies doing the testing were selected by the regional energy agency (Energieagentur NRW) through a qualification round. Residents also have access to support instruments for renovations, such as the exchange of experience between owners. All of these activities are accompanied by experts from enterprises, public utilities, banks etc. To enhance pro-ecological activities among the inhabitants, Herten awards the best of them with a prize.

From the perspective of Herten, the most significant argument for cooperation with local actors is their competence and resources, even though there are not many strong and independent small and medium-sized enterprises in the Ruhr area. The cooperation should be coordinated by competent persons in order to best synthesise their activities.

Take-Away Messages

- ✓ Cooperation with local actors (especially private stakeholders) is a key factor in successfully implementing local climate policy
- ✓ A focus on new technologies can encourage international companies to become active in the city, thus revitalising its economic development
- ✓ Becoming a forerunner in climate protection at the local level helps to attract financial support from public funds.

Key Data for the application centre

Financing:
Through the state of North Rhine-Westphalia and European structural funds

Duration:
Since 2009
Estimated saving of CO_2 equivalent:
Around 200,000 tonnes annually as an overall result of the strategy "Climate Concept 2020+"
Costs:
EUR 3 million

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The hydrogen application center h2herten

Source: www.wasserstoffstadt-herten.de

Chapter 2

Using private funds

Making use of private funds is another strategic way for municipalities with limited municipal budgets to finance the transformation towards a low-emission economy. Contracting in various legal forms and with various types of financing can be favourable and can produce bilateral benefits for municipalities - not only from an ecological point of view but also because it brings savings in costs and economic benefits.

Using private funds

Public buildings from the 1960s, 70s and 80s that were built according to those years' standards and are equipped with outdated technical systems usually have high maintenance costs, especially with respect to heating. In this chapter we present how Polish municipalities can approach this problem despite their tight budgets by applying innovative instruments such as Energy Performance Contracting (EPC) and Energy Delivery Contracting (EDC), as well as benefiting from the support for public private partnership (PPP) operations from European Structural and Investment (ESI) Funds in the 2014-2020 financial perspective.

Energy consumption in older public buildings can be substantially reduced and can unburden municipal budgets through the implementation of two types of measures which improve energy efficiency in buildings:

1) Thermal insulation measures that mainly entail insulation of the building frame, roof insulation and replacement of windows and doors, leading to a significant reduction in heat consumption,
2) Technology measures that entail the modernisation of a building's technological equipment, such as: replacement of the heat source, renovation of the heat distribution system and radiators, interventions in cooling, domestic hot water and ventilation systems, installation of new measurement and regulation systems, as well as energy management in the building during a given period of time.

The comprehensive renovation of buildings covering the coordinated implementation of thermal insulation, combined with additional technology measures, leads to substantive energy and cost savings[1]. Thus, comprehensive renovations can achieve significant savings of municipal costs, while at the same time contributing to the improvement of the air quality and reduction of CO_2 emissions.

The two types of measures mentioned above differ with regard to financing and implementation:

1) Investment outlays required to implement thermal insulation measures are often high and usually cannot be fully covered by municipal budgets. Furthermore, their payback time often exceeds 10 years in many cases. Thus the implementation of thermal insulation measures is often subsidised by application-based programmes available at the national or European level. If the municipality wants to use subsidies, it has to assure that background documents such as a feasibility study and energy audits are prepared in accordance with the rules of the specific subsidy programme. It also has to procure suppliers of thermal insulation measures according to the rules of the relevant subsidy programme and its evaluation criteria.
2) The payback time for technology measures is often less than ten years. These measures are best financed through a private energy service/savings company (ESCO), by applying the Energy Performance Contracting (EPC) model. The municipality has to prepare and implement the procurement of EPC services in accordance with the requirements of the Public Procurement Act. It is recommended that the selection of the EPC provider is carried out according to the competitive dialogue procedure or is based on negotiations with a prior publication of the tender.

It is very important that thermal renovation measures are applied before technology measures are implemented. In such a way the building's heating system can be sized according to the building's energy demand achieved as a result of its thermal insulation. It is also recommended that the EPC provider (ESCO) guarantee the whole amount of energy savings, i.e. both energy savings from the implementation of technology measures and energy savings from the thermal modernisation measures.

Comprehensive renovation is a complex process that requires professional management, detailed planning, preparation and implementation. Furthermore, additional organisational and administrative efforts are required from municipalities applying for subsidy programmes in order to comply with the respective requirements of financing institutions. However, the effort put in to all of that has a worthwhile payback.

The good practice cases included below show that these efforts have the potential to bring substantive benefits for municipalities.

Sources of possible subsidies for thermal renovations and the implementation of RES have been described in the previous chapter (Chapter 1). The focus below is on characteristics of EPC that are relevant for municipalities and its application in PPP projects involving energy efficiency.

1 www.combines-ce.eu

Energy Performance Contracting

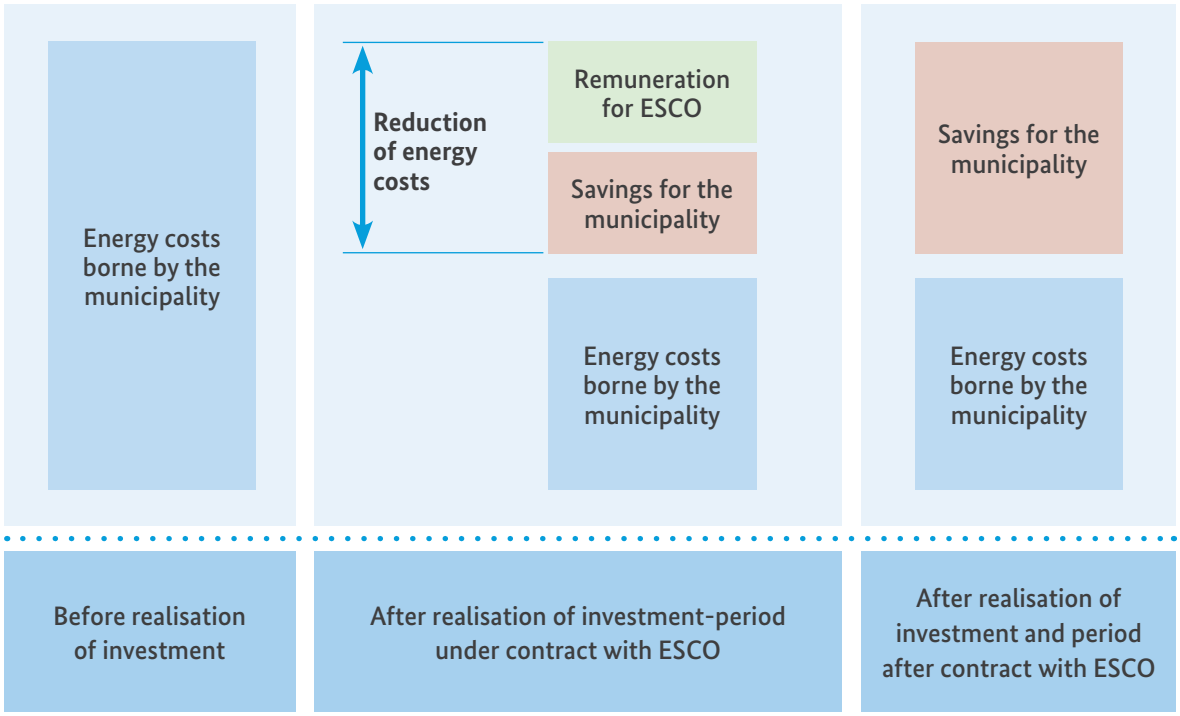
Energy Performance Contracting (EPC) can provide substantial energy savings using the principle of recouping the energy efficiency investments directly from the saved energy costs.[2] Energy Performance Contracting allows municipalities to upgrade ageing and inefficient assets while recovering the capital required for the upgrade directly from the energy savings guaranteed by the ESCO. Furthermore, the modernisation of internal lighting systems in buildings and of street lighting can be done by ESCOs, under the EPC contract, and can lead to substantial energy and cost savings in municipal budgets paired with ecological effects. The main features of EPC are as follows:

- Turnkey service – The ESCO provides all of the services and inputs required to design and implement a complex energy efficiency upgrade at the selected municipality's building(s), from the initial energy audit through long-term measurement and verification of project savings.
- Comprehensive measures – The ESCO tailors a comprehensive set of technology measures to fit the needs of a particular facility, focussing on energy efficiency. In addition, this can include renewables, distributed generation and water conservation.
- Project savings guarantee – The ESCO provides a guarantee that the savings produced by the project will be sufficient to cover the cost of the project's financing for the lifetime of the project.
- Project financing – The ESCO usually arranges for long-term project financing that is provided by a third-party financing company, typically in the form of a bank loan.

EPC contracts can alleviate the main barriers in implementing energy efficiency projects in public buildings. Namely, there is no need for the up-front capital to be covered from the municipal budget and municipalities can draw on ESCO know-how and experience as needed for the optimal selection of technology measures. Moreover, the ESCO takes on the technical risk and guarantees the savings. The ESCO is usually paid a management fee out of these savings – if there are no savings, there is no payment – and is usually obligated to repay savings shortfalls over the lifetime of the contract. At the end of the specific contract period the full benefits of the cost savings revert to the facility owner.

Changing weather conditions or a change in the use of the building after thermal renovations may lead to a failure to achieve the forecasted energy savings – which would bring financial losses to either the contractor or the municipality, depending on the contractual arrangement. Precise rules of conduct need to be set in such cases. Furthermore, in the case of savings that are smaller or larger than those guaranteed in the contract, the rules of their distribution or covering should be described.

ESCO: concept of the energy service



Source: KAPE S.A.

2 www.transparense.eu

Energy Delivery Contracting

Another interesting energy service for municipalities can be Energy Delivery Contracting (EDC), focusing on renewable energy sources and high efficiency Combined Heat and Power (CHP). This model is often utilised for replacing or installing machines that generate heat or electrical power: the municipality commissions a contractor to install heating boilers, CHP generators or biogas plants for providing energy to a number of selected buildings. For this service, the contractor receives annual payments from the municipality consisting of a fixed sum and a flexible sum that depends on the amount of energy consumed. Typical EDCs last between 10 and 15 years, depending on the amortisation period of the new equipment and installations. Once the contract has ended, the municipality becomes the owner of the installation. Municipalities benefit because they often do not have additional costs over the course of the contracting period while improving their energy supply with the funds and know-how of the ESCOs responsible for the operation of the equipment.

Both types of innovative instruments, Energy Performance Contracting and Energy Delivery Contracting, can be applied within public private partnerships.

Advantages for municipalities of PPP in energy efficiency projects

Public private partnerships (PPPs) are forms of cooperation between public bodies and the private sector, which leverage investments in infrastructure projects or other types of operations, delivering public services through risk sharing, pooling of private sector expertise and additional sources of capital.

The cooperation between public and private partners is based on the assumption that the two sides complement each other – each of them is able to fulfil the tasks they have been entrusted with more competently than the other side, thereby creating an opportunity (with similar, sometimes lesser costs) to increase the volume of the public services provided and increase the effectiveness of their production.[3] The key elements of a PPP are:

- cooperation between the public sector and the private sector;
- contractual nature (in terms of civil law);
- purpose: implementing initiatives (infrastructure construction, provision of services) traditionally performed by the public sector;
- optimal division of tasks;
- adequate risk sharing and
- bilateral benefits.

In the context of Poland's and European existing regulations, PPPs offer a number of significant benefits to municipalities. Firstly, there is the possibility of not having to include the assets of the local government entity involved in the PPP in the public finance sector debt. This is where the private partner carries the majority of the construction risk, availability risk or demand risk[4]. That once again opens the perspectives for the ESCO market in Poland.

Secondly, there is the possibility of hybrid financing, that is, financially supporting the initiative with funds from a private partner as well as support from EU funds or national programmes.

Thirdly, there is indirect support from the European Structural & Investment Funds for PPPs: when public entities apply for selected EU funding, they are allowed to count their private sector partner's share in the initiative as their own contribution – in order to fulfil the required quota of own funds. This solution would allow many Polish municipalities, which often do not have enough financial resources, to leverage the potential offered by EU funds and implement a range of initiatives for transitioning to local low-emission economies with the help of private partners.

Usually, initiatives implemented using PPPs allow the local government to avoid considerable initial investment costs and to utilise the private partners' know-how for facility management. Moreover, a PPP provides a way of financing public sector investments that is characterised by a relatively long contract period between the public and private sectors. However, there are complex legal issues to be taken into account when preparing a PPP project and for this reason municipalities can greatly benefit from using the support of external consultants. Polish municipalities can also build on the experience of other local governments and access the knowledge on PPP projects that is publicly available.

Prior to launching a tender or entering into a procurement phase, a municipality has to go through a project preparation process. In particular, the public partner must define all project parameters, assess the potential involvement of private partners, evaluate the costs, risks and benefits of different options available and prove that the PPP option is preferable to any other alternative.[5]

Also, it is advisable to conduct the public procurement as a competitive dialogue procedure that allows for the municipality, during the course of negotiations, to acquire

3 European Commission (EC) Guidelines for successful PPP, March 2003
4 Act of 19 December 2008 on public-private partnerships, article 18a
5 Guidance on Energy Efficiency In Public Buildings, European PPP Expertise Centre (EPEC)

knowledge on relevant technical issues directly from those applying for the tender. This enables the municipality to create optimal contract documentation describing the energy savings to be implemented and it minimises the risk of drawbacks in the technical part of the procurement's terms of reference.

What is particularly interesting for the development of local low-emission economies is an implementation of the above-mentioned Energy Performance Contracts (EPC), not from own funds or through loans, but through PPPs. This can guarantee significant energy savings, using the principle of investment cost reimbursement directly from the saved energy costs. The same holds true for Energy Delivery Contracting, where the know-how of the private partner guarantees the proper operation of new energy sources in municipalities. As PPPs can also apply to the construction of public buildings or rental apartments, it may be worth it for municipalities to consider a PPP operation in the field of designing and constructing nearly zero energy public buildings, where private partners' know-how can assist local governments in meeting the obligations required by the Energy Performance of Buildings Directive.

The number of PPP projects related to improvements in the energy efficiency of buildings has increased in Poland over the last few years. Projects concerning RES and CHP are also being developed. Apart from energy efficiency measures in buildings, Poland has a lot of potential for PPPs with regards to the modernisation of street lighting, in which the private partner upgrades the efficiency of the lights and is reimbursed by the municipality over the years using the savings achieved from the reduced electricity consumption.

Within the EU programmes of the 2007-2013 perspective, 20 hybrid projects with a total value of PLN 3,927 mln were identified. One of these projects – mineral pools in Solec Zdrój – is currently operational.[6] The biggest project with hybrid financing in Poland and the combined value of EUR 247 mln contributes to the development of a low-emission economy. It is being implemented by the public partner – the city of Poznań, and the private partner – Sita Zielona Energia Sp. z o.o.. The contribution from EU funds is EUR 85 mln, the private partners' contribution is EUR 160 mln, and the public contribution is EUR 12 mln. The city of Poznań welcomed the use of private partner entities' know-how concerning operating the thermal waste incineration installation, which was key in choosing the PPP concept for the investment.

It is also possible for Polish municipalities to combine financing from the PPP operations with support from the National Fund of Environmental Protection and Water Management programmes. This concerns, for example, the SOWA programme[7] devoted to street lighting modernisation that is financed within the Green Investment Scheme from sales of CO_2 Amount Assigned Units (AAU).

While there now is an adequate legal framework for PPPs in Poland, projects still need time, expertise and creativity to be developed and not every project idea makes it the to implementation stage. Experiences with PPPs in many different countries over 30 years show that there are typical steps for initiating a PPP that also apply to the Polish market. The PPP Centre summarises them in the "Achievement Pathway"[8] (the estimated duration of each stage is in brackets):

"Achievement Pathway of the public entity towards full PPP project implementation"

1. The public entity identifies needs and possibilities for meeting them via implementation of a PPP initiative in a given sector (2-4 months),
2. Choice of advisor (1-3 months),
3. Market research for potential investors (2-6 months),
4. Organisational, financial and legal structuralisation of the PPP project (1-4 months),
5. Choice of project implementation method (2-6 months),
6. Choice of private partner (depending on the procedure: about 4-6 months),
7. Negotiations/dialogue and signing of the contract with the private partner (up to 2 months),
8. Financial close,
9. Project implementation – contract fulfillment (depending on the contract's content),
10. End of the initiative's project phase.

Source: PPP Centre

6 www.basenymineralne.pl
7 www.wfosigw.gda.pl/news,858,SOWA___Program_Priorytetowy_dotyczacy_energooszczednego_oswietlenia_ulicznego
8 www.centrum-ppp.pl/sciezka-dojscia,1

Examples of good practices

In this chapter case studies are presented on how contracting in various legal forms and with various types of financing can be favourable for municipalities, not only from an ecological point of view but also because it brings savings in costs and economic benefits.

The good practice case from the Polish municipality of Karczew shows how an Energy Performance Contracting project relating to the thermal renovation of ten municipal educational buildings has been successfully implemented. The project has been realised in a public private partnership (PPP) operation with a German contractor, with hybrid financing including a grant from the NFEP&WM. This case has created a valuable model that could be followed by other Polish municipalities managing obsolete and energy-consuming assets requiring substantial investments for their modernisation.

Next, the example of the Polish city of Chorzów shows how the introduction of modern technology can reduce electric energy and reactive power consumption and yield up to 20 per cent savings in the operational costs of buildings. The application of this technology does not require investment outlays, as used devices can be leased from the supplier and paid back from savings within three years. Therefore this solution can be accessible to a large number of municipalities managing small and big public buildings of various kinds and sizes. The case of Częstochowa illustrates the potential of utility and facility management for reducing resource consumption and expenses.

The achievements of the Polish city of Jaworzno showcase how to obtain a substantial reduction in the costs of street lighting by implementing a contract for lighting services with the energy supplier. The contract was approved by the Office for Public Procurement (UZP) and by the Regional Office for Accounts (RIO).

Karczew: Comprehensive improvement of the thermal performances of public buildings using public private partnerships

"The determination of Mayor Władysław Łokietek and the City Council showed that it is possible to participate successfully in such a project without having any previous experience or a template from which to draw. Our contract was the third of this type of contract in the country. In the field of hybrid financing this is the first contract of its kind in Poland."

Bartłomiej Tkaczyk, Deputy Mayor of the Municipality of Karczew

Karczew, a municipality in the Warsaw agglomeration with a population of 16,000 people, has always been innovative and never feared challenges. Thus, it was no surprise that when the national law on public private partnerships (PPPs, of 19 December 2008) entered into force, the administration in Karczew decided to take advantage of the new possibilities offered by the legislation. The first approach towards PPP projects in the municipality dates back to 2009, when the first procedure for choosing a partner for building a health clinic was announced. Unfortunately no partners applied, probably due to the fact that at the time it was just the beginning of a public private partnership in Poland.

Preparations for the launch of the PPP procedure started in 2011 with the search for a private partner for a comprehensive thermos modernisation of educational facilities in Karczew. It has been recognised that due to the lack of experience in this area in the country, municipalities must themselves prepare the project as thoroughly as possible. Karczew possesses a Multi-Annual Forecast until 2027 in which investments are earmarked for implementation. The investments in this forecast that could proceed as a PPP were identified by the municipality and the thermal modernisation was deemed the most appropriate. This is because it is relatively easy to identify savings and because the municipality had gained a grant from the National Fund of Environmental Protection and Water Management. The municipality of Karczew wanted it to be a combined project with so-called "hybrid financing".

The mayor issued appropriate orders and established an eight-person team which had to prepare the implementation of the PPP project within a few months. The team included representatives from various departments of the Municipal Office. For several months the team took part in various consultations and workshops organised, among others, by the selected legal adviser who supported the team throughout the whole process. Eventually in late 2011 the Municipal Office of Karczew underwent a certification procedure called "Transparent Municipality" whose aim was to show to the public that, based on an objective evaluation, the municipality is ready to enter into a PPP. Additionally the certification procedure authenticates the offices in the eyes of potential private partners, so that the risk calculation is reduced. At the beginning of 2012 Karczew received such a certification and could proceed to select the private partner.

Throughout the entire duration of the project, the Municipality of Karczew conducted the necessary consultations with the City Council, which represents the residents. Information about the tender and the preparation of the project was published on the website of the Municipal Office and in the local press. Once the contract with the private partner was signed, a press conference was held with the representative from the Ministry of Regional Development, the Ministry of Economy, the National Fund of Environmental Protection and Water Management, as well as with the representatives from local governments from Mazowieckie province and the rest of Poland. The mayor of Karczew stated that there was no negative feedback from residents about PPPs and this project.

When the project entitled "Comprehensive improvement of the thermal performance of public buildings in the Karczew municipality, implemented according to the public private partnership formula" started on January 2nd in 2013 it covered ten public buildings: schools, pre-schools and a health centre, all within the Karczew municipal area.

The aim of the project is to achieve heat and electricity savings, to improve the look of the buildings and to introduce a better energy management system taking into account environmentally friendly solutions. The moderni-

sation works included, inter alia, the construction of a remote system for heat and power consumption monitoring and management, temperature control systems, upgrading of indoor lighting systems, replacement of heat sources and thermal insulation of the buildings. The contribution of the municipality to the partnership includes the documentation developed as a result of energy audits of the buildings within the scope of the project, the design documentation for three buildings, and the obtaining of funds from the National Fund (under the allocation for thermal performance improvement).

The thermal performance improvement for the ten buildings was finished by 31 December 2013. However, the duration of the PPP agreement is 15 years – one year for construction works and 14 years for maintenance. The total value of the contract after 3 Annexes is PLN 11.66 mln (including VAT at 23 per cent). The municipality's own resources amounted to 31.27 per cent of the project financing, a grant from NFEP&WM amounted to to 11.35 per cent, and the share of the private partner financing equalled 57.38 per cent of the contract value. Thus the public partner share in the project, composed of the municipality's own resources and a grant from NFEP&WM, amounted to 42.62 per cent. The remuneration of the private partner is the so-called availability fee – an amount depending on the degree to which the guaranteed savings are achieved. The contracted payments will be made in 168 monthly instalments, including maintenance costs during the 14 years to the amount of PLN 781,788.

The PPP agreement regarding remuneration caters for inflation, based on the annual rate of inflation in prices of consumer goods and services. If the value of the savings is higher than planned, the surplus will be transferred to the public partner. If the value of the savings is lower, the private partner will pay the difference as well as penalties for failing to achieve the guaranteed savings.

As the public partner share covered more than 50 per cent of the construction works it meant that the building risk was on the side of municipality. Therefore Karczew has decided to classify the remuneration to the private partner for the thermal performance improvement works as the public sector's debt.

The private partner has submitted a forecast of achieving annual thermal energy savings of 56 per cent and electricity savings of 20.9 per cent, i.e. improvement in energy efficiency due to lowering the levels of heat consumption by 5,082.48 GJ/year and electricity consumption by 32.67 MWh/year. This brings in monetary savings of PLN 253,000 per year, which amounts to PLN 3.55 million over 14 years. The ecological effects of the project include a reduction in greenhouse gas emissions and other air pollutants. Also, there will be substantial improvements of aesthetics and comfort standards in ten public buildings implemented in the first year. This was the main value added for the town, as residents easily notice an improvement in the look of buildings.

Small projects, like the one in Karczew, constitute the future for PPPs in Poland. The potential encompasses 2,500 municipalities, each with a number of public buildings, as well as several hundred counties and government hospitals all over the country.

Take-Away Messages

- ✓ The preparation for a PPP operation is much more complex and demanding than the preparation for other types of projects. It is therefore recommended that municipalities undertake more detailed analyses, establish a dedicated team in the office and hire external advisors to help during the process of gaining a private partner. In particular, participation of the municipality's treasurer in negotiations with potential private partners facilitates a good assessment of the impact of the proposed measures on the financial position of the municipality.
- ✓ The advantage of competitive dialogue over a tendering mode is the ability to precisely determine the scope of work at the negotiation level. The crucial feature of a PPP operation involving an EPC agreement is that the savings are guaranteed in the contract, while with public procurement the municipality can only call for the scope of work that has been specified in the Terms of Reference.
- ✓ Negotiated terms and conditions of the PPP contract determine the division of risks between parties. The division of risks, in turn, is decisive for meeting the contractual obligations and has influence on whether municipal assets involved in the project are classified as public debt or not.

Key Data

Financing:
The project is based on a PPP agreement with hybrid financing including private and public partner contributions combined with the grant from NFEP&WM.

Duration:
From 2013 to 2027
Estimated saving of CO_2 equivalent and air pollutants:
Approx. 1,200 Mg CO_2 per year (in 2014)
Costs:
The remuneration of the private partner is the so-called availability fee. The total value of the contract after 3 Annexes is PLN 11.66 mln (including VAT at 23 per cent). Savings due to the thermal performance improvement in 2014 is estimated approx. 269,000 PLN.

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Elementary schools in Karczew before and after the PPP project

Source: Own sources of Fundraising and Investment Department

Chorzów: Reducing electricity consumption and reactive power in public buildings

"We have had a positive experience installing systems in Chorzów and we are enlarging the number of public buildings with installations. The systems are leased from the distributor and give us monetary savings of over 20 per cent on electricity costs as well as lower energy consumption. In this way municipalities can save money and protect the climate without the need of raising funds for up-front investments. Tests carried out by system distributors before installation guarantee savings."

Wiesław Raczyński, Deputy President of Chorzów

Chorzów is located in the Upper Silesian agglomeration, with a population of around 100,000. Reducing the consumption of energy in the municipality is of high importance for the local administration. They have demonstrated this by implementing a number of initiatives, such as introducing elements of Demand Side Management in public buildings.

In some of these projects the municipality has signed contracts with a technology supplier for implementing demand side management systems. In the case of electrical energy, this pertains to systems that stabilise the electricity parameters from the grid as well as the operation of the electrical equipment. The system consists of three components: the control unit, the software, and the active filter module. This system is an intelligent controlling and stabilising unit which controls the circuits with mixed load i.e. resistive load and inductive load. The system constantly monitors and adjusts the input power parameters. It controls the power factor, actively filters the harmonics, and protects the circuits from surges in the grid, as well as optimising the work of the electrical installation (current, voltage and frequency), and manages the overall performance of the receivers. This results in lower electricity consumption (active and reactive power), and often makes it possible to avoid the excessive demand for reactive energy which is penalised by the local energy distributing operator.

The achieved savings can be calculated in two ways. The first way is to compare electricity consumption before and after installing the system. The second way is to switch off the system periodically and to compare electricity consumption during the system's operation and during the system's standstill. Tests carried out in October 2013 in the buildings of the Chorzów Municipal Office, the Fire Brigade and the Cultural Centre confirmed monetary savings of over 20 per cent on electricity costs. The system has been installed in these three buildings as well as in three schools.

Such systems can be bought or leased from the distributors. The system's price depends on its parameters and ranges from PLN 10,000 to over PLN 100,000. In some of Chorzów's projects such systems remain the property of the distributor, and the city transfers the agreed part of the savings to the distributor's company. The improvement in operating conditions should result in electrical appliances remaining longer in service. However, due to the short time frame, it has not been possible for the municipality to assess the validity of this argument yet.

These technologies are proven to work well in co-operation with supply circuits with mixed resistance and reactance, such as light bulbs and computers. It should be noted, however, that to achieve better results the system is individually tailored for each building. Moreover, there are buildings in which such systems do not work well. In Chorzów, two buildings have been identified where the system's installation would not be cost-effective: a school building to which electricity is supplied with low and unstable voltage and a swimming pool building with pumps that have converters that consume large amounts of electricity.

In conclusion, the use of such technology offers energy savings, reduction of CO_2 emissions, and reduction of fees due to the reduction in reactive power. It can also help extend the service life of the equipment and machinery. The effective reduction in electricity costs is between 10 and 26 per cent. Furthermore, the use of such a technology prevents short circuits and overvoltage and improves the quality of electricity supplied to the circuits.

The payback period is three years on average and the service life of the equipment is expected to be up to 20 years. Before installing the system it is necessary to carry out detailed testing of the electrical parameters and to take into account the specific types of data.

Take-Away Messages

- ✓ Apart from costly investments in the improvement of municipal assets there is a portfolio of activities that can be performed by municipalities that are directed at the rationalisation of electric energy and heat consumption.
- ✓ Implementation of technological fixes in public buildings aimed at reducing reactive power can bring substantial savings in the operational costs of municipal assets.
- ✓ In the case of electrical energy, devices are bought or leased from the supplier and they are paid for from the savings. After the pay-off period – on average three years – they can become municipal property. In the case of heating, monthly payments are made to the company operating the devices and regulating heat flow.

Key Data

Financing:
Leasing from the distributor paid for from cost savings resulting from the reduction of electricity consumption and reactive power. One payment for devices plus monthly fees for regulation and data transmission and processing.

Duration:
From 2013

Costs:
From PLN 10,000 to over PLN 100,000 depending on system parameters that are adjusted to the needs of the building or t.b.a

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Fountain in Chorzów

Source: Chorzów City Hall

Częstochowa: A comprehensive approach to utilities management as an opportunity for major local government savings

"Every municipality has the possibility of pursuing its own energy and environmental policy, which includes ensuring the security of electricity and gaseous fuels supplies to the residents, minimising energy service costs and improving the quality of the environment. For me, it is equally important to encourage the residents to engage in activities in their daily lives that prevent negative climate impacts. In Częstochowa, the city's entity responsible for the energy policy is the City Engineer's Office which since 2003 has been implementing consistent measures in the field of energy efficiency improvement, including the Programme of Energy and Environmental Management in the public buildings in Częstochowa."

Krzysztof Matyjaszczyk, President of the City of Częstochowa

Since 2003, the municipality of **Czestochowa,** a city of 235,000 inhabitants, has been implementing a programme called "Energy and Environmental Management in the City's Public Buildings", which has led over time to substantial economic and environmental benefits in terms of cost savings, air-quality improvements and CO_2 emission reductions due to reduced water and energy consumption.

The following effects were achieved during 2013 for 118 carefully monitored educational facilities:

- complex fuel and electricity consumption amounting to 52,998 MWh was reduced by 19,603 MWh (27 per cent) in comparison to 2003;
- complex CO_2 emissions amounting to 23,764 tonnes were reduced by 8 363 tonnes (26 per cent) in comparison to 2003;
- complex water consumption amounting to 124,367 m^3 was reduced by 77,036 m^3 (38.2 per cent) in comparison to 2003.

Looking at the overall period from the start of the programme in 2003 until 2013, the total results for 118 educational facilities were a reduction in energy consumption of 169,171 MWh; a reduction in CO_2 emissions of 71,877 tonnes and a reduction in water consumption of 601,978,052 m^3.

The overall savings for the municipal budget from the reduced consumption of utilities during the years 2004-2013 totalled approximately PLN 26 million.

Częstochowa's successful sustainability policies are based on a long-term vision and strategic policy planning, paired with the development of innovative partnership arrangements with external partners such as energy companies, research centres, independent experts and external investors.

The rationale behind the initiation of the "Energy and Environmental Management in the City's Public Buildings" programme was originally driven by the interest and need of Częstochowa to ensure a rational management of municipal assets and a more economical spending of the city's budget funds. The idea of the programme originated in the City Engineer's Office.

Częstochowa counts among the major programme achievements in its first phase twenty educational facilities that were given full-range thermal upgrading measures (insulated external walls and roof, replaced windows, modernised heating installations), which were financed completely from the city budget.

However, the most effective initiative undertaken by the City Engineer's Office over the years has been the introduction of a comprehensive zero-cost management system, i.e. activities which do not require extra funding and are aimed at optimising the consumption of utilities (e.g. water, heat, electricity etc.) and the contractual terms related to financial arrangements. A special computer-based Media Monitoring System (System Monitoringu Mediów or SMM in Polish) was created, which included a detailed reporting scheme for each facility. The following activities result in significantly reduced energy, heat, and water management costs for the municipality. For energy and heat consumption: maintaining optimum room temperatures; monitoring the

operation of lighting and other electrical equipment; optimising utility supply contract conditions concerning tariff group selection, contracted capacity and other financial arrangements; analysing energy invoices for their compliance with contract conditions, tariffs and energy sector regulations; and providing assistance in dealing with cases of incorrect invoicing. For water consumption: eliminating water leakage from indoor plumbing systems, periodically inspecting the correctness of main water meter readings, applying for the return fees for wastewater which has not been discharged to the sanitary sewer system as a result of failures in the plumbing system, and educating end users.

From 2012 (the 2nd phase), the scope of zero-cost management activities was extended to include the installation of innovative fittings offered by an external supplier (Energy Service Company- ESCO) under a programme called "Drop by Drop". The programme aims to reduce the costs of water consumption and energy consumption for heating tap water, based on individualised technical solutions for specific facilities (e.g. water aerators that decrease water consumption in sinks, kitchens and showers, or containers that diminish the volume of old-fashioned flushing reservoirs). The office opted to implement the "Drop by Drop" programme in educational facilities that had the highest water consumption.

Neither the municipality of Częstochowa nor any of the entities covered by the programme incurred any costs at the start of the programme. The company that installed the innovative fittings agreed to be paid from the savings made by the participants in the programme. The financial arrangements of the programme foresee 30 per cent of the savings staying with the given educational facility and 70 per cent going to the company to pay off modernisation costs. The payoff period varies from two months to one year depending on the building. Additionally, the innovative water supply fittings remain installed and continue to generate savings for the municipal budget. The programme generates reductions in three kinds of costs: water supply, tap water heating and wastewater discharge. The overall results of the "Drop by Drop" programme from January to December 2013 for 21 educational entities in Częstochowa resulted in a reduction in water consumption of 13,052 m^3; a reduction in energy consumption for heating water of 652 MWh, and a reduction in CO_2 emissions of 289 tonnes.

The municipality of Częstochowa remains active in the international field with projects such as:

- „EURONET 50/50 MAX" – the main purpose of this project is to save energy within public buildings through the implementation of the 50/50 methodology that is used in 12 educational facilities in the city of Częstochowa,
- MESHARTILITY – the main purpose of this project is to develop tools that facilitate the exchange of data on energy consumption between utilities and local authorities.

The City Engineer's Office also engages in comprehensive educational and promotional activities to promote environmentally friendly habits including awareness campaigns, workshops and training courses. By partnering with the Energy Efficiency Foundation (seated in Katowice), the office now runs a website ("Częstochowa – Energy and Environment") that provides up-to-date information on the city's energy activities and its results, which produces a high level of transparency.

The municipality of Częstochowa recently gained the following prizes and distinctions for creating and applying local energy-related policies:

- 1st Prize in the category "a city with county rights" in the 2012 Local Government Management Leader competition
- Distinction in the "City of opportunities – The Sustainable City" competition – for consistent and innovative efforts to improve energy efficiency
- Distinction in the ECO-MIASTO competition – for ecological architecture policy
- Recognition of the important role played in the field of sustainable development and respect for the natural environment in the 2014 Eko-Inspiracja competition.

Take-Away Messages

- ✓ Running an effective energy and environmental management programme in a municipality requires detailed planning and proper task assignment to overcome the usual decentralisation in this field. This involves smart delegation of tasks and clearly determining the responsibilities of the personnel assigned to the operational programmes. It further involves raising awareness and changing the attitudes of administration staff responsible for energy and water consumption optimisation.
- ✓ Improving the efficiency of energy, heat and water consumption is a fundamental responsibility of the local government. It is advisable for local governments to exploit the possibility of cooperating in this area with external companies specialising in delivering energy-efficiency measures. The services of these companies can be paid for from the generated savings.
- ✓ The implementation of energy and environmental management programmes in a municipality also requires effective communication with the local community. Educational facilities have a special role to play in this area, as well as a very high potential for creating new positive habits among children and youth.

Key Data

Financing:
City of Częstochowa, ESCO
Duration:
"Energy and Environmental Management in the City's Public Buildings" from 2013,
"Drop by drop" from 2012
Estimated saving of CO_2 equivalent:
71,877 tonnes during the years 2003-2013
Costs:
Covered from payroll or savings generated by installed devices

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Modernised school heat exchange in Częstochowa

Source: City Engineer Office, City Hall of Częstochowa

Jaworzno: Modernising a street lighting system financed by contracting

"Municipalities seeking proven solutions developed by other Polish local governments are welcome to, and even should, use our database www.dobrepraktyki.pl, which contains several hundred descriptions of the key features of already-implemented projects. Any new implementation of a good practice by another municipality allows for continuous improvement in its various dimensions of municipal activities. An important aspect of the use of the database is also networking and the development of social relations between local governments."

Paweł Tomczak, Director of the Office, Union of Rural Municipalities of the Republic of Poland,
Content Manager of Good Practices Database

Jaworzno – a city with a population of around 94,000, located in the Śląskie Province (Polish: województwo Śląskie) – has managed to work out a solution with the local power distributor that allows for modernisation of street lighting despite lacking the financial resources required for such investment in the municipal budget.

Before the modernisation, the street lighting system in the municipality of Jaworzno had become outdated, using inefficient lighting with mercury-vapour and sodium-vapour light sources and very high electricity consumption. Therefore, in 2004, the mayor of Jaworzno decided to carry out a comprehensive upgrade of the street lighting system. The whole process and installation, including the preparation of technical documentation, negotiations between the city and the power company, took almost four years.

The project envisaged the use of modern lighting with highly efficient sodium-vapour light sources. The project setup – a contract with the local power company in Jaworzno for the provision of the street lighting service on a monthly basis – was approved by the Regional Office of Accounts and by the Public Procurement Office. It was accepted by the City Council that gave its authorisation to the President of Jaworzno.

The monthly cost of the service was financed from the savings in electricity consumption; this cost was determined in the negotiations between the power company (the supplier) and the municipality (the client). The modernisation works were carried out by the power company based on the contract with the municipality. The basic requirement of the municipality was that the annual cost of the street lighting and maintenance, compared with the previous year (before the upgrade), should not be increased. Because the municipality did not have the funds required for implementing the project, the cost of replacing the lighting system was incurred by the local power company. The municipality agreed to purchase the street lighting service for a determined period of 80 months i.e. such was the duration for self-financing of the modernisation costs. The costs of the service included maintenance costs of the street lighting system in Jaworzno.

However, there were some costs to be borne by the municipality connected with the project preparation that could be considered marginal compared to the project value. Namely, the procurement of the technical documentation cost PLN 27,645 as well as various organisational measures required spending of PLN 28,060. The most relevant cost factor was the time of many municipal employees needed to carry out and supervise the project and to conduct all the required administration and legal tasks.

The modernisation works were carried out across the whole city area by the power company and its subcontractors. The old inefficient lights with mercury or sodium lamps and very high power values (150 to 400 W) were replaced with modern energy-saving lights with highly efficient sodium lamps (50 W to 150 W).

Modernising a street lighting system not only decreases energy consumption, but also leads to a reduction in CO_2 emissions, which significantly increases safety on the streets and is an excellent way of promoting the municipality, according to Tadeusz Kaczmarek, Deputy President of Jaworzno City.

The modernisation yielded a number of benefits. Overall, the energy consumption of the system has been reduced by 45 per cent on average as a result of the reduction of installed capacity of the lighting equipment – before the upgrade, the power demand was 1,757.06 kW, after the upgrade it was diminished to 819.54 kW. Assuming a yearly time of operation for street lights to be 4,000 hours, electricity consumption was reduced by approximately 3,752 MWh/year. This led to annual financial savings to the municipal budget of PLN 1.16 mln (from PLN 2.18 mln to PLN 1.02 mln).

Furthermore, the upgrade of street lighting improved the image of the city, ensured even lighting of the streets and pavements, improved road and traffic security for drivers and pedestrians. It also yielded other environmental benefits, such as lower electricity consumption which translates into reduced emissions of harmful substances to the environment.

On 23 February 2009 at the "Light" fair in Warsaw, Jaworzno City was awarded third place in the national competition "Best Illuminated Municipality and City in 2008". The prize was handed out by Mr Olgierd Dziekoński, the Deputy Minister of Infrastructure.

Take-Away Messages

- ✓ The implemented project was a complex undertaking which had to be planned with a long-term perspective. It was strongly dependant on the positive attitude of the power company and the municipality's determination to carry out the works.
- ✓ While preparing such projects each municipality has to conduct a thorough stock taking of the street lighting system and monitor project results. Regular supervision and participation in the works and in the partial and final approvals is required on the side of the municipality.
- ✓ After the successful modernisation project, the terms of contracts for energy purchases of street lighting circuits relating to the power demand should be adjusted according to the upgraded lighting system.

Key Data

Financing:
Via a contracting arrangement with the power company that covered all the costs, which were then repaid by the municipality from the savings achieved during the 80-month contract.

Duration:
From 2004 to 2014
Estimated CO_2 savings:
3150.3 tonnes/year
Costs:
PLN 13.83 mln
Cost savings:
PLN 1.16 mln

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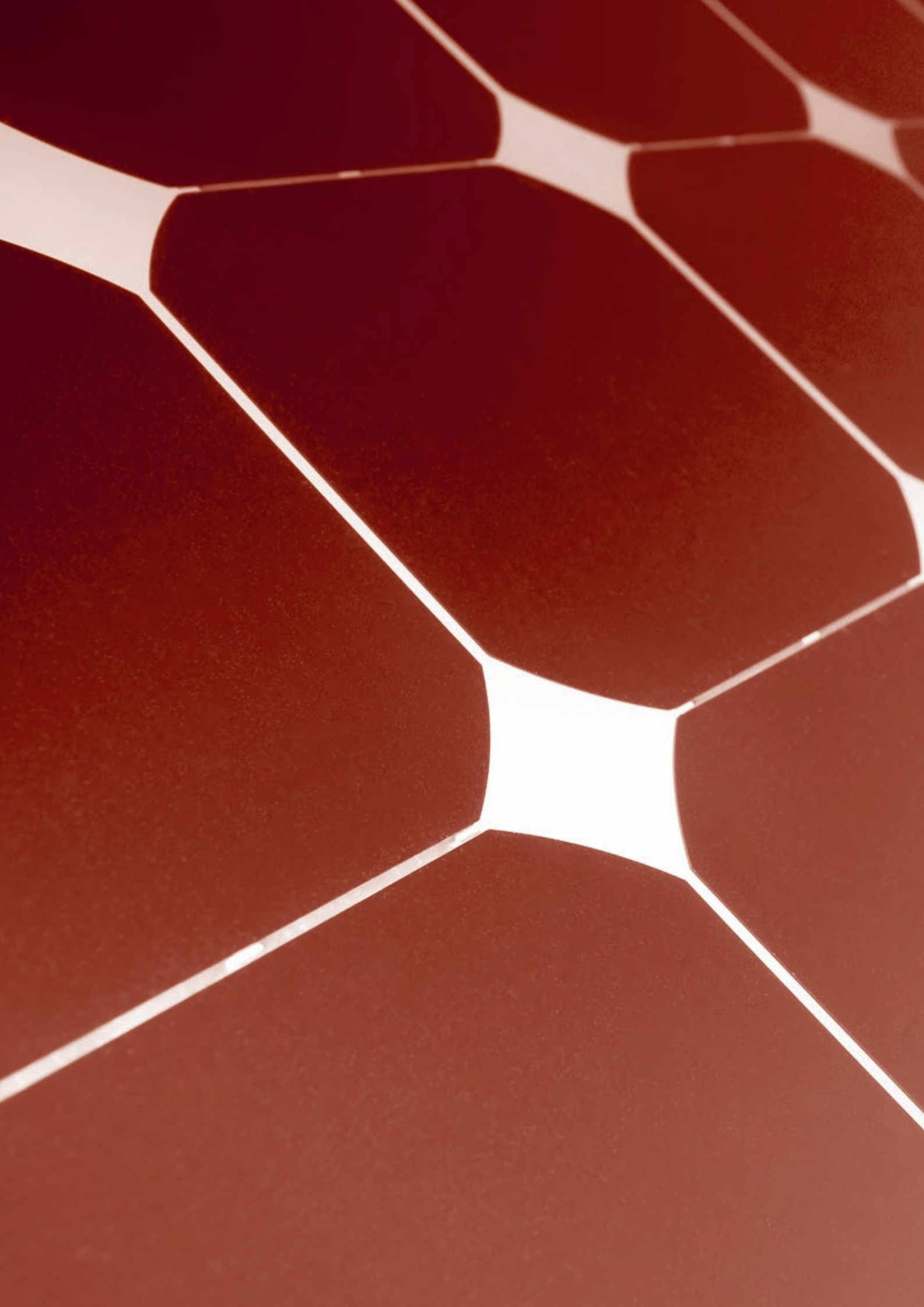
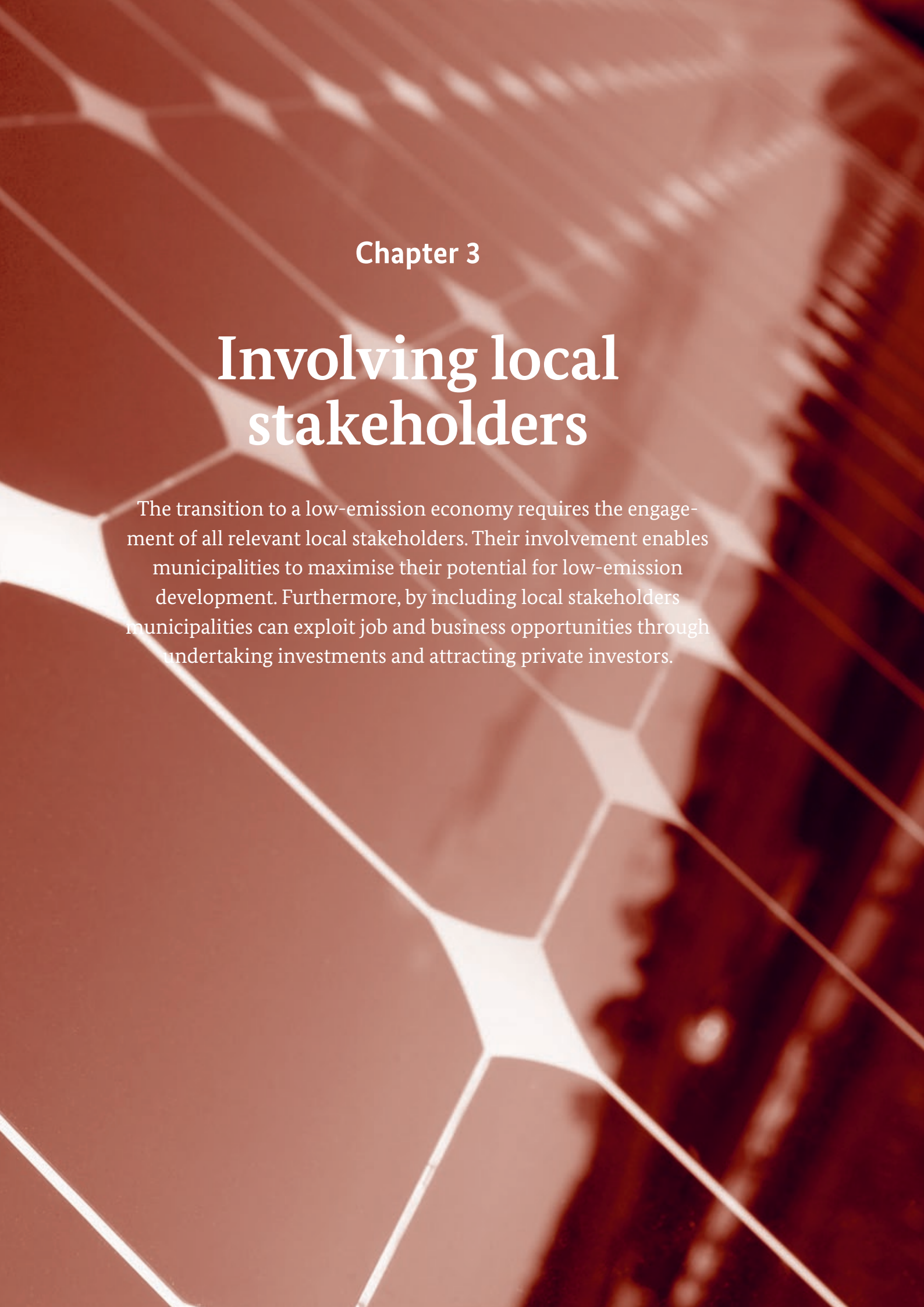
Street in Jaworzno before and after street lighting modernisation

Source: Jaworzno City Hall





Chapter 3

Involving local stakeholders

The transition to a low-emission economy requires the engagement of all relevant local stakeholders. Their involvement enables municipalities to maximise their potential for low-emission development. Furthermore, by including local stakeholders municipalities can exploit job and business opportunities through undertaking investments and attracting private investors.

Involving local stakeholders

The generation of energy from renewable sources as well as the replacement of boilers in private and public buildings help to significantly improve air quality and contribute to climate protection. Both large and small municipalities possess the ability to initiate the transition process to a low-emission economy and can support its development. Even in the smallest villages there are numerous opportunities for emission reductions, as well as the huge potential for stimulating the economy and creating new employment opportunities.

Opportunities for municipalities and local stakeholders

In Poland, dispersed energy production and investments in energy efficiency improvements generate new jobs in the whole country and may particularly enhance the labour market in small towns and rural areas. A transformation of the economy creates job opportunities especially for regions with currently limited economic potential. It is important that municipalities exploit these opportunities by undertaking investments and attracting private investors to start low-emission activities. Moreover, the transformation to a low-emission economy can avoid health problems related to air pollution while reducing environmental risks resulting from energy generation from fossil fuels. The latter impose so-called external costs on society, such as the treatment of respiratory health problems that are not taken into account in energy market prices.

Including local stakeholders in order to exploit the key potential of municipalities

A transition to a low-emission economy requires the engagement of all relevant local stakeholders, such as citizens, businesses, energy suppliers and utilities, building companies and developers, private and public transport companies, local banks and private funds, universities, the church and NGOs. It is often advantageous to have co-operation between neighbouring municipalities and local representatives of regional or national administrations.

If local stakeholders are not properly involved from early on, this will likely impede the implementation of low-emission economy plans. Therefore, it is crucial for local governments to gain support from local stakeholders and establish a common vision for the future of their municipality. This can be achieved through the distribution of information and educational activities on the part of municipalities, and through gathering feedback from and holding consultations with local citizens, organisations and businesses. In addition, the investment plans of local governments and companies seeking to improve energy efficiency and introduce renewable energy sources should be included into municipal low-emission economy plans. This will allow access to EU funds and guarantee a coordinated approach to the modernisation and the development of local infrastructure.

Development of green jobs in a low-emission economy

The United Nations Environment Programme (UNEP) has developed a definition of green jobs as "positions in agriculture, manufacturing, construction, installation, and maintenance, as well as scientific and technical, administrative, and service-related activities, that contribute substantially to preserving or restoring environmental quality". These include jobs contributing to protecting and restoring ecosystems and biodiversity, the reduction of energy, materials and water consumption, development of a low-emission economy, as well as the reduction of waste and pollution. In general, green jobs tend to have higher productivity compared to other sectors. In the EU, the number of green jobs increased by 770,000 between 2000-2010 and reached 3 million. The share of green jobs in Poland is similar to the EU average, which corresponds to approx. 200,000 employees[1]. The boom in employment in the renewable energy sector took place after the adoption of the climate and energy package in 2008. Further dynamic growth is expected in employment related to environmental and climate protection, as well as effective use of EU-funds.

In 2010, about 2 million people were employed in green jobs (approx. 4.8 per cent of all employed) in Germany. Most positions are created in the areas of waste management, water protection, noise abatement and air protection[2]. This development is driven by strong employment growth in renewable energy, the growing export of German environmental technologies and environmentally friendly services. These sectors are key elements of the green economy and offer great potential for creating new jobs. Around 371,000 people were working in the sector of renewables in 2013. Wind, solar and bioenergy remain the sectors with the highest employment rates.

1 Source: "W KIERUNKU NISKOEMISYJNEJ TRANSFORMACJI RYNKU PRACY", Andrzej Kassenberg, Aleksander Śniegocki, Fundacja Instytut na rzecz Ekorozwoju, Warszawski Instytut Studiów Ekonomicznych

2 Source: www.umweltbundesamt.de/en/press/pressinformation/environmental-protection-provides-employment-for-2

Poland's development towards a low-emission economy and the role of local stakeholders

In order to get citizens involved in the transition to a low-emission economy, a conducive legal framework is essential. By modifying the national law in 2013, Poland has taken an important step in this regard.

The law regulates two additional types of installations producing power or heat:

- Micro-installation – RES with a maximum combined power of 40 kW electric (connected to networks below 110 kV) or 120 kW thermal.
- Small installation – RES with a maximum combined installed power between 40 kW and 200 kW electric (connected to networks below 110 kV) or between 120 kW and 600 kW thermal.

The amendment of the national energy law promises the opportunity for natural persons to generate electric energy in micro-installations and connect these to the energy distribution network. The latter is an important step toward developing a "prosumer" energy economy. Individuals who wish to produce energy from RES in their households are allowed to sell their energy at 80 per cent of the average national electric energy selling price from the prior year (Energy Regulatory Office price). On 20 February 2015 the Polish Parliament passed a new Act on Renewable Energy Resources. This Act promotes 'prosumer' energy by introducing a system of feed-in tariffs. The electricity generated from RES in plants with a maximum installed capacity of up to 10 kW (divided into categories up to 3 kW and between 3 and 10 kW) get guaranteed prices for 15 years from the date of first production, but no longer than until 31 December 2035. The system of feed-in tariffs will start on 1 January 2016. Selected RES installations can also get support in the form of guaranteed prices above the market level.

In addition, the law amends the building code. The new regulation states that the installation of heat pumps, photovoltaic systems (up to 40 kW) and detached solar collectors will not require a building permit.

Households – from energy consumers to prosumers

For municipalities, citizens' micro- and small installations can be a path to energy independence, lower energy bills, new employment opportunities, additional income sources and better air quality. The development of prosumers (citizens who not only consume but also produce energy), especially in small municipalities and particularly in rural areas, will help to overcome the disproportionate quality of life between cities and villages while contributing to environmental protection.

Experts highlight the huge potential of popularising combined heat and power production on the micro scale (mCHP). It is a highly efficient technology and mCHP equipment can achieve a combined efficiency (96 per cent). Furthermore, by installing a small-scale photovoltaic system into the building, a four-person household can reduce its purchase from the grid by 30 per cent, and even 60 per cent, if the photovoltaic system is connected to a battery. Photovoltaic panels yield between 100 and 180 kWh per m², depending on the local conditions.[3]

The NFEP&WM has also started a loan programme supporting RES development. Natural persons, housing communities and associations can become beneficiaries of the Prosumer programme.

The programme provides financing for the installation of the following systems:

- solar collectors – with an installed heating power of up to 300 kWt,
- photovoltaic systems – with an installed electric power of up to 40kWp,
- small wind farms – with an installed electric power of up to 40kWe,
- heat pumps – with an installed heating power of up to 300 kWt,
- biomass-fuelled heat sources – with an installed heating power of up to 300 kWt and
- micro-generation – with an installed electric power of up to 40 kWe.

The proposed loan covers (maximum loan of up to PLN 150,000, with a 40 per cent grant) and housing communities/associations (maximum loan of up to PLN 450,000, with a 40 per cent grant).

Polish municipalities can encourage their residents to take part in the programme and support them in producing their own heat or electric energy. The Prosumer programme will be implemented until 2020 and the call for applications is ongoing.

3 BSW Solar (n.d.). From zero to plus energy house: Will we soon be heating with solar power? Retrieved from http://enree.com/fileadmin/user_upload/ Downloads/Konferenzen/PV-Konferenz_April_2013/Praesentationen/6_Mayer_EN_final.pdf

Energy co-operatives as an opportunity for local value creation in small and rural municipalities

An energy co-operative is a legal organisation that is co-owned by its members and aims to generate electricity (or sometimes heat). Co-operatives are very popular in some European countries, such as Germany or Denmark. Municipalities do not necessarily take part in these projects but can become a reliable partner. For instance, municipalities can provide plots for RES or roofs and communal buildings for investments, and can strive to convince and connect citizens to form a co-operative. Energy co-operatives are more likely to succeed with municipal participation.

The following box explains how the low-emission economy potential is exploited at the local level by energy co-operatives in Germany.

Energy co-operatives in Germany

With about 888 energy co-operatives encompassing around 200,000 members, the model of energy co-operatives became a successful form of prosumer investment into renewable energy resources in Germany. In recent years they have developed rapidly. The German Renewable Energies Act (EEG) from 2000 created very favourable conditions for the development of energy co-operatives, including priority connection to the grid and feed-in tariffs.

Most of the energy co-operatives in Germany are local projects that focus on electricity generation from renewable energy resources (around 87 per cent of them), mostly from the sun, followed by bioenergy, wind and water. Each of them produces an average of 1,025 MWh of electricity, which is enough to supply around 290 households with electricity (as of 2013). Besides electricity generation, in agricultural areas many co-operatives provide heating produced from biomass to connected households. A co-operative can be established by a minimum of three members (individuals or legal entities), whereas the maximaum number of members is unlimited. Often municipalities or public utilities (German: Stadtwerke) join co-operatives, which decreases the investment risk. The liability of members is limited to the amount of their shares and they can benefit from favourable tax treatment. In general, co-operatives are not focussed solely on financial concerns, but foremost on serving the common interests of their members. The model of energy co-operatives enables a relatively simple, direct participation in renewable energy resources at low cost and risk. The following table presents the characteristics of German energy co-operatives as a legal form.

Registered co-operative (German: eingetragene Genossenschaft eG)

Share capital	No minimum share capital and sum to acquire the shares are required
Establishment and administration formalities	***High*** Minimum three partners, the association of co-operatives regulates the by-laws and business plan, entry into the register of co-operatives is necessary, annual financial statements are required (auditing and disclosure requirement)
Liability	***Limited*** Limited to the amount of the shares (determined in the byelaw)
Participation in management	***Moderate*** The supervisory board and in some cases also the management board are chosen by the members, with the right to speak, deliver petitions, vote and disperse information in the general assembly
Entry and exit	***Simple*** The approval of the co-operative is necessary upon entry, termination of the shares is possible in compliance with the given notice period. Entry into the register is necessary, as well as the right to repayment in case of exit
Especially suitable for…	…complex projects with bigger investment sums

The involvement of local stakeholders in the transition to a local low-emission economy based on an inexpensive, reliable and sustainable energy system becomes even more necessary when the transition takes place within pan-national electric energy systems. These systems unequivocally possess many economic and technological advantages. However, apart from the tremendous environmental and logistical problems they also have highly significant disadvantages, including the requirement of multiple voltage transformations for energy transmission over huge distances. This leads to a paradoxical situation – for many energy recipients the costs of transmission and distribution are higher than the costs of production. This particularly pertains to remote recipients for whom delivery costs are continually on the rise.

Advances in technology and the technical design and construction of energy sources with minor outputs, also called dispersed energy sources, are opening up new perspectives for acquiring energy from local sources, with small distribution costs. Compared to traditional energy grids, this type of energy production and distribution will be cheaper in most cases. Building local, autonomous energy complexes is an innovative breakthrough in the energy industry. Another way to move forward on this would be to invest in better grids that can balance the fluctuating electricity from renewable sources between regions.

Examples of good practices

The portfolio of local stakeholders encompasses a variety of subjects and entities. Various forms of multi-stakeholder cooperation within the framework of building a low-emission economy will prove beneficial for municipalities and the economic development of the region.

This chapter starts with the good practice case of the city of Jelenia Góra, where a KAWKA pilot programme finances low emission source mitigation projects and establishes a system of incentives for individuals to liquidate stoves, boilers and other heating appliances burning solid fuels. The KAWKA programme thereby exemplifies synergies between air and climate protection measures as part of local low-emission strategies through the successful reduction of air pollutants from communal sources and private houses.

The good practice case of Warsaw I demonstrates that inclusive communication policies and participatory measures are indispensable for gaining residents' acceptance and support for the modernisation and extension of the Wastewater Treatment Plant "Czajka". The foundation of the Energy Consultation Centre in the German municipality of Willich indicates that an extensive information and consultation service can serve to successfully pique the interest of residents in renewable energies.

Encouraging local citizens to act as prosumers can substantially improve the air quality by increasing the share of energy and heat generated from RES, as has been shown in good practices from Bielsko-Biała and Niepołomice.

The good practice case of the German municipality Jühnde illustrates how the first bioenergy village in Germany achieved 100 per cent coverage of its energy and heat demand from locally produced biogas through the involvement of local stakeholders and citizens.

The implementation of sustainable public transport and the establishment of an extensive city bike system in Warsaw were only possible due to the cooperation of the City Hall with other stakeholders. The good practice case of Warsaw II shows how collaboration with the research and private sector can significantly contribute to more innovative solutions.

Co-operation requires efforts from municipalities, including designing programmes, applying for external funds, promoting the initiative amongst inhabitants, and finally offering financial support to inhabitants from the municipal budget. The cases of the German municipalities Sprockhövel and Saerbeck show further good examples of how local stakeholders and citizens can become the "best experts on site" and lead to innovative forms of local low-emission development.

Jelenia Góra: Implementing KAWKA – the NFEP&WM priority programme concerning the liquidation of low emissions, increasing energy efficiency and developing dispersed sources

"The Voivodeship Fund for Environmental Protection and Water Management in Wrocław has been founding operations for over 20 years involving the improvement of the air quality in the Lower Silesia Region. These operations include the KAWKA programme, initiated by the National Fund for Environmental Protection and Water Management, which supports provisions (resolusions) of the "CAFE" Directive (Directive on Ambient Air Quality and Cleaner Air for Europe) 2008/50/WE of 21 May 2008. Meeting the KAWKA programme requirements will lead to a significant reduction in air pollutant emissions in the most contaminated cities of the region such as: Wrocław, Jelenia Gora, Legnica, Nowa Ruda and Szczawno Zdroj. I would like to thank all authorities for taking part in KAWKA programme and encourage other cities to continue air protection operations"

Aleksander Marek Skorupa, President (Chairman) of the Board, WFOŚiGW in Wrocław

The city of Jelenia Góra is located in the south-western part of Poland in the Lower Silesia region. The city area is approx. 110 km² with a population of over 82,000 people. Jelenia Góra is subject to continuous air monitoring conducted by the Regional Inspectorate for Environmental Protection in Wrocław. It monitors particulate matter PM10 and PM2.5, carbon monoxide (CO), sulfur dioxide (SO_2) nitrogen oxides (NO_x, NO_2) as well as benzo(a)pyrene, nitrogen oxide (NO) and ozone (O_3).

High average daily concentrations of particulate matter exceeding the allowed limits are mainly related to the combustion of coal and coke in individual boilers and stoves. During the heating season the intensity of combustion and thus emissions of dust increase. The specific weather conditions in Jelenia Góra Valley, i.e. the frequent atmospheric silence and thermal inversion, hinder the dispersion of pollutants and contribute to their accumulation. This identified air quality problem has been included in the programmes and strategies defining the long-term tasks.

The city is part of the air protection programme for the region of Lower Silesia. The problems of Jelenia Gora have also been taken into account in the study "Remedial programmes for air protection zones in Lower Silesia exceeding acceptable levels and limits of substances in the air". The issues emerging from air monitoring led city authorities to seek financing for low emission source mitigation projects and to establish a system of incentives to liquidate stoves, boilers and other heating appliances burning solid fuels.

In the years 2008-2014, thermomodernisation and heating source exchange was performed in 13 educational institutions. The projects were implemented under the Infrastructure and Environment Operational Programme and the Regional Operational Programme of Lower Silesia. The scope of work included: external wall insulation, insulation of roofs, insulation of ceilings, replacing old windows with energy-saving ones and replacing old doors. Thermomodernisation achieved significant savings by reducing heat losses and GHG emissions – including CO_2. The operating costs of the objects were reduced and the look of the buildings was improved by renovations. Jelenia Gora also joined the NFEP&WM KAWKA pilot programme, to which the following box gives an overview.

Overview of the KAWKA programme

The aim of the programme is to reduce the influence of particulates on the population, in particular PM10, PM2.5 and benzo(a)pyrene which endanger the health and lives of people in areas where there are significant excesses of the levels of these pollutants and in which special air protection programmes have been developed. The NFEP&WM has made PLN 400 million of grants available to its provincial branches for this purpose, as part of the Voivod Fund for Environmental Protection and Water Management (VFEP&WM). They implemented this programme in their regions specifying the terms of the competition and the type of final beneficiaries who are eligible for funding. The total amount of the grant can be up to 90 per cent of eligible costs (the remaining 10 per cent has to be covered by the beneficiary), of which up to 45 per cent is disbursed by the National Fund grants while the local branches provide funding for the next 45 per cent.

Due to the fact that the main source of air pollution in cities are local heat sources (including domestic stoves) and urban transport, funds within the framework of the programme will, among others, be directed toward the following projects:

- Forgoing local heat sources (or replacing them with more environmentally friendly sources) and connecting to the district heating network instead. In cases where exchanging coal-fired stoves with gas-fired ones or the district heating system is not possible, the programme allows use of solid-fuel-fired furnaces (with efficiency above 80 per cent) and must fulfil the emission standards set by the local government;
- Expansion of the heating system in order to connect the existing facilities to a central source of heat;
- Use of solar collectors solely to reduce emissions in the solid fuel furnaces;
- Thermomodernisation of multi-family buildings as an element of modernisation or liquidation of solid-fuel-fired heat sources;
- Reduction of emissions from transport:
- Implementation of traffic management systems in cities;
- Construction of fuel stations with CNG / LNG or electricity in urban public transport;
- Implementation of other projects limiting the levels of pollutants caused by transport in urban centres (excluding fleet or engine replacement, reconstruction or construction of new roads and rail);
- Educational campaigns showing the health and social benefits of eliminating low emissions and/or providing information on low emissions, and
- Development of databases allowing the inventory of emission sources.

The programme has been in force since 2013. So far two calls for proposals were announced to VFEP&WM and 12 proposals were submitted, covering projects in urban areas where PM10 and benzo(a)pyrene exceeded the given limit and for which air protection programmes are needed (36 cities in the first call and 48 cities in the second call). In most projects the beneficiaries include local governments that allocate funds for the decommissioning of coal heat sources in their own buildings and in houses belonging to individuals or housing associations. In many projects local heating companies were the partners.

In most cases, the projects connect customers previously using stoves and fireplaces to district heating, replacing coal heating (individual and central) with gas heating. In many cases, the multi-family buildings were also subjected to thermomodernisation in order to achieve energy savings and reduce heating costs. In several projects the installation of solar collectors is planned as an emission-free means of hot water production.

The implementation of all projects allows the elimination of approx. 34 000 inefficient coal-fired sources of heat and the elimination of the coal combustion in these heat sources at the amount of approx. 106,000 tonnes per year.

Reduction of emissions of individual pollutants is estimated at the following levels:

- Dust PM 2.5 – 822 Mg / year,
- Dust PM 10 – 862 Mg / year,
- SO_2 – 2,300 Mg / year,
- NO_x – 328 Mg / year,
- Benzo(a)pyrene – 410 kg / year,
- CO_2 – 134,000 Mg / year

In Jelenia Góra the KAWKA programme was recognised as an attractive means of co-financing low-emission source mitigation projects in order to combat a severe pollution problem, mainly due to the fact that it is the only programme aimed at individuals. This makes it possible for the support and incentives package to reach areas where the predominant individual heating system is a major source of low-stack emissions. In the area of Jelenia Góra the implementation of the KAWKA programme was initiated in 2013 and was preceded by an information and promotional campaign, in which a brochure was published which was distributed among residents (out of 250 pcs.). Invitations to participate in meetings (for the amount of 250 pcs.) were sent. Meetings were held, where the importance of the problem was presented and ways to address the issue of low-carbon pollution were identified. In this campaign direct approaches (such as meetings with residents) were used as well as broadcasts on local radio and television and advertisements in local newspapers and on the website of Jelenia Góra municipality. Recruitment for the programme KAWKA was announced. Because of the very high interest in participating in the programme, reserve lists had to be created. The decisive criterion for placement in the appropriate list was the deadline for the residents' submission of a declaration of their participation in the programme. Regulations were issued, setting out detailed rules for the grant by the city of Jelenia Góra.

The programme plans to remove 508 individual furnaces burning solid fuel (coal, coke) in 292 localisations including 368 stoves, 107 coal-fired boilers and 33 coal stoves. In order to implement the above project, the city of Jelenia Góra signed an agreement with an entity engaged in the supply of thermal energy to connect the five municipal buildings. The thermomodernisation of 14 multi-family buildings is also in planning, as part of a permanent change in the heating system. In order to intensify the effect of reducing emissions, it is also planned to use the city budget to allocate funds derived from fees for using the environment, as a subsidy to the subsequent liquidation of approx. 20 sources of pollution. The value of the KAWKA pilot programme is approx. PLN 10 million, of which the contribution by the NFEP&WM is 45 per cent. A subsidy from the Regional Fund for Environmental Protection and Water Management in Wrocław makes up 15 per cent and the grant from the City makes up 9 per cent of the funding. The remaining 31 per cent is the residents' share.

Taking into account the interest of the residents in the KAWKA programme, the city plans to take part in subsequent editions of the programme and use other sources to support the liquidation of low emissions for the period 2014-2020.

Buildings after thermomodernisation, located in Jelenia Góra

Source: Property of Jelenia Góra City Hall

Take-Away Messages

- ✓ Local authorities planning to implement action aimed at the elimination of stack emissions, should be performing intense information campaigns to win the residents' approval and should also be focused on education regarding the usage of the external sources of financing,
- ✓ In order to provide stability for the implemented solutions, it is recommended to initiate effective administrative methods preventing the usage of low-efficiency or high-emission heating equipment and poor quality fuels. To increase the efficiency of the aforementioned actions it is worth considering the effectiveness of currently existing structures such as chimney inspections,
- ✓ Due to limited financial sources, criteria for selecting specific tasks should contain an efficiency evaluation expressed as a ratio of investment expenditure to received ecological effect, determined by e.g. (quantity of) reduction in particulate matter. Implementing complex investments is also advised. This will result in stack emissions decreasing in scale in streets, districts or even whole cities where air pollutant emission limits are greatly exceeded.

Key Data

Financing:
Grants Regional Fund for Environmental Protection and Water Management in Wrocław with funds provided by the National Fund
Final-beneficiaries are the owners of the dwellings
The beneficiary of the aid:
City of Jelenia Gora

Duration:
2013-2018
Estimated saving of CO_2 equivalent:
Reduction of low level emissions through the elimination of over 500 solid fuel heating furnaces.
Estimated reduction of CO_2:
134,000 Mg per year.
Costs:
PLN 10 mln

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Warsaw I: Engaging local residents in the modernisation and extension of the Wastewater Treatment Plant "Czajka"

"Development and modernisation of the Wastewater Treatment Plant "Czajka" has been the largest environmental project in Central and Eastern Europe, which has allowed Warsaw to treat 100 per cent of waste water from the municipal sewage system. The plant not only meets European quality standards of wastewater discharged to surface waters, but it achieves double the required results when it comes to phosphorus compounds, which is of great importance for improving water quality in the Baltic Sea"

Leszek Drogosz, Director of the Office of Infrastructure of the City Warsaw

The city of Warsaw supported the modernisation and extension of the Waste Water Treatment Plant called "Czajka" as an important priority investment for the city.

Situated in the north-eastern part of Warsaw, the Waste Water Treatment Plant "Czajka", designed in the mid-70s, originally served the residents of the right bank of Vistula river in Warsaw. Due to a very prolonged construction period, the facility only started operating in 1991, and as a result was based on outdated technology suited to the reduction of organic carbon compounds only.

Initially there were mostly forests around the "Czajka", and Local Development Plans were missing. However, as more and more residential housing was built around the plant, the protection zone practically ceased to exist and the number of dissatisfied residents increased as a result of the sewage odour. All attempts by the local authorities to modernise the plant raised local protests. Particular unpopular was a planned enlargement of the waste water treatment plant to process additional sewage from other residential areas in Warsaw. The conflict with the local community escalated in 2005, when a draft for building an additional incineration plant for dewatered sewage sludge was published.

The investor – Municipal Water and Sewerage Plant (MPWiK) – publicly announced the decision to proceed with this investment, which was of great importance to the city. No consultations with the local community were originally foreseen. As a result, residents appointed the Committee for the Defence of Residents against the unwanted expansion of the Waste Water Treatment Plant "Czajka" and the Protest Committee "Our Choszczówka".

Solutions for social problems

As communication with the residents was essential for the project to progress significantly, the City Hall (Bureau of Environmental Protection, Bureau of Infrastructure, Social Communication Center) and the investor initiated and implemented a successful communication campaign to engage the enraged residents and win their acceptance of the modernisation plans. A number of informational and participatory measures were taken in order to substantiate the dispute. These included, inter alia, the appointment of a social dialogue committee which included the participation of environmental organisations and the organisation of specialised meetings with domestic and foreign experts that were invited to explain the safety of modern waste water treatment technologies. A study trip of residents, activists and journalists to Berlin in 2005 to visit a modern operational waste water treatment plant also helped to diffuse fears and substantiate facts. Furthermore, informational instruments generated positive feedback among residents, such as the organisation of so-called "open days" at the "Czajka" plant and organised public debates. Another move that further served to create trust and transparency was the inclusion of the "Our Choszczówka" representative into a delegation of the City of Warsaw that participated in a Brussels meeting that discussed the investment contribution with the European Commission.

Thanks to such a systematic educational campaign, residents' concerns were successfully dispelled. Protests ceased almost completely after the commencement of work by the new "Czajka" plant. Meanwhile the investor, MPWiK S.A., gained support from the city authorities. A local government representative participated in the tender procedure for the selection of a contractor. The city supported the investment and also accepted new, higher fares of water and sewage services to balance and cover the financing needs of the company. This investment was implemented as part of the National Programme for Municipal Wastewater Treatment. Nowadays, "Czajka" is the biggest and most modern waste water treatment plant in Poland. Construction work began in 2008 and lasted until the end of 2012.

Sewage Sludge Thermal Treatment Station in "Czajka"

In Warsaw "Czajka" some 400 tonnes of sludge is produced every day. As a result of its fermentation, 30,000 m³ of biogas is produced per day, which is burned in gasifiers. The generators produce 5 MW of electrical power and 7 MW of heating power. This electricity and heat is consumed by the plant. Warsaw's waste water treatment plant is the first installation of its kind in Poland, designed to produce heat and electricity from screens, fats and dehydrated sludge.

Environmental results of the project

The annual electricity production in "Czajka" was 29,930 MWh in 2014, which corresponds to 30 per cent of the annual electricity consumption of Warsaw's street lighting. The annual production of heat in the "Czajka" reaches 209,279 GJ (58,133 MWh) – the equivalent of 140 cargo containers of coal. Every year, "Czajka" removes more than 4,000 tonnes of nitrogen and more than 500 tonnes of phosphorus from waste water. The increasing quality of water in the Vistula River and the Baltic Sea demonstrate the beneficial impact for the environment.

Take-Away Messages

✓ Local authorities that plan major infrastructural investments should pursue inclusive communication policies based on reliable information, dialogue and consultation. Key methods used in Warsaw to gain the residents' acceptance included meetings with experts, study visits and informational activities such as "open days".

✓ Municipalities engaged in the development and modernisation of the sewage treatment plants should consider the introduction of combined heat and power generation in stations for the thermal treatment of sewage sludge

✓ Over a number of years, the sewage treatment plant was located in the same area as other new installations under construction, with some 1,000 construction workers active on site. Organising the work without conflicts required a concordant approach and the co-ordination of meetings where problems could be solved swiftly.

Key Data

Financing:
Municipal Water Supply and Sewage Plant (investor – Warsaw utility), EU Cohesion Fund

Duration:
2005-2012 (construction works 2008-2012)

Ecological results:

- Reduction of nitrogen discharged into the Vistula River from 5,537 to 1,457 tonnes per year (about 74 per cent)
- Reduction of phosphorus from 635 to 100 tonnes per year (about 84 per cent)
- Annual CO_2 reduction: 27,550.8 tonnes

Costs:
EUR 632 mln (including EUR 224 mln from EU Cohesion Fund)

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The Wastewater Treatment Plant "Czajka"

Source: Own resources of the Warsaw City Hall

Source: Own resources of the Warsaw City Hall

Willich: Founding an Energy Consultation Centre

> "What makes this project special is that it focuses on the stock of present buildings as well as the fact that we were able to equip the Energy Center Willich with basic funding almost independently from the city's budget. We have proven our commitment to climate protection because you can only convince people to run when you yourself are running."
>
> Willy Kerbusch, City Treasurer of Willich

In the German city of Willich (53,000 inhabitants, located in North Rhine-Westphalia) interested citizens and companies can get free advice on the subject of renewable energy. The Willich Energy Centre (Energiezentrum (EZW) was founded in 2008. In the spirit of renewable energy and eco-friendliness, the centre was established in a former steel mill that had been renovated and converted into a modern business park. Optimal geological conditions made it possible to use heat from the ground. Willy Kerbusch, Managing Director of the Real Estate Agency of the city of Willich (Grundstücksgesellschaft (GSG), wants to introduce citizens to the topic of geothermal energy free of charge. The GSG, Willich Public Services (Stadtwerke) and the "GEOBIT-Ingenieursgesellschaft" (Society for Engineers) have agreed to jointly finance and run the Energy Centre. The municipality is part of the EZW through its holdings in the GSG and the Public Services.

Together with skilled engineers, the GSG succeeded to set up the "Centre of Competence for Geothermal Energy" within six weeks and to offer weekly office hours for consultation, as well as on-site information. From 2009, the number of visitors with questions regarding solar energy increased and more experts on this issue were added to the team. Since then the EZW has also been advising on the functioning, funding mechanisms and installation of photovoltaic systems. In 2011, the portfolio of advice has been enlarged to include the topics of energy counselling and on the construction of passive houses. Today, the EZW has grown beyond simply having consultation hours for geothermal energy to include a comprehensive set of consulting services for a range of renewable energies.

In addition to the consultations in the EZW, public information events take place in the centre. These events include open days, in-house exhibitions and lecture evenings. Since its inauguration, more than 650 people have made use of the weekly consultations with experts. Moreover, delegations, school classes and student groups use the centre as an opportunity to gain information on topics related to renewable energies.

The floor space of the hall is approximately 1,000 m² and is heated by geothermal energy. In 2009, the energy cooperative Solar Willich eG built a photovoltaic installation on the roof of Hall 4 of the former steel plant. Visitors can now admire a geothermal system with a borehole, technical equipment, wall and floor heating as well as functioning photovoltaic modules in action.

The Energy Centre is financed by the contributions of the three bodies (the GSG, Public Services and GEOBIT), as well as those from banks, consulting and craft enterprises as partners and by leasing the roof surface with installed photovoltaic systems. The cost of running the centre annually is roughly EUR 40,000. 50 per cent of this is financed from the agreed contributions, 40 per cent stem from the rental of the roof and 10 per cent is contributed by the city directly. The municipality profits from the EZW not only by attracting new businesses through the use of geothermal heat as a locational advantage and through additional work for local handicraft, but also as a contribution to the positive image of Willich. Another boost was the reception of the European Energy Award®Gold in 2011 (re-certified in 2014).

Take-Away Messages

- ✓ The basic funding that is almost independent from the city's budget led to the long-term existence of the project, without requiring annual negotiations.
- ✓ In spite of the simplistic organisation of the project, much has been achieved. Local and regional companies continue to benefit from contracts through the activities of the Energy Centre
- ✓ Supporting and networking with competent partners increases the project's credibility in the eyes of the public as well as its acceptance.

Key Data

Financing:
Contributions from three institutions and cooperation partners as well as lease income (rental of roof space for photovoltaic systems)

Duration:
Since 2008

Costs:
EUR 40,000 per year (10 per cent is contributed by the municipality)

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Heat Pump System at the Energy Consultation Centre

Source: City of Willich, M. Pluschke

Bielsko-Biała I: Low-Stack Emission Reduction Programme as a role model for other Polish cities.

"The emission reduction programme in Bielsko-Biała has been operating continuously since 2007 and is enjoying strong popularity. This is despite the fact that the waiting time for the replacement of the installation can be up to two years, and numerous documents have to be submitted. Thanks to the simultaneous educational and awareness-building measures the local residents know that the agreements they sign are aimed at having cleaner air, and are not just subsidies for boiler room modernisation. In 2015 we plan to replace a further 100 old coal-fired boilers. Our project is expected to operate until 2020."

Piotr Sołtysek, Bielsko-Biała Mayor's Proxy for Energy Management, Bielsko-Biała Municipal Office

Bielsko-Biała is home to about 174,000 inhabitants. Until a few years ago, the city suffered from the serious problem of air pollution due to the widespread use of old, coal-fired boilers. In order to tackle this problem the city decided to apply a solution developed by the city of Tychy in the Province of Śląskie. Between 2002-2004 and 2006-2007, the city of Tychy successfully implemented a large-scale low-stack emission reduction programme that achieved significant positive environmental, economic and social effects.

The term "low-stack emission" refers to pollutants concentrated close to the ground, resulting from transport and the heating of buildings. The dust and harmful gases produced by buildings stem mainly from household and local district heating boilers fired by coal. In order to counteract the negative impacts of low-stack emissions on the environment, on residents and on the attractiveness of the city for tourists, the City Council of Bielsko-Biała adopted the "Comprehensive air protection programme to reduce air pollutant emissions in Bielsko-Biała" in 2007. The programme, which has been enjoying large interest among residents, is focused on gradually replacing old and inefficient coal-fired heating sources with environmentally friendly heating.

The residents are allowed to choose their preferred source of heating from a list of devices with proven environmental characteristics. According to the Programme Regulations[4] the new sources of heating have to have a valid safety certificate and an environmental/energy standard certificate issued by an entity authorised by the Polish Centre for Accreditation. The improvement of the heating systems' efficiency should be around 30-40 per cent. The main benefits for residents when generating their own energy include energy security and financial stability.

In order to implement the programme effectively an external operator has been selected. In addition, the city of Bielsko-Biała appointed a Programme Supervisor to control the investment activities and to ensure that municipal grants are appropriately awarded.

Only residents being able to cover the entire costs of upgrading the boiler room are eligible to receive funding under the programme. The grant awarded to the residents does not cover all costs but only those directly connected to the replacement of the old heat source and the installation of the new one. Once the work is completed, the resident is obliged to use the new source in accordance with the manual for a period of five years.

Between 2007-2013 a total number of 2,280 residents benefitted from the programme and signed a grant agreement. The most popular boilers selected by the beneficiaries were retort feeder boilers for solid fuels due to their high efficiency, followed by gas boilers. In addition, 726 solar collectors with a total surface area of 3,200 m^2 as well as four heat pumps were installed. Information about the programme was disseminated through leaflets and brochures, the publication of articles, presentations and competitions, and online information campaigns.

Due to its active engagement in the field of low-stack emissions reduction the city of Bielsko-Biała was awarded the main prize in the national competition "Mission-Emission" in 2014.

4 Resolution No. XXIV/832/2013 OF THE CITY COUNCIL OF BIELSKO-BIAŁA of 24 September 2013 adopted the "Comprehensive air protection programme to reduce air pollutant emissions from households in Bielsko-Biała" and set out the procedure for awarding grants to entities outside the public finance sector, the method of settling grants, and the method of monitoring the grant task implementation.

Take-Away Messages

- ✓ The size of the grant has to be appropriately balanced in order to encourage people to buy more expensive sources of heating while preventing the market being spoiled by the increasing costs of equipment and their installation. An annual limit on installations to be implemented should be determined to avoid a price increase on the market of installation services.
- ✓ The organisation and requirements of the Programme should ensure that the new heat sources meet/comply with all relevant environmental requirements and guarantee efficiency. The old inefficient appliances should be scrapped and the residents should be required to use the new "green" solutions for a minimum of 5 years.
- ✓ The programme's results show that the replacement of traditional coal-fired boilers is more environmentally sound than installing solar panels. This is due to the fact that solar collectors generate heat for domestic hot water primarily during summer, while most of the emissions caused by old boilers occur during the heating season in winter.

Key Data

Financing:
City budget, loan from the Regional Fund for Environmental Protection and Water Management in Katowice, inhabitants' own resources.

Duration:
Since 2007
Estimated saving of CO_2 equivalent:
8,928 tonnes during 2007-2013
Costs:
PLN 27.99 mln during 2007-2013

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Boilers before Low-Stack Emission Reduction Programme

Source: Own resources of Energy Management Office

Boilers after Low-Stack Emission Reduction Programme

Bioenergy village Jühnde

"In principle the idea can work for any village with enough space for biomass cultivation."

Eckhard Fangmeier, Chairman of the local co-operative

People from around the world are visiting the first bioenergy village **Jühnde** in Lower Saxony in Germany, which is a small municipality with about 750 inhabitants. The idea of creating the first municipality that covers its entire demand for electricity and heating from local renewable energy sources derived originally from scientists at the University of Göttingen. In the meantime the project has gained many followers in Germany and worldwide. The municipality has been producing energy for its own use since 2005, based on biomass from local agriculture.

The main component of the energy supply in Jühnde is the biogas plant with 716 kW of installed capacity. It runs on maize, wheat and barley from formerly fallow land and manure from livestock. All of the resources are provided by local farmers. The biogas plant generates electricity and provides houses in the village with heat obtained from the combustion process. In the past, most of the residents had oil-fired heating systems but now receive heating from a specially constructed network through an access point in the cellar. Pipes with an overall length of around 5.5 km serve 144 households with warm water of approx. 80-85° C. In winter, a woodchip heating and burning oven with a capacity of 550 kW serves as an additional heating source. costs decreased by about EUR 750 a year for an average household.

The combined heat and power plant is run as a co-operative that has currently 195 members, including all farmers, heat consumers, the local government and the church. The by-law allows admitting up to 25 per cent of members from outside the municipality.

In cooperation with an industrial partner the municipality of Jühnde has built two photovoltaic panels (producing a total of 18.6 kWp), which meet the annual electricity demand of seven households. Additionally, a small wind turbine was built as a pilot project. Furthermore, one of the activities of the municipality focuses on e-mobility where the municipality is developing a charging infrastructure and a car-sharing system for electric cars. In the future, they are supposed to use the energy generated from the biogas power plant.

The total costs of preparing Jühnde's transition to energy autonomy amounts to EUR 380,000. About 70 per cent of the planning phase was financed by the Federal Ministry of Food and Agriculture and Consumer Protection, 15 per cent came from EU funds (the programme LEADER+) and the remaining 10 per cent from the municipality's own resources. However, the biggest part of the investment was implementation, which amounts to around EUR 5.4 mln. The sum was financed from the municipal resources (about 70 per cent), credit loans and EU funds.

Since the beginning of the project in 2001, the municipality of Jühnde has been undertaking efforts to involve its citizens in activities and provide them with information. Among the instruments being used are a village assembly, street discussions, workshops etc. In 2009, the Centre for New Energies (German: CNE – Centrum Neue Energien) was established. CNE offers consulting and support for the implementation of projects with alternative energy resources for both local and international actors involved in transformation processes. In this way, Jühnde aims at becoming a model for other municipalities and actors to follow.

Take-Away Messages

- ✓ A biogas power plant should be adapted to the environment, not the other way around. Thus the energy generation in the power plant in Jühnde focuses on the use of locally available plants.
- ✓ The biogas power plant ensures the supply of electricity and heat for the nearby public buildings.

Key Data

Financing:
Own resources, funds, governmental support, credit loans

Duration:
Start of the project 2001, the first biogas power plant has been operational since 2005
Estimated saving of CO_2 equivalent:
Around 3,500 tonnes annually
Costs:
EUR 5.4 mln
Electricity production:
5 mln kWh annually
Cost savings:
An average household in Jühnde saves around EUR 750 annually through the use of bioenergy (number from 2014 and in comparison with the costs of fossil fuels)

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Biogas Power Plant at Jühnde

Source: www.bioenergiedorf.de

Niepołomice: Installation of renewable energy systems in public and private buildings

"I know that our municipality is considered rich and entrepreneurial. This is largely due to the fact that we can identify and use new opportunities. There are investment opportunities that help save quite a lot of money, both on the side of the municipality and of household budgets. They include, for instance, the Swiss Programme. More and more often you can see solar installations on the roofs of Niepołomice buildings. Residents of our municipality apply to the project and they get high quality solar panels for 30 per cent of the regular price. The panels are adjusted to the requirements of individual buildings and come with a guarantee. Those who already have such devices at home say that the savings are quite large. We are therefore encouraging people to participate in the project and in 2015 we invited new municipalities Myslenice and Zabierzów to join as project partners."

Roman Ptak, Mayor of Niepołomice

The municipality of **Niepołomice**, with a population of over 24,000 inhabitants, is a member of several national and international associations of local governments, including the Covenant of Mayors.

Since 2013 and in cooperation with several neighbouring municipalities (Wieliczka, Skawina, Miechów) Niepołomice has been implementing a project aimed at reducing low-stack emissions from the municipal sector by decreasing the consumption of fossil fuels for hot water supply in private and public buildings. Consequently, the amount of pollutants emitted into the air, especially particulate matter and benzo-alpha-pyrene, will be significantly reduced.

The project is a response to the requests of local residents to improve quality of life, reduce the risks of respiratory diseases, and to protect local natural ecosystems which are the region's main environmental resources[5]. The municipalities participating in the project are particularly affected by low-stack emissions due to their proximity to Kraków which has one of the highest air pollution rates among European cities.

In order to reduce low-stack emissions, the project seeks to diversify local energy sources to increase and promote the share of renewable sources in the region, and improve the economic situation of citizens in non-urbanised areas. Residents interested in participating in the project had to submit an application and agree to cover 30 per cent of the price of the solar installation on their building.

By the end of 2015, solar systems with a total surface area of 18,514.5 m^2 will be installed on 3,841 private buildings and 29 public buildings for producing domestic hot water. The technical parameters of the solar systems installed on private buildings have to ensure that at least 50 per cent of the heat demand for domestic hot water production is covered by the solar panel system throughout the entire year. The residents who already use the solar systems have noted a significant drop in the costs of domestic hot water. The expected, measurable results of the project include the following reduction of pollutants:

- CO_2 – 3,305 t/year
- CO – 55,505 kg/year
- SO_2 – 15,778 kg/year
- NO_x – 1,783 kg/year
- Particulate matter – 49,206 kg/year

The project is implemented within the framework of Objective 2 of the Swiss-Polish Cooperation Programme, and is 60 per cent co-financed by Switzerland under the Swiss Contribution programme regarding cooperation with new EU member states[6]. The partner municipalities cover 40 per cent of the project costs, while a large amount of the money is being generated through the installation of solar systems on private and public buildings. The interest of local stakeholders and citizens in renewable energy systems has significantly increased due to the project and the available EU and national funds.

5 The region's main environmental resources include the Niepołomice Forest complex which is home to nearly all species of forest trees and numerous habitats of various birds and animal species. The largest forest covers an area of about 110 square kilometres and is classified as a Natura 2000 Special Protection Area focused on bird protection.
6 www.programszwajcarski.gov.pl/

Most of the project budget (approximately 85 per cent) is spent on the purchase and installation of the solar systems, followed by photovoltaic systems, and heat pumps. In addition, the project finances promotional and educational activities aimed at raising awareness among local residents. Activities that have already been implemented are two promotional conferences, educational and information campaigns, and well as the creation of a manual entitled "Clean energy means clean environment" for youth and adults.

Take-Away Messages

- ✓ Environmental education, the distribution of information and promotional activities should be an integral part of projects related to low-emission economy building in municipalities, and respective funds should be allocated to these activities.
- ✓ With regards to the installation of Renewable Energy Sources it is key to ensure the appropriate quality of devices and their installation, adequate warranty service, and comprehensive training of private beneficiaries on the operation of the systems.
- ✓ Various sources of funding and inspiration are available for Polish municipalities. In particular, membership in the Association of Municipalities in the Polish Network "Energy Cités" (Polish: Stowarzyszenie Gmin Polska Sieć "Energie Cités") allows access to a number of interesting projects in the field of climate protection and sustainable development as well as access to international know-how.

Key Data

Financing:
Co-funding under the Swiss-Polish Cooperation Programme; own contribution of the municipal budgets, and own contribution of local residents

Duration:
2013-2016 (installation stage: 2013-2015)
Estimated saving of CO_2 equivalent:
3,305 t/year
Costs:
PLN 69.45 mln

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Private house with photovoltaic system

Source: City of Niepołomice

Sprockhövel: Photovoltaic-installations on public buildings

"In the context of global climate change, we are convinced that in Sprockhövel we have taken the right decision to lead by example. To be active in local climate protection also has positive effects on the strained budgets of municipalities."

Ralph Holtze, Manager of ZGS

The German North-Rhine-Westphalian city of **Sprockhövel** (25,600 inhabitants) offers its residents the opportunity to actively work towards a sustainable and decentralised energy supply. Since April 2011, citizens and companies have had the opportunity to invest in solar power. The project "Sprockhöveler SonnenInvest" (Sprockhövel SunInvest) was established to address global climate change and to devote the city to the issue of renewable energy while at the same time boosting the regional economy.

The joint project involves the public central building management (Zentrale Gebäudebewirtschaftung, ZGS), a local savings bank (Sparkasse) and the specifically created citizen energy co-operative – the "BürgerEnergieGenossenschaft eG (BEG)". The ZGS restores roofs on public buildings, on which the BEG then installs photovoltaic (PV) systems.

Both citizens and businesses can become members of the co-operative. Therefore, even those who do not possess roofs themselves can become involved in the installation of PV systems. The co-operative is designed to last at least 20 years, with the possibility of extending that duration. A business share is EUR 500. This minimum holding is paid with the acquisition of membership. Each member may participate with the approval of the Executive Board with additional shares of up to EUR 10,000. The sale of investment shares is made through the local savings bank. Through the feed-in tariff members receive a return of roughly 3-4 per cent per year. The orders for construction works and installations are, as far as is possible and economically feasible, given with priority to capable companies in the region.

So far, within the framework of "Sprockhöveler SonnenInvest", PV systems have been installed on three primary schools, two gyms and the roof of the "Glückaufhalle" (a regional conference centre). The systems became operational in 2011. The six installations have a capacity of 238 kWp and produced 123,000 kWh of solar energy within the first year of installation. The project had optimal starting conditions mainly due to measures in energy-related modernisation in recent years. Due to energy-related modernisation activities undertaken by ZGS between 2004 and 2010 amounting to EUR 3.2 mln, the city now saves approx. EUR 150,000 annually in energy costs and approx. 550 tonnes of CO_2.

The cost of the six PV plants amounted to roughly EUR 635,000, of which EUR 190,000 was covered by 52 new members of the BEG. Two-thirds was financed by funds from the German KfW Bank, a state-owned institution, and the remaining third via a savings credit bank. For the city of Sprockhövel no costs were incurred for this project. In return for providing roof surfaces, the ZGS receives 3 per cent of the feed-in tariff. As a result, both the city and the climate benefit. The energy that is generated by the installations supplies about 50 households. The CO_2 savings from the six PV systems alone is between 130 and 150 tonnes per year.

Take-Away Messages

- ✓ Through optimal cooperation between the three actors in the construction of PV systems on public roofs, the subject can gain broad public attention.
- ✓ Citizens are given the opportunity to help shape the local and regional energy future.
- ✓ Regional businesses benefit from contracts, having a positive effect on the local economy.

Key Data

Financing:
Public Participation (co-operative) in combination with loans from KfW and the local savings bank

Duration:
Since 2011 (designed for 20 years)
Estimated saving of CO_2 equivalent:
Approx. 150 tonnes per year
Costs:
EUR 635,000 (EUR 190,000 through the BürgerEnergieGenossenschaft eG (BEG)
Reduction in Costs:
Lease in the form of 3 per cent from revenues from the feed-in tariff
Installation capacity:
238 kWp

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PV Installation on Public Building

Source: City of Sprockhövel

Warsaw II: Cooperation with the research and private sector in reducing transport emissions and achieving sustainable transport in the capital metropolitan area

"The transport sector ranks second highest in the world in terms of CO_2 emissions. In Warsaw, emissions from the transport sector are 15 per cent of total emissions. That is why Warsaw is taking steps in order to modernise the transport infrastructure and rolling stock of our carriers, as well as the popularisation of alternative drives and fuels, both targeting public and private transport."

Marcin Wróblewski, Main Specialist, Infrastructure Department of Warsaw City Hall – Organisation and Projects Unit

Warsaw's sustainable transport policy is a successful public policy example of reducing CO_2 emissions based on a long-term vision, strategic planning and supported through an innovative partnership arrangement with research and private sector associations. Thanks to the openness of the local authorities to cooperate with the private sector and the city's interest in adopting innovative solutions, Warsaw has successfully reduced emissions of the city's rolling stock and supported environmentally friendly public transport measures.

The development of sustainable transport in Warsaw is considered a priority given that the transport sector is currently responsible for 63 per cent of air pollution in the city and 15 per cent of total CO_2 emissions. Meanwhile the local government is faced with the requirement of ensuring an effective system of public transport for more than 2 million residents. The city must also deal with high transit traffic, which is a result of not having a complete bypass system around the capital.

Warsaw has modernised its public transport system largely by investing in rail transport (subway, tramways and urban trains) and intelligent sustainable traffic management, such as the construction of Park & Ride parking lots on city outskirts and at major transport hubs plus a number in nearby towns. These parking lots allow commuters to switch from cars to public transport in convenient locations, thereby contributing to better harmonisation of traffic.

The "E-Mobil" Cluster, electrical mobility, alternative fuels and new forms of mobility

Electric drives have the technical and environmental advantages over combustion in terms of energy efficiency, greenhouse gas emissions, noise and air pollution. However investments in sustainable transport system can become costly. The involvement of local partners in reducing transport emissions is therefore noteworthy. In 2011, as a means of accessing know-how, the City of Warsaw formed a partnership with the Warsaw Technical University. An initiative, called 'E-Mobil' and coordinated by the Warsaw University of Technology, was launched to coordinate and institutionalise efforts to promote environmentally friendly transport. Together with private companies, such as Fiat Auto Poland/IVECO, PIMOT, PGNiG, MMC Car Poland and ITS, the City of Warsaw works towards e-mobility and other alternative driving systems. Also the Municipal Bus Company (Miejskie Zaklady Autobusowe (MZA)) became a member of the cluster.

The city has further introduced measures which ensure preferential treatment of electric vehicles. For example, the City Street Management Board has put up restricted access signs at battery recharging points, with additional information that cars are exempted from the paid parking zone fee for the time of recharging; and the vehicle tax has been reduced by 10 per cent for electric and hybrid vehicles. Further preferential treatment measures (such as reduce parking fees) are in preparation. In addition, the city is supporting the development of an electric car recharging infrastructure (among others, a network of 12 recharging points has been created by RWE).

Activities aimed at developing energy-efficient transport are bringing results. Between 2012 and 2014 in Warsaw as a whole, the number of electric vehicles and hybrid vehicles has grown from 124 to 197 and from 100 to 532 respectively, without any additional public financial incentives for electric mobility.

Municipal companies are also interested in activities in the field of e-mobility and alternative energy resources. The Municipal Bus Company (MZA), for instance, already runs numerous hybrid, gas and electric buses and plans to use 130 hybrid and electric buses by 2020, the Municipal Water and Sewage Company already uses 60 electric vehicles, and the Municipal Sanitation Company has 27 dust carts running on compressed natural gas (CNG).

Today Warsaw features the largest city bike system in Poland and the eighth largest in Europe. The city and a system operator of city bikes ("Nextbike") have developed a model of cooperation with private companies. As a result, eight widely available urban bike VETURILO stations have been built with the support of private investors. In return, the private investors received advertising space. The Veturilo self-service city bike system has been in operation since 2012. Together with the Bemowo Bike system, it comprises 200 stations and 3,000 bicycles. The project has turned out to be a huge success in terms of promoting bicycles and is continuously increasing in popularity. To date, Warsaw has registered over 4.1 million bike rentals and the number of registered users of the system is almost 300,000. Furthermore, the approximate length of bicycle routes currently equals over 412 km.

Benefits in terms of energy efficiency and climate protection

Warsaw's strategy for a sustainable transport system has also been taken into account in the city's "2020 Sustainable Energy Action Plan for Warsaw" (SEAP). The Plan envisages that by 2020 CO_2 emissions and energy consumption will be reduced by 20 per cent vis-à-vis 2007 while the share of RES will increase by 20 per cent. It is hoped that in 2020, the amount of energy used annually by Warsaw's transport will drop by 3,268,766 MWh, which corresponds to 843,342 tonnes of CO_2.

Take-Away Messages

- ✓ Local governments can provide a wide range of solutions to reduce transport emissions in cities, ranging from the development of rail transport and the replacement of rolling stock, through traffic management systems, transfer hubs and Park & Ride parking lots, ticket zones, to the development of bicycle paths and promotional and educational activities addressed to residents. Each solution needs its own specific means to achieve its goal and the highest possible mutual synergy.
- ✓ As for the area of public transport, there are private investors available and interested in cooperating with local governments. Areas of interest for investments include, for example, the development of low-carbon elements for urban transport systems. Well-negotiated cooperation arrangements can bring about tripartite benefits: residents have access to a better developed transport infrastructure, the municipality does not bear the cost of this expansion, and private partners gain more clients while building an environmentally friendly corporate image.
- ✓ The research and development sector is interested in testing and implementing developed solutions, especially in the area of alternative drives and fuels. Such cooperation with Polish and foreign centres may allow local Polish governments to participate, for example, in the work of the national transport clusters or projects implemented under the Horizon 2020 programme from the new EU financial perspective.

Key Data

Financing:
Money from EU funds and from the city budget, public-private partnership

Duration:
2010-2020

Estimated saving of CO_2 equivalent:
Reduction of 3,268,766 MWh of energy used for the transport sector which means reduction of 843,342 Mg CO_2

Costs:
Approx. PLN 3.8 bln

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Veturilo public bikes

Source: Warsaw City Hall Public Authority

Underground 2nd Line, Plac Wilsona station

Source: The Warsaw Underground Facility

Saerbeck: Bioenergy Park Saerbeck

"Citizens are the best on-site experts"

Guido Wallraven, Project Manager

The city of **Saerbeck** (7,200 inhabitants) is located in the mid-western part of Germany in the rural region of Münsterland. It is devoted to renewable energy, climate protection and climate adaptation in practice.

In 2008 the municipality set an ambitious goal of reaching full energy self-sufficiency through renewable energies by 2030 – and it is on the way to achieving it. Five years after initiating the project in 2009, these renewable resources produce almost 3.5 times more energy than Saerbeck consumes. The project includes three initiatives: Sunny side of Saerbeck, Saerbeck insights – future energies made transparent, and Steinfurt flow patterns of material.

The biggest project so far is the Saerbeck Bioenergy Park which was built on the grounds of a former German army ammunition camp that has belonged to the municipality since 2011. On the 90 ha area, instead of stored ammunition there is now 29 MW of installed electric power. The park consists of a biomass plant and a bio waste plant each producing 1 MW of power, 6 MW peak solar panels and seven wind turbines with a total capacity of 21 MW. The installations are connected to the power grid by a separate power line that connects to the transformer substation located around 10 km away from the city of Emsdetten. The Bioenergy Park also offers research, development and education in the field of environmental protection.

The driving force of the Bioenergy Park and all other projects conducted in Saerbeck is its mayor who is very devoted to climate protection. But the success of the municipality is largely due to the inhabitants' contribution.

The solar power plant and a wind turbine in the Bioenergy Park are investments by the energy co-operative "Energy for Saerbeck". The second wind power plant was financed by the municipality itself and is run by its own business development agency. As a result, the park indirectly belongs to all the citizens of Saerbeck. Local farmers also invested in and are running the biogas power plant, whereas all others installations in the Bioenergy Park are financed by local investors.

The energy co-operative Energy for Saerbeck was established in 2010. The co-operative has seven founding members, including the mayor, and has received professional support from local banks (Volksbank and Raiffeisenbank). It turned out that many inhabitants are actually experts who are willing to support the project.

The citizens of Saerbeck were convinced to take part in the co-operative and to invest in the Bioenergy Park by a promotional campaign conducted as part of the initiative "The Sunny Side of Saerbeck". As a result of this project, over 400 PV power plants with an electric power output of 9.9 MW peak were installed on private houses.

In addition to the promotion campaign, in 2010 a Central Heating Unit was constructed that supplies public buildings with heat produced from wooden pellets. The heating unit was built in such a way as to show its working processes transparently and also serves as the community's Climate Information Centre, providing the visitors with information about the municipality's activities and organising events concerning climate protection.

Together with the heating unit, the environmental education programme "Saerbeck's Energy Experience Path" was developed and is dedicated to kindergartens and schools. As part of the project an LED floodlight in the local sport club was installed, which is one of the most modern of its kind in Germany. The "Saerbeck's Energy Experience Path" accompanies the construction of "hardware" (wind turbines, biogas, PV power park) and represents a versatile environmental education concept. It includes a special smartphone app for the project programmed by students from the local school, a solar workshop for students from all over Europe organised by a local institution and a learning centre in the Bioenergy Park established for schools. Thanks to its commitment to climate protection, Saerbeck became a university centre (the University of Applied Science Münster operates a laboratory for biogas research in the Bioenergy Park). Moreover, the association "Climate Municipality Saerbeck", founded in 2013, provides citizens with many possibilities for participation.

The climate protection goals in Saerbeck were implemented as part of the integrated climate protection and climate adaptation concept (ICCC) and Saerbeck was honoured as the NRW (North Rhine-Westphalia) "climate community of the future" in 2009. Saerbeck was also honoured with a number of prizes for its climate protection activities, including The European Energy Award in gold 2010 and 2013, the German Sustainability Prize 2013, and the RES Champions League 2014, to just name a few. Over 40,000 people have visited Saerbeck since 2011.

Saerbeck is pursuing its efforts further, starting new projects with a focus on e-mobility and the establishment of a local combined heat and power (CHP) plant network which will service about 60 per cent of the city's houses. The CHP plants are fed with biogas coming from the Bioenergy Park.

Take-Away Messages

- ✓ Former military and industrial areas are a suitable location for the development of renewable energy power plants.
- ✓ The planning and implementation of the projects is put forward by the municipality and only local actors and investors are involved.
- ✓ Local added value is the best motivation for citizen participation and acceptance of renewable energy and also provides a business strategy for municipalities.

Key Data

Financing:
Funded by the municipality, citizens and local investors

Duration:
Since 2010
Estimated saving of CO_2 equivalent:
From 9.6 to/inhabitant/year in 2009 to 5.5 to/inhabitant/year in 2014
Costs:
EUR 70 mln (Bioenergy Park)
Cost savings:
Reduction of energy costs through district heating by 16 per cent

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Bioenergy Park Saerbeck 2009 and 2013

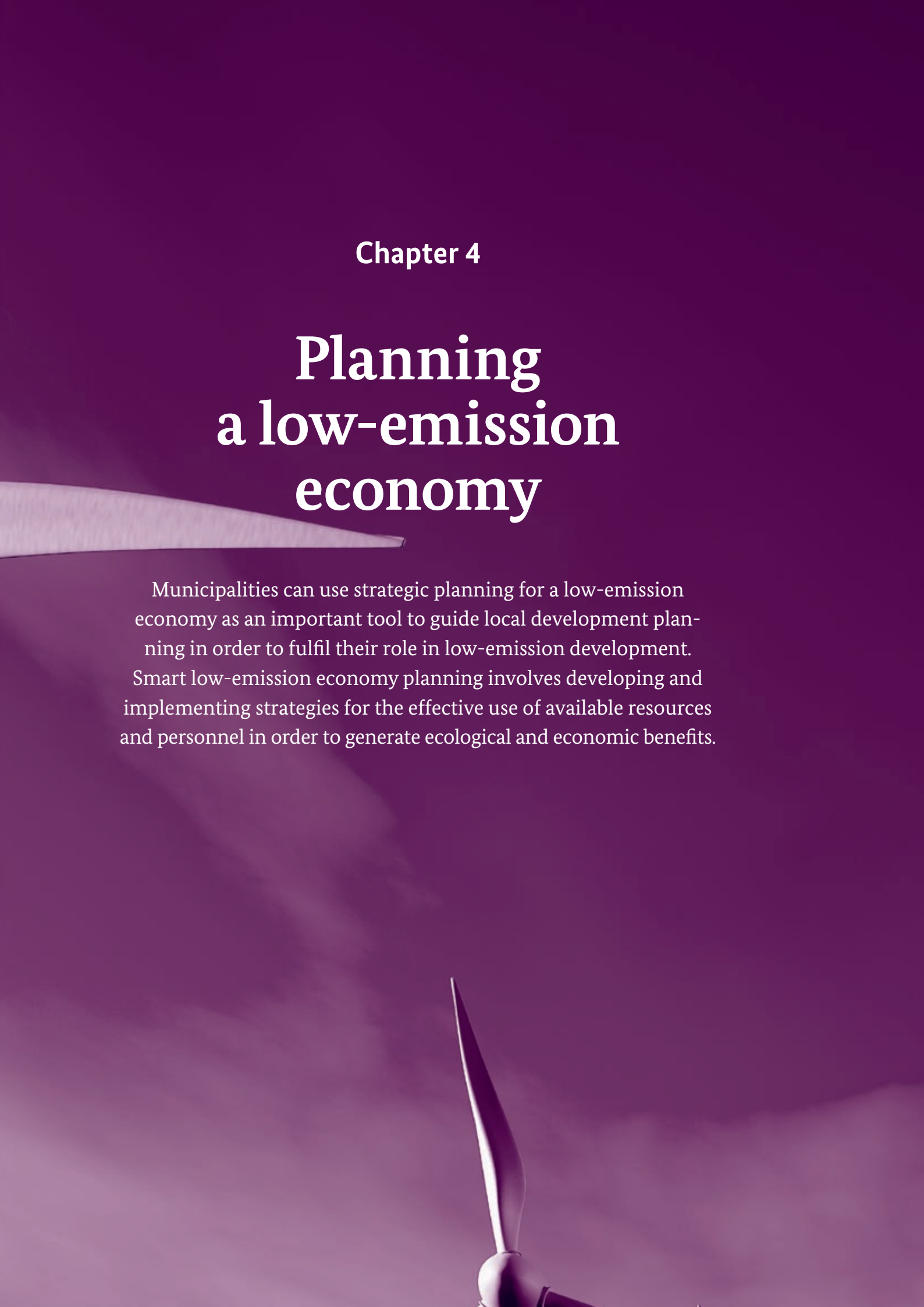
Source: City of Saerbeck

Source: City of Saerbeck

Chapter 4

Planning a low-emission economy

Municipalities can use strategic planning for a low-emission economy as an important tool to guide local development planning in order to fulfil their role in low-emission development. Smart low-emission economy planning involves developing and implementing strategies for the effective use of available resources and personnel in order to generate ecological and economic benefits.



Planning a low-emission economy

Smart and strategic planning for a low-emission economy is a key tool for stimulating national, regional and local sustainable economic growth and can provide interesting incentives for investors. It further helps to minimise negative environmental impacts. Smart low-emission economy planning can simultaneously generate ecological, economic and social benefits and should guide any local strategic development planning. Despite tight municipal budgets, sustainable growth can nevertheless be achieved through an effective use of available resources and effective planning.

The role of municipalities in a low-emission economy: Responsibilities and opportunities

Never before has low-emission economy planning been so important for municipalities. Municipalities are a key government partner in achieving Poland's Energy Policy and the Climate Package targets and in implementing the National Low-Emission Economy Development Programme.

Municipalities are the ones – in cooperation with local stakeholders, citizens and energy companies – that can significantly influence decisions affecting the low-emission economy in their region. This requires, above all, suitable low-emission economy development strategies and corresponding plans for supplying heat, power and gas fuels. A well-developed low-emission economy plan is the key foundation for local development. Faulty design and poor execution can undermine sustainable economic growth in a given region, discourage investors and even cause an increase in unemployment rates. Also, with the possibility of energy deficits becoming more real, an elaborate low-emission economy plan and its consistent implementation is a key ingredient for tackling municipal supply concerns.

It is important to keep in mind that smart local low-emission economy planning will need to take into account the differences in size of cities and villages, which results in different needs and challenges to be addressed.[1]

Municipal energy manager – a new profession

Strategic planning and implementation of such local low-emission economy plans and strategies at the municipal level requires qualified personnel. Given the broad spectrum of expertise required to manage and effectively coordinate low-emission economy activities, a new job profile for local energy and low-emission economy experts is emerging and will be a key success factor.

So far only a limited number of municipalities in Poland have positions or departments dedicated to energy management and the achievement of low-emission economy. Many municipalities still need to be better equipped to

Good practice: Local low-emission planning in Germany

The promotion of local climate mitigation is well institutionalised in Germany. At the national level, the Federal German Environment Ministry supports effective climate protection measures through various programmes and projects in municipalities, in industry, for consumers and in schools and educational facilities through its National Climate Initiative programmes. The National Climate Initiative offers financial incentives for municipalities to implement a transformation towards a low-emission economy. One of the core elements of the National Climate Initiative is the "Directive for Local Climate Mitigation" ("Kommunalrichtlinie"), a financial instrument for funding local climate mitigation projects. Local authorities are encouraged to apply for support in developing climate protection strategies and concepts.

Additionally, local authorities may receive a refund of up to 75 per cent for establishing and employing a so-called "municipal climate manager" for a period of two to three years, a role similar to the one of energy managers in Poland. Climate managers fulfil important tasks as they are responsible for the conceptualisation, coordination and implementation of mitigation activities, project management, advising policy makers, data collection and analysis, supervision of decision-making processes, the organisation of citizens' dialogues, etc. At the same time, they usually have to mediate interests of different, sometimes opposing stakeholders within their jurisdiction. In order to strengthen their abilities to cope with such challenges, since the last amendment of the directive in the beginning of 2013, extra funding opportunities have been made available for training climate mangers in soft skills such as networking, stakeholder facilitation and process design capacities.

1 See "Basic application requirements for a low-emission economy plan" in the Annex

handle the development, management and implementation of local low-emission economy plans and associated tasks. Most often, the respective tasks are still distributed and decentralized among several departments (construction, municipal economy, environment protection, water-sewage management etc.) thus complicating effective coordination and cooperation. The activities and results of energy management offices or officers are seldom subject to separate reporting.

Municipal energy and low-emission managers are becoming more and more important in an emerging low-emission economy. It is important for municipalities to consider the added value of such employees also in terms of the potential economic savings that can be achieved with low-emission economy actions. The savings which will be generated by such specialists and their contribution to the economic development at the local level over a long-term period should be taken into account. While small municipalities may be sufficiently served with one expert staff member, larger cities may need a bigger team with more specialised expertise. It will be especially important to have such experts in municipal teams in the coming years that will help to acquire and invest the funds available for the development of low-emission economy plans and associated tasks in the new EU financial perspective.

Support for developing low-emission economy plans and strategies

Developing and formulating local low-emission economy plans and strategies is a complex challenge and requires long-term municipal commitment paired with adequate funding and dedicated and well-trained staff.

In 2013, the Polish Government offered opportunities to access funding and training for developing such local low-emission economy plans through a call from the National Fund for Environmental Protection and Water Management (NFEP&WM) (see box below). As of 2015, almost all of over 800 municipalities that applied have received additional funding for the development of low-emission economy plans, the creation of a GHG-database as well as other activities covered by the funding (see annex for Basic application requirements for a low-emission economy plan).

The formulation of such plans is a requirement for Polish municipalities in order to access certain Operational Programmes' funds (compare also chapter 1 for these respective funds).

Any prepared local strategy that concerns the achievement of local energy security and the achievement of targets as laid out in the energy-climate package (3 × 20 per cent targets at the EU level) qualifies here as a low-emission economy plan.

Scope of support for a low-emission economy plan

The NFEP&WM, on the basis of an agreement with the Minister of Economy, announced a call in 2013. Municipalities, their unions, groups and associations were eligible to enter applications for low-emission economy plan financing. Time frames are announced by the NFEP&WM. Grants consist of 85 per cent of the qualified cost.

The support is limited to the following obligatory actions:

- Development or update of a low-emission economy plan for municipalities (contracted out to an external company, or carried out by municipality employees, reimbursing personal costs),
- Creation of a municipal database containing selected and systematised information allowing the evaluation of the energy economy in a municipality with respect to particular sectors and objects, and the creation of a greenhouse gas inventory,
- Workshops for municipality employees on issues concerning the formulation of low-emission economy plans,
- Disseminating information on and promotion of co-financing in the creation of low-emission economy plans and the publication of information on creating plans,

and non-obligatory tasks:

- A study of the elements used in the developed or updated plans for supplying heat, power and gas (or their assumptions)
- A strategic evaluation of environmental effects

Outlook into the future: The main challenges of the low-emission economy in Poland

Beyond the provision of funding for local low-emission economy plans, the government is developing a National Low-Emission Economy Development Programme. The overall goal of the Programme is to ensure economic, social and environmental benefits in accordance with sustainable development. These benefits will be achieved by increasing innovation and implementing new technologies, decreasing energy consumption and creating new employment opportunities.

The National Low-Emission Economy Development Programme will support activities leading to the implementation of:

- Reduction in GHG emissions resulting from the climate-energy package and Poland's Energy Policy (PEP) 2030,
- Guidelines for the air quality directive (CAFE) leading to reductions in air pollution,
- Provision of the industrial emissions directive preventing pollution from industrial sources,
- Settlements of the Gothenburg protocol concerning prevention of acidification, eutrophication, and the creation of sea-level ozone.

To achieve these reduction targets for all substances, a wide range of actions will be required at the national, regional and local level. It is envisioned that such a wide range of actions should eventually be covered at the local level by low-emission economy plans as well. Against this backdrop, it will be important for municipalities to consider the synergy of planned actions for a low-emission economy.

Examples of good practices

The municipality of Kisielice, the 2014 winner of the ManagEnergy Award[2], is an outstanding example of the effective and successful municipal planning of energy measures and activities, leading to significant cost savings and emission reductions. The development of RES constitutes a crucial element of Kisielice's municipal strategy, while the mayor acted as key change agent.

The case of the German city of Norderstedt exemplifies how technical improvements and optimisation of the building management system allowed improving energy efficiency in the city hall. This examples highlights the relevance of qualified personnel for effective planning and management of low-emission economy activites.

The comprehensive achievements of the Energy Management Office in Bielsko-Biała is another pioneering example of successful strategic and long-term energy planning, demonstrating the importance of a well-trained and staffed energy/low-emission team on the ground.

The case of the German district Barnim, with one of the most sustainable public buildings in Europe, demonstrates how an integrated approach and interdisciplinary cooperation can improve energy efficiency while ensuring user-friendly and high-quality architecture. In addition, the example shows how the introduction of energy-efficient public buildings may contribute to the revitalisation of a given area, as it was the case for the city centre in Eberswalde.

The introduction of a systematic and long-term municipal energy management system in the German city of Delitzsch has proven to be beneficial both for local authorities and their citizens in terms of economic savings and environmental benefits. This has made Delitzsch Saxony's first city to be honoured with the European Energy Award®Gold.

2 The ManagEnergy Award: Intelligent Energy - Europe (IEE) programme of the European Commission is given to public authorities and energy agencies at the local and regional level that have shown outstanding achievements in the area of renewable energy, energy efficiency and clean transport.

Kisielice: Investments in Renewable Energy Sources as a stimulus for local economic development

> "Our municipality is one of the first places in Poland where wind farms, biomass boiler plants and a biogas plant were built. This makes Kisielice one of the leaders in renewable energy investment in the country. The execution of our project required many years of work by several people. The ManagEnergy Award applies to all citizens of Kisielice."
>
> Tomasz Koprowiak, Mayor of Kiselice in the years 1990-2014

The small semi-rural municipality of Kisielice (6,450 inhabitants), located in the eastern part of Warmińsko-Mazurskie Province, became known for its use of investments in renewable energy sources to stimulate local economic development.

In 2014, Kisielice won the ManagEnergy[3] Award for its energy self-sufficiency projects designed to increase energy independence, make the best use of local agricultural production capacity and reduce CO_2 emissions. The award was in recognition for the implementation of a strategy that has been pursued since the end of 1990s. The amount of energy produced in Kisielice municipality today is several times larger than required to cover its needs and the municipality has thus become energy self-sufficient.

Key strategic developments

The idea of introducing Renewable Energy Sources came from the mayor, who had been instrumental as a change agent in seeking ways to stimulate the municipal economy. Most land is farmland covering 72 per cent of the municipal areas, reflecting the agricultural character of the municipality. Looking at the experiences of other European countries, the municipality decided to invest in wind energy projects. The Local Spatial Development Plan was changed accordingly in 1998 in order to allow for the construction of wind turbines on agricultural land outside protected landscape areas and ecological corridors. Research on wind power and resources was carried on in 2001-2002, financed by a grant. The research showed favourable conditions for wind energy development. During that time, a series of informational and educational activities addressing residents were conducted in order to overcome frequent social resistance to the construction of wind farms.

As the initial concept to build a wind turbine of 1.5 MW and owned by the municipality was abandoned, local authorities turned to external investors. An investment offer presented at a number Polish RES trade fairs and conferences eventually brought success by attracting investors. Different foreign investors came in over the years, building 52 wind turbines that operate on the territory of Kisielice today with a capacity of 94.5 MW in total. The amount of electric energy generated by the wind farms and fed into the grid is estimated at 370 TJ, which corresponds to the combustion of about 36,000 tonnes of coal.

Parallel to the developments in wind energy, the municipal authorities evaluated the local potential with regard to other RES paired with analysing access to external sources of financing. As a result, a new municipal biomass boiler plant was built in 2004, financed by a grant from Ekofundusz and a loan from the Regional Fund of Environmental Protection and Water Management as well as the municipality's own resources. The plant had 2 straw boilers of 2 MW and 1 MW power, and run on cereal straw bought from local farmers. Its construction allowed for 1 coal boiler of 0.8 MW and 2 oil boilers of 1.6 MW to be periodically switched off, resulting in the following reductions of greenhouse gases and air pollutants emissions: 12.22 t/year of SO_2; 2.74 t/year of NO_2; 14.1 t/year of particulate matter and 2,909.22 t/year of CO_2.

The taxes paid by the wind farm investors added additional revenue to the municipal budget, which were in turn used to support the implementation of the investments described above. Thus, the revenues co-financed facilities with a direct benefit for the local community. The expansion of the district heating grid was achieved in 2007-2008. Furthermore, the modernisation of the combustion process through economiser installation and the straw new boiler plant expansion to 6 MW of total power were carried out during the years 2010-2013. Other sources of financing were grants from the EU.

During the whole project, some 250 private and public buildings in Kisielice were connected to the grid. New heat exchanges were installed and old coal boilers demounted, further contributing to the improvement of air quality. Today, the biomass-fuelled district heating system in Kisielice supplies 85 per cent of the city's buildings, serving more than 90 per cent of the population.

3 The ManagEnergy Award is given to public authorities and energy agencies at the local and regional level that have shown outstanding achievements in the area of renewable energy, energy efficiency and clean transport. ManagEnergy is a technical support initiative of the Intelligent Energy - Europe (IEE) programme of the European Commission which aims to assist actors from the public sector working on energy efficiency and renewable energy at the local and regional level.

Tomasz Koprowiak, Mayor of Kiselice in the years 1990-2014

Source: City Hall of Kisielice

Another key project pursued by the local authorities concerned finding private investment for renewable energy installations that could make use of local agricultural by-products, such as a biogas plant. The initial plans to use waste from the food industry and manure as substrates had to be changed due to the lack of permit from the Regional Directorate for Environmental Protection. However, these difficulties did not discourage the mayor. Eventually, a biogas plant of 1 MWel and 1 MWh capacity was built and has been in operation since May 2014. It is fuelled by silage corn supplied from surrounding local fields. It is located close to a biomass plant and connected to the town's district heating grid. The unit's waste heat is enough to supply the town with hot tap water during summer months and allows for switching off the straw boilers in this season.

When implementing the biogas project, Kisielice authorities pro-actively pursued transparent consultations with the local community to discuss openly possible concerns and create local ownership among residents. Local opinion leaders – village administrators, school directors and members of the municipal council – were invited for study visits to biogas plants in Germany and in Poland. A project presentation open for all inhabitants of Kisielice was organised in the town hall and results from the study visit were presented. As a result, the biogas plant construction was not met by any local social protests.

Kisielice authorities also got involved in solar energy installations. Construction of photovoltaic project installation – a municipally-owned PV panel of 99.84 kWp – was finished in February 2015. It is located on the roof of a straw shelter close to the straw boiler plant, and the electrical energy produced serves the needs of the municipal heat plant. The sources for the financing of the PV panel came partly from a Fund coupled with municipal financing (50 per cent from a Regional Operational programme 2007-2013 grant and 50 per cent of costs covered from the municipal budget).

Benefits for the municipality and local stakeholders

The experiences of Kisielice demonstrate that renewable sources of energy can become a driver for local economic development. The municipal strategy led to numerous direct and indirect economic benefits both for the municipality and its inhabitants.

For instance, in 2012 Kisielice raised PLN 2.34 mln in taxes from the wind farms, i.e. 6 per cent of the municipality's total revenue, compared to PLN 1.21 mln in 2008. Farmers – on whose land the wind turbines have been built – are paid on average EUR 5,000 in land lease fees per year for each turbine. Additional easement fees were paid to land owners for providing access to build power lines connecting the turbines to the grid.

Thanks to the construction of the boiler plant, the transport of coal is no longer necessary. Instead, during the years 2009-2014, the municipality bought straw from local farmers for PLN 1.13 mln, thereby increasing the income of the municipality's residents. In 2014, the purchase of straw fell, but the biogas plant investor started to procure corn for silage from 500 ha of arable land. Part of these individual revenues returns to the municipal budget in the form of personal income taxes while the rest is spent on the local market, thus contributing to the improvement of the local economy.

The production of electricity for the heat plant from the municipally-owned PV panel achieves savings in the plant budget. This in turn allows for keeping low heat prices for town residents that are already competitive due to modern production facilities and a modern network of pipes with small heat losses. The municipality has prepared plots near biogas and straw plants for investment needs, so potential economic entities operating there could be supplied with heat and electric power at competitive prices directly from the plants.

The development of renewable energy sources has also led to improvements in local infrastructure. The investors of the wind farms covered the costs of modernisation of some 30 km of municipal roads, 4.5 km of district road and 6.5 km of voivodeship road. Moreover, 12 km of power lines of 110 kV and two Main Supply Points were built as part of local grid adjustments to serve the wind turbines.

The fact that the municipality has won numerous prizes and enjoyed much media attention has become a source of local pride. Paired with the boost for local farming and private income growth from land lease, it has helped the community to develop a better understanding of the need for rational and future-oriented energy planning and for minimising the environmental impact of the energy sector.

Take-Away Messages

- ✓ The project under way in Kisielice municipality may be replicated in small rural municipalities with a strong agriculture base, one or two dominant and densely built-up towns or villages and a relatively low mean population density. Such municipalities typically have extensive stretches of farmland away from inhabited areas.
- ✓ Effective communication with main stakeholders has proved to be a key success factor in such projects. It should be led in a way that avoids unfulfilled promises. Populations between 5,000-10,000 people make it relatively easy to carry out communication campaigns and public consultations.
- ✓ Major energy projects implemented on municipal territory bring twofold financial gains. If projects are implemented by external investors, they pay taxes to the municipal budget. If the municipality owns the facility, it brings revenues from sales of energy or allows for a lower level of energy purchase from external sources. Second, farmers are paid land lease fees in the case of wind turbines, or contract fees for supplying substrates in case of a biogas plant, or cereal straw in the case of a straw-fired boiler plant.

Key Data

	Wind turbines	Straw-fired boiler plant + development of district heating system	Biogas plant for silage corn	PV panel
Financing	External investor	Municipality, EU grant from IOPRD and ROP	External investor	Municipality, EU grant from ROP
Duration	2006, 2008-2012, 2013 2014-2015	2004, 2007-2008, 2010-2013	2013-2014	2014-2015
CO_2 savings (t/year)	Approx. 172,869	More than 2,909.22	Approx. 6,652	Approx. 83
Costs (mln PLN)	N/A	5.1 + 3.1 + 7.9	N/A	0.67

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Biogas plant in Kisielice

Source: City Hall of Kisielice

Norderstedt: Energy savings through connection of ventilation and cooling systems in the city hall

> "Our experience with the connection of the ventilation and cooling system in the city hall clearly shows that dedicated and technically competent staff have significantly contributed to the success of the project. In combination with intelligent building management technology, this eventually pays off for the climate and the municipal budget."
>
> Birgit Farnsteiner, Climate Protection Coordinator of the city of Norderstedt

Built in 1984, the city hall of Norderstedt in in Schleswig-Holstein (75,000 inhabitants) is a multi-purpose building with an attached event centre. Due to various forms of usage, differing usage times, as well as different heating and cooling needs, the energy efficient control of the system is a challenge. In particular the high energy demand for cooling the rooms, in which the temperature must be kept constant (for legal and technical reasons) – e.g. server rooms, the fire alarm panel, the traffic monitoring systems or the building management system (BMS) – is costly in the long run.

In 2007, after nearly 25 years of operation, the heating and ventilation system was thoroughly renovated. The additional investment costs of EUR 120,000 for software, a sensor system for air quality measurement, presence detectors etc. were financed entirely through the budget of the city. The technical planning and support of the project was taken over by the measurement and control technician in the office for facility management, who is also a member of the coordination group for climate protection.

Technical improvements and the optimisation of the building management system made significant energy savings possible. Particular emphasis in the modernisation was put on the cooling system, so that it was not only dependent on the outside temperature, but also on load. In such a way, not only the temperature, but also the position of the heating and cooling valves of both ventilation and heating systems are taken into account for determining the right temperatures for cooling and heating water.

The building management system gradually sets the cooling – if necessary – through:

- free cooling through outside air,
- additional cooling of air over the central chilled water air conditioning of the city hall; and
- individual cooling units (split units).

Besides the efficiency of modern facilities, significant energy savings are achieved by using the BMS to automatically select the most efficient cooling method. For example, the engineering and computer rooms are cooled by a small split unit on weekends. This way, the cold water cooling can operate in the optimal load range, which also extends the lifetime of the engines.

By these measures a total of 147 tonnes of CO_2 are being saved annually. Further positive effects can be observed as well: the costs of maintenance personnel are lower; additionally, about 600 m^3 of drinking water can be saved per year. By reducing its electricity and heat consumption, the city of Norderstedt saves about EUR 50,000 per annum. Thus, the modernisation and demand-oriented control of the cooling system has become a success not only for the city, but also for climate protection – and not least because of the fact that the costs were amortised after 2.5 years.

Take-Away Messages

- ✓ Investments in competent technicians and engineers are worthwhile and pay off for the municipality in the long run
- ✓ With the modernisation of ventilation and cooling systems besides the potential of technical improvements, the optimisation of building control systems also offers large energy savings and potential for climate protection.
- ✓ This project can be transferred to properties with strongly fluctuating ventilation and cooling demands.

Key Data

Financing:
Self-financing with own funds

Duration:
2007-2009
Estimated CO_2 savings:
147 tonnes per year
Costs:
EUR 120,000
Costs savings:
About EUR 50,000 per year

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The cooling unit being built into the city hall

Source: City of Norderstedt

Bielsko-Biała II: An Energy Management Office as a source of economic and ecological benefits for the municipality

"A low-emission economy, from the perspective of the city authorities, means reducing or eliminating any energy consuming processes that are not necessary. It further means replacing inefficient service infrastructures with an energy-efficient infrastructure. It also means stimulating and promoting the use of renewable energy sources. But to achieve these effects, it is necessary to familiarise the local community with the importance of the rational use of energy in households, public buildings and in the whole economy. A low-emission economy also means optimising spatial planning aimed at reducing energy transmission losses and the rationalisation of public transport. The creation of an Energy Management Office leading projects related to the achievement of the energy and climate package objectives allows energy policy to be effectively carried out and optimal ecological and economic Effects to be achieved."

Zbigniew Michniowski, Deputy President of Bielsko-Biała, Deputy President of Energy Cities, President of Polish Network Energie Cites Board

Bielsko-Biała is a city with a population of 174,000 and a forerunner of activities related to energy management. Local authorities have realised the importance of energy conservation issues since as far back as the early 1990s.

The creation of a well-staffed Energy Management Office already in 1997 played a key role in initiating, managing and co-ordinating a broad scope of successful energy conservation activities. Bielsko-Biała is one of the few Polish municipal offices with a large energy-management team. The major achievements of the Energy Management Office, leading both to substantial economic savings and environmental protection, include consistent, long-term strategic energy planning, rigorous energy data monitoring, targeted involvement of key municipal stakeholders and educational and awareness-raising activities.

The Energy Management Office is subordinate to the city president and deals with the local energy market, oversees the drawing up of local spatial development plans insofar as energy use is concerned and co-operates with city utilities. The office further conducts activities concerning Renewable Energy Sources covering the use of solar energy, biogas and heat pumps. For example, since 2007, Bielsko-Biała has been implementing a programme replacing old inefficient coal-fired heat sources in detached houses with environmentally-friendly heat sources (compare also Chapter 3).

As for energy planning, the development and implementation of a "City Heat, Electricity and Gaseous Fuels Supply Plan" has proved to be a key instrument and focuses on building an environment for cooperation between energy suppliers and the city that secures continuity and quality of supplies while maintaining energy prices at a reasonable level and minimising environmental costs. One example of such activities is a three-party agreement between the city, PK Therma (the local district heating supplier), and PKE SA (the largest local producer of heat and electricity). The agreement resulted in a decision to build a new heat and power generation plant matching the city's actual demand. The project's implementation was arranged with the aim of ensuring that the impact of the project on the final price of heat would be as low as possible. Thanks to that agreement, the risk of overspending or unplanned spending, which would have been reflected in the district heating costs, was avoided. Earlier agreements concluded with the heat distribution company contributed to the stability of district heating prices. The results of those measures are estimated to be millions of PLN in annual savings by the city's residents.

The modern heat and power plant has been operating since 2013. The efficiency of the new facility is 25 per cent greater than that of the old one and emissions of air pollutants from combined heat and power generation have

decreased by the same percentage. The reduction corresponds to 125,000 t CO_2/y due to the use of a state-of-the-art fluidised bed boiler, high peak gas and oil boilers and a huge heat storage tank with a capacity of 20,000 m³ to address the issue of heat demand variations.

Bielsko-Biała is also member of the Polish Energie-Cités association of local governments and has signed the European Covenant of Mayors. As a result of these affiliations, in January 2010 the municipality developed Poland's first Sustainable Energy Action Plan (SEAP) – in addition to the "City Heat, Electricity and Gaseous Fuels Supply Plan" – adopted by the city council with the Energy Management Office as coordinator. The Plan requires the municipality to reduce CO_2 emissions by at least 20 per cent by 2020. It means the reduction of 186,768 t CO_2 between 2009 and 2020 (on average 18,667 tonnes of CO_2 per year). The total costs of the implementation of the SEAP have been estimated at PLN 304.5 mln. Its financing is based on a various sources, including contributions from the city budget (PLN 81 mln), input by private persons (PLN 16.6 mln), input from utilities at PLN 64.2 mln (transport) and PLN 62 mln (district heating), as well as additional external sources of financing (PLN 81 mln). Estimates suggest that the full implementation of the SEAP will lower the yearly costs of heating by PLN 49 mln in Bielsko Biała and the costs of electric energy in the city will fall by PLN 9 mln per year.

Rigorous supervision activities and energy data monitoring implemented by the Energy Management Office have led to important economic savings for the municipality. The energy data supplied on a continuous basis to the Energy Management Office undergoes analytical processing, providing a tool for identifying and enhancing the potential savings which can be made e.g. through the thermal upgrading of buildings. For example, a survey of the technical condition of heat sources and heating systems in city-owned public buildings, conducted in 2003, has brought their poor condition to light. In response, decisions were taken to ensure closer supervision of the operation and maintenance of those facilities.

Over the years, various methods for monitoring energy have been introduced and have helped to enhance savings. Computer-based energy monitoring tools were introduced as early as 2000 and have been gradually refined over the years. Savings were achieved, for example, through the development of a data acquisition system, which resulted in facilities being improved in order to increase their efficiency and reduce the number of system failures. Other achievements included a pilot energy monitoring study on a new municipal swimming pool during its start-up. A computer application developed for this purpose and based on "manual" readings of meters twice a day provided valuable data about the facility, allowing an analysis of its energy performance to be performed, as well as the planning and execution of appropriate remedial measures which resulted in annual savings estimated at approximately PLN 250,000.

The energy data also proved particularly useful in the renegotiation of energy supply contracts; this application alone has resulted in about PLN 1.5 mln in direct savings since 2000, practically without capital costs. The total savings since the year 2000 are estimated at more than PLN 8 mln. The money is spent on other public expenses or used for the implementation of further environmental and energy efficiency measures.

From the beginning, the Energy Management Office invested a lot of effort in engaging local stakeholders and supported regular educational and awareness-raising activities in order to create an enabling environment for its activities. Between 2010 and 2012, an EU project called "ENGAGE" – supported under the Intelligent Energy Europe Programme – was implemented with the objective of mobilising residents around the issues of energy efficiency and climate protection. Awareness-raising activities deriving from the project are still being continued by the city in the form of the campaign "Bielsko-Biała Protects CLIMATE", to be run at least until 2020. The 4th Good Energy Beskids Festival in 2014 featured as one of its highlights the awards ceremony of the local contest "Save Energy and Protect the Climate" and the 1st gala for companies, institutions and persons who made outstanding contributions to the "Bielsko-Biała Protects Climate" campaign.

In November 2013, the "Bielsko-Biała Protects Climate" project won the European Public Sector Award (EPSA) 2013 award. The project was included in the EIPA's list of good practices and granted a Good Practice Certificate.

Take-Away Messages

- ✓ Energy management needs a dedicated team of professionals (Energy Management Office) or at least one person in the municipality (Municipal Energy Manager). Energy management requires careful planning in co-operation with local stakeholders and brings results also in the long term.
- ✓ The Sustainable Energy Action Plan (SEAP) can be considered a low-emission economy plan with an additional condition, i.e. the volume of CO_2 savings until 2020 established at a level of 20 per cent. Therefore, municipalities preparing low-emission energy plans can draw from the experiences of Bielsko-Biała and other Polish members of the Covenant of Mayors.
- ✓ A municipality should act as a role model for other municipal stakeholders.

Key Data

Financing:
Mixed (city budget, utilities, private persons, external sources)

Duration:
2010-2020
Estimat ed saving of CO_2 equivalent:
15,564 tonnes of CO_2 per year
Costs:
PLN 304.5 mln
Cost savings:
PLN 250,000 per year

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The group of co-workers of the Energy Management Office, as background: City Hall Bielsko-Biała

Source: Picture by 70mm – Photoshoot Studio

Barnim: The 'energy municipality' with Germany's most sustainable public building

"By building the Paul-Wunderlich-House we have set a symbol for sustainable construction in the region and we laid the foundation for our district-wide energy strategy 'The future is RENEW:ABLE' "

Head of the county administration Bodo Ihrke

The district of Barnim in the German state of Brandenburg is conducting the campaign "the future is RENEW:ABLE" („die Zukunft ist ERNEUER:BAR") aiming at utilising the potential of resources in the region, rediscovering flow patterns for material and increasing the added value in the district.

Since 2008, the district of Barnim has been implementing a zero-emission strategy. The long-term goal is to meet the entire energy demand of the district with renewable energy resources. Barnim is on track to achieve this. Thanks to 1,116 solar and 118 wind power installations, the production of electricity from renewables already meets the demand of all households. A total of 3,500 renewable energy power installations provide energy for a quarter of the total energy consumption in Barnim.

All ten municipalities in the district cooperate with each other and much has been achieved in the field of climate protection: installed solar panels with megawatts of capacity, passive buildings, e-mobility, energy parks and many more. They focus on raising awareness among citizens, providing information, stimulating interest amongst children as well as intensive research in renewable energy. Additionally, the zero-emission-network serves as a platform for companies, municipalities and researchers responsible for the development and implementation of renewable energy projects.

Eberswalde: Zero-emission building as a service and administrative centre

Eberswalde is the administrative seat of the district of Barnim and belongs to one of the most active municipalities in Brandenburg in terms of energy and climate protection. By building the seat of the district government in form of the Paul-Wunderlich-House in Eberswalde, the district government of Barnim realised its largest project in terms of sustainable construction.

During World War II, the centre of Eberswalde was destroyed and since then the three-hectare area remained a vast wasteland for many decades. It was not until 2001 that the administrative district of Barnim decided to construct a building for the district council and the council departments in that area.

A Europe-wide competition was held to find architects that would be able to create spaces for administration and commercial use, while focusing on high energy efficiency. The winning design was submitted by GAP Architekten (architects) and named the Paul-Wunderlich-House after the eponymous famous modern artist born in the town. The building consists of four units, linked together into a "U" shape, between which is a public space for pedestrians. The fifth building, located on the south side, is a car park. The total area is around 17,000 square meters and serves as a workplace for 550 employees.

Energy-efficiency was a key criterion in this project, demanding a high level of interdisciplinary cooperation between architects and energy consultants – also because it was to be included in the energy-optimised building development programme of the German government (Energieoptimiertes Bauen – EnOB). The energy efficiency also had to be user-friendly and harmonised with functionality.

The architects brought natural light into the interior, even into the parts further away from windows. The offices are equipped with lamps that switch on and off depending on the daylight conditions and can also be regulated by users.

Energy demand in the building was minimised by implementing diverse techniques, including compact building volumes, optimised thermal insulation, glazing, reduction of cooling loads, integration of thermal buffer zones, underfloor heating/cooling and ventilation systems, geothermal energy-use, energy-efficient lighting, building automation and user-training. These measures enable consumption of 70 per cent less energy than in comparable buildings.

The building is equipped with geothermal heat pumps. Thanks to the highly insulated walls, the energy demand for heating in winter is low. The heat is transferred to the offices by two systems: a ventilation system, controlled by external temperature, and radiators fitted with thermostatic controls for peak loads. In times of higher temperatures the system switches to the re-cooler located on the roof.

The investment costs amounted to approx. EUR 36 million, financed solely from district Barnim's own resources. The funding was acquired from sustainable construction and urban redevelopment funds.

Beginning in 2007, a two-year energy monitoring period was initiated. It resulted in some necessary changes, e.g. with heat pumps and lamps. Nevertheless, the targeted energy performance was achieved in the first year – primary energy demand was 94 kWh/m² in 2008 (less than 10 per cent above the target).

In 2009, the Paul-Wunderlich-House received a certificate for sustainable construction (German: Deutsches Gütesiegel für Nachhaltiges Bauen), and is now the most sustainable public building in Germany – and most certainly one of the most sustainable buildings in Europe.

The building also has artistic value – around 300 works by Paul Wunderlich are on display and are open for viewing to the public. The main hall is regularly booked for a wide range of occasions. As a result, an average of over 1,000 people visit the building every day.

Take-Away Messages

- ✓ All municipalities in the district undertake mutual activities in the field of climate protection to scale up the results.
- ✓ The architects of the building cooperated closely with energy specialists when designing the building.

Key Data

Financing:
Own resources

Duration:
From April 2005 to July 2007
Primary energy demand:
Total 95 kWh / m²
CO_2 emission:
16.58 kg / m²
Costs:
EUR 36 mln
Cost savings:
Due to the geothermal heat pumps there are no expenses for fossil fuels. 10 per cent of the annual demand in electric energy are covered by the solar energy system on the roof.

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Paul-Wunderlich-House in Eberswalde

Source: www.eberswalde.de

Delitzsch: The introduction of municipal energy management

"The introduction of a municipal energy management system was an important decision that has paid off not only with a rapid reduction in operating costs but also with regard to a long-term vision for our city. Administrative staff and citizens have been made aware of the issue of energy efficiency."

Dr. Manfred Wilde, Mayor of Delitzsch

The German city of Delitzsch (25,000 inhabitants) is firmly committed to energy efficiency. In 2003, rising energy costs pushed the city to introduce municipal energy management mechanisms. With regards to energy management the city follows its "Guiding Concept Delitzsch 2015" and includes a target to push for a sustainable use of resources and effective climate protection.

The building and property management of the city of Delitzsch serves a total of 83 buildings with a gross floor area of approximately 65,000 m². This property portfolio contains old and new buildings with very different energetic conditions. Municipal energy management was also supposed to point out areas where minimal effort could achieve large savings.

After administration executives and the municipal parliament had been made aware of the issue, an "energy team" was established. This team consists of representatives of the administration, the economy, the largest housing companies and the public utility company. The energy team came to the decision to install an energy management system in all schools, kindergartens and municipal buildings. Thanks to this system, the caretakers of the buildings can retrieve data on energy consumption, such as data for heating, on a mobile phone.

The caretakers submit monthly readings of the meters to the building and property management. Through the use of software and the relatively short intervals of trouble-shooting, issues such as defective water pipes can be responded to promptly. The caretaker and employees of the building and property management meet regularly – this is also part of municipal energy management. In this way, additional optimisation opportunities can be found.

It quickly became apparent that energy management is worth the effort. In 2006, the energy costs were EUR 300,000 less than the projected costs without an energy management system – a substantial relief for the city's budget and the climate.

Since 2006, Delitzsch has been successfully taking part in the certification process of the European Energy Award® (eea®). Within this framework, all local energy activities are systematically monitored by an external consulting firm, as well as being rated and reviewed continuously. This costs roughly EUR 5,000 a year, while up to 75 per cent of the eea® process is funded by the Free State of Saxony within the framework of the directive "Energy and Climate" (RL EuK/2007). The energy management software costs an additional EUR 10,000. The development of the software was supported as part of a pilot project of the East-German Savings Banks and Giro Association (Sparkassen- und Giroverband). The commitment is worth it: In 2012, Delitzsch was the first city in Saxony to be honoured with the European Energy Award®Gold.

Take-Away Messages

- ✓ To implement a project such as the successful and quick introduction of a municipal energy management system, it is necessary to include the top management of a municipality from the beginning. Furthermore, it may be necessary to continuously convince stakeholders.
- ✓ Accurate and current information on energy management can be drawn from meter readings on site, for example, by the staff of the building and property management (with intervals being as short as possible).
- ✓ To prevent inevitable organisational blindness, it is advisable to consult external advisors and to share experiences with other municipalities.

Key Data

Financing:
Funding (East-German Savings Banks and Giro Association, subsidy of the state of Saxony)
Duration:
2003 (since 2006 eea®)
Costs:
EUR 10,000 for the initial purchase (supported), EUR 5,000 per year (about EUR 1,250 is covered by the municipality
Costs savings:
about EUR 300,000 per year

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The Energy Team of the City of Delitzsch honoured with the European Energy Award® in Gold 2012

Source: SAENA/DocWinkler

Annex:

Basic application requirements for a low-emission economy plan

Preparing low-emission economy plans is a key element of successful local development. Municipalities have to present the scope of action for the next three to four years from the acceptance of a plan. The presented actions must be compatible with the respective long-term municipal financial planning and forecast. The basic requirements for low-emission economy plans include:

1
Acceptance of the plan's implementation by the Municipality Council (inclusion in the long-term financial forecast)

2
The plan has to be up-to-date for the moment of settlement of the co-financing agreement in the framework of Task 9.3

3
Indication of criteria for achievement of objectives

4
Definition of financing sources

5
Implementation, monitoring and verification of plans (procedures)

6
Compatibility with other plans / programmes (local land management plans, assumptions / plans for heat, power and gas fuels supply, air quality protection programme)

7
Compliance with regulation on strategic environmental effect evaluation

8
Indication of investment tasks, among others in the following areas:

a. energy use in buildings/installations (public buildings and equipment, non-public service buildings and equipment, residential buildings, street lighting, industrial plants outside the EU Emission Trading System (ETS)) – non-obligatory, heat distribution;

b. energy use in transport (public transport, municipal transport fleet, private and commercial transport, rolling stock) including the implementation of traffic management systems;

c. waste disposal with respect to emissions not connected to energy use (CH4 from landfills) – non-obligatory,

d. energy production – plants/installations generating power, heat and cooling, not including installations under EU ETS

9
Non-investment tasks such as urban planning, public procurement, communication strategy and promoting low emission economy, etc

The effects of every initiative corresponding to the 2020 climate and energy package should be included in the low-emission economy plan and have to be enumerated:

- Annual decrease of emission in CO_2,
- Increase of production of energy from RES,
- Improvement in energy efficiency and lowering the absolute demand for energy.

Moreover, the implementation of low-emission economy plans should decrease pollutant emissions (including dust, sulphur dioxide and nitrogen oxides) in regions where their concentration exceeds acceptable levels, and air quality (reparation) protection programmes are being implemented together with short-term task plan. This involves implementing the decisions of the CAFE Directive.

Low-emission economy plans should concern a municipality's entire geographical area and guarantee the involvement of local stakeholders, especially of energy producers and consumer entities (excluding EU ETS installations) focusing on the public sector.

Low-emission economy plans and their documentation can be prepared by external companies, but also by municipality employees – in this case their salaries will be reimbursed as part of the project. It is advised to form a team of external consultants and municipality employees to ensure that all local issues and problems specific for a given location (that external consultants might not be familiar with) will be properly addressed.

List of Abbreviations

AA units – Assigned Amount Units
BMS – Building Management System
BMUB – German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
BUtK – Bottom Up to Kyoto
CAFE – Clean Air for Europe Programme
CESBA – Common European Sustainable Building Assessment
CHP – Combined Heat and Power
CNE – Center for New Energies (German: Centrum Neue Energien)
CNG – Compressed Natural Gas
CO_2 – Carbon dioxide
CO_2eq – Carbon dioxide equivalent
DC RES – Demonstration centre for Renewable energy sources
EC – European Commission
EDC – Energy Delivery Contracting
eea® – European Energy Award®
EEG – German Renewable Energies Act (German: Erneuerbare-Energien-Gesetz)
eG – Registered co-operative (German: eingetragene Genossenschaft)
EIPA – European Institute of Public Administration
EnOB– Energy-Optimized Construction (German: Energieoptimiertes Bauen)
EP – European Parliament
EPBD – Energy Performance of Buildings Directive
EPC – Energy Performance Contracting
EPSA – European Public Sector Award
ERDF – European Regional Development Fund
ERP – Emission Reduction Programme
ESCO – Energy Service Company
ESIF – European Structural and Investment Funds
EU – European Union
EU ETS – EU Emissions Trading System
EUR – Euro currency
EZW – Energy Centre Willich
GEOBIT – Society for Engineers (German: Ingenieursgesellschaft)
GHG – Greenhouse gas
GIS – Green Investment Scheme
GJ – Gigajoul
GSG – Real Estate Agency of the city of Willich (German: Grundstücksgesellschaft)
HVAC – Heating, Ventilation, Air Conditioning
ICCC – Integrated Climate Protection and Climate Adaptation Concept
IEE – Intelligent Energy Europe
KAPE – The Polish National Energy Conservation Agency
kg – Kilogram
km – Kilometers
kV – Kilovolt
kW – Kilowatt
kWe – Kilowatt-electric
kWh – Kilowatthour
kWp – Kilowattpeak
kWt – Kilowatt of thermal energy
LNG – Liquefied Natural Gas
LPG – Liquid Petroleum Gas
m – Meter
m^2 – Square meter
m^3 – Cubic meter
mCHP – Combined heat and power production on the micro scale
Mg – Megagram
MPWiK – Municipal Water Supply and Sewerage Plant
MS – Member State
Municipality – Urban administrative division
MW – Megawatt
MWel – Megawatt electric
MWh – Megawatt hour
NFEP&WM/National Fund – National Fund for Environmental Protection and Water Management
NGO – Non-Governmental Organization
NO_x – Nitrogen oxides
O_3 – Ozone
OP IE – Operational Programme Infrastructure and Environment
PEP – Poland's Energy Policy
Phare CBC – Phare Cross Border Cooperation
PLN – Polish zloty currency
PM – Particulate matter
PONE – Low-Emission Control Programme (Polish: Program OgraniczeniaNiskiejEmisji)
PPP – Public-Private Partnership
PV – Photovoltaic
RDP – Rural Development Programme
RES – Renewable Energy Sources
ROP – Regional Operational Programme
SEAP – Sustainable Energy Action Plan
SO_2 – Sulfur dioxide
SOWA – Energy-saving street lighting (Polish: System Oswietlanie w Aglomercjach)
SPCP – Swiss-Polish Cooperation Programme
t – Tone
t/a – Tonnes annually
TO – Thematic Objective
TPC – Third Party Contracting
TPF – Third Party Financing
UN – United Nations
UNEP – The United Nations Environment Programme
UZP – Office for Public Procurement
V – Volt
VFEP&WM – Voivod Fund for Environmental Protection and Water Management
Voivodeship – Highest-level administrative subdivision of Poland (corresponding to provinces in others countries)
W – watt
WIBOR – Warsaw Interbank Offered Rate
Wp – watt peak

Glossary

Bioenergy village – is a concept in which the energy demand of a region is fully covered by renewable energy sources. It is introduced especially in rural areas and focuses on the use of locally available resources, such as biomass from local agriculture and forestry. The first bioenergy village was Jühnde in Germany.

Combined Heat and Power (CHP) – also called co-generation – is a simultaneous production of heat and electricity from one fuel source.

Dispersed energy production – energy produced out of electric or thermal energy and fossil fuels by smaller units or production facilities initially for local usage.

Energy co-operative – a co-operative is an association established with the purpose of meeting common economic, social, and cultural needs and aspirations of its members (who are also the owners) on a democratic basis. Energy co-operatives are focused mostly on energy production from renewable energy sources and are very popular in some European countries, such as Denmark or Germany.

Energy Delivery Contracting (EDC) – agreements under which an energy services company modernises and installs energy generating devices and provides energy supply at a fixed price. After the contract, the principal becomes the owner of the installation.

Energy Performance Contracting (EPC) – agreements under which an energy services company provides a comprehensive solution to increase the energy efficiency in modernised buildings, guaranteeing savings from reduced energy bills, as well as ensuring project financing. The risk of not getting guaranteed savings lies with the contractor.

Energy savings – are results of implementing energy efficiency improvement measures. The amount of saved energy is determined by the consumption level and energy costs before and after realization of these measures.

Energy Service/Savings Company (ESCO) – is a company offering services for energy efficiency in utilities. ESCO guarantees energy savings and/or provision of the same level of energy service at lower cost, which are the base of payment for the service delivered.

Electromobility (e-mobility) – refers to the development of electric vehicles in transport. It includes full electric vehicles, hybrid electric vehicles and those using hydrogen fuel cell technology.

Geothermal heat pump – is a central heating and/or cooling system that extracts heat from the ground.

Low-emission (low-carbon) economy/zero-emission economy – is an economy that produces minimal greenhouse gas (GHG) and pollutant emissions. It's main objective is to enhance energy efficiency and clean energy production, use renewable energy resources, while increasing economic growth and energy security. A low-emission economy encompasses activities, inter alia, in the areas of renewable energy, energy efficiency, sustainable transport, as well as waste management and waste water treatment.

Prosumer – is a term introduced by futurologist Alvin Toffler in 1980 formed from the words “producer” and “consumer”. It describes a person who is combining the economic roles of producer and consumer. In the energy market it is a person producing electricity for its own use.

Public-private-partnership (PPP) – is a form of cooperation between public bodies and the private sector, which leverages investments in infrastructure projects or other types of operations, delivering public services through risk sharing, pooling of private sector expertise or additional sources of capital.

Primary energy – an energy form found in nature that has not yet been subject to any conversion or transformation process.

Sustainable mobility– mobility that enables free movement of people and goods, accessibility, communication and trade, while being affordable, promoting economic development and contributing to environmental protection (i.e. by minimising air pollution and noise) today and for the future.

Thermo-modernisation – is a process aimed at reducing usage of thermal energy in buildings.

Third party financing (TPF) and contracting (TPC) – is a way of financing involving a third party that provides energy services and finances the investment.

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Acknowledgements

This handbook was published thanks to the funding of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety with means of the Advisory Assistance Programme for Environmental Protection in the Countries of Central and Eastern Europe, the Caucasus and Central Asia and written under the supervision of the German Federal Ministry for the Environment (BMUB) and the Federal Environment Agency (Umweltbundesamt, UBA).

We thank all local government representatives who have provided valuable technical input and materials for this handbook:

Ina Bassin, Barnimer Energiegesellschaft mbH (BEG)

Andrzej Bielski, Main Specialist in the Department of Investments and Communal Resources, City Hall Chorzów

Grzegorz Boroń, Deputy Director for Environment, District Geologist, City Hall Bydgoszcz

Bernd Bremerich-Ranft and **Willy Kerbusch,** Energy Centre Willich

Olaf Dierks, Technician for Energy Management and Climate Protection, Department of Buildings and Outside Facilities, Norderstedt

Leszek Drogosz, Director of the Infrastructure Office, Warsaw City Hall

Eckhard Fangmeier, Chairman of the local co-operative BioenergiedorfJühndeeG

Marek Gabzdyl, Mayor of Raciechowice

Bożena Herbuś, City Engineer, City Hall Częstochowa

Tomasz Koprowiak, Deputy President of the Board of the Association of Renewable Energy-Friendly Municipalities, Mayor of Kisielice in the years 1990-2014

Leszek Kuliński, President of the Board of the Association of Renewable Energy-Friendly Municipalities, Mayor of Kobylnica

Zbigniew Michniowski, Deputy Mayor of Bielsko-Biała and President of the Board of the Association of Municipalities Polish Network “EnergieCités” (PNEC)

Katarzyna Napierała, Division of Municipal Economy and Environmental Protection Bydgoszcz City Hall

Dr. Babette Nieder, Managing Director of HertenerBeteiligungsgesellschaft and Consultant to the Mayor on Energy and Ennovation

Stanisław Nowacki, Project Coordinator, Implementing Authority: Strategy Department, Niepołomice Municipal Council

Małgorzata Pajek, Treasurer of Karczew

Czesław Piechociński, Head of the Urban Engineering Office, Infrastructure Department of Warsaw City Hall

Arnold Rabiega, Plenipotentiary of the Management Board, Energy co-operative "Our Energy"

Wiesław Raczyński, DeputyMayor of Chorzów

Andreas Rieck, Head of the Property Management, Procurement and Inventory Department, Delitzsch

Wiesława Sieńkowska, Mayorof Komarów

Piotr Sołtysek, Proxy of Bielsko-Biała Mayor for Energy Management

Łukasz Dąbrowski, Junior Inspector for Energy Issues, Gdynia Municipal Office

Guido Wallraven, Project Manager, Municipality of Saerbeck

Rolf Weber, Bürger EnergieGenossenschaft eG (BEG), Sprockhövel

Krzysztof Wilczyński, Main Specialist in Energy Managing, City Hall Ełk

Marcin Wróblewski, Main Specialist, Infrastructure Department of Warsaw City Hall - Organization and Projects Unit

Agnieszka Wszoła, Environment Protection, City Hall Komarów