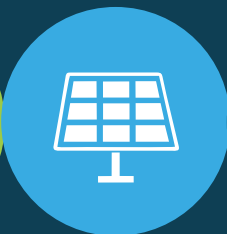




Sustainable energy in public spaces located in the town centres of the Central Functional Zone in the West Pomeranian Voivodeship based on the example of Połczyn-Zdrój

Regional Office for Spatial Planning, PP 10

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BEA-APP
BALTIC ENERGY AREAS
A PLANNING PERSPECTIVE

**„Sustainable energy in public spaces
located in the town centers of the Central Functional Zone
in the West Pomeranian Voivodeship based
on the example of Połczyn-Zdrój”**



(Project implemented as a part of a project Baltic Energy Areas – A Planning Perspective BEA-APP
Work package 4 “From strategies to action”; GoA 4.2. Energy mix in CFZ)

Study developed by project team of Regional Office for Spatial
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Regionalne Biuro
Gospodarki Przestrzennej
Województwa
Zachodniopomorskiego

Study developed for the pilot project:

1. Thermo modernization and an increase in the energy efficiency of the buildings under heritage protection law and in the protected areas of health resorts (Paweł Dura, Karolina Kurtz-Orecka, Halina Rutyna, Robert Ulass, Waldemar Waszkiewicz; 2018)
2. An energy audit to point out weak points in the lightning of the streets and public spaces, as well as to suggest optimal solutions for using RES to fix the existing problemsdr (inż. Tomasz Walski, 2017)

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Educating prosumers of third wave, who await not only economical, but also social and ecological benefits from energy transition, requires introduction and strengthening of proper habits in the society. Significant influence on those behaviors has the direct neighborhood of the inhabitants of cities, including housing environment and widely understood public space. Introducing RES and energy efficiency in those areas of life is one of the basic factors, which increase ecological awareness, while at the same time they are creating ecological attitudes of the users of urban space. Spatial planning could be a support for the third wave prosumers, since one of the basic aims of it is to realize the ideas of balancing and harmonizing the development. Rising the determined standard within sustainable development of the cities can't happen without fulfillment of certain criteria. One of those is the aspect linked to the environment protection, particularly with lowering the energy use and introducing alternative technologies in urban areas.

The following study presents the results from extensive research, analysis and field studies on public space, with using energy mix, realized as the part of pilot project. Based on those actions, concrete, tailor made solutions, tailored to the chosen area of Połczyn-Zdrój have been developed, and, as a consequence, they caused the creation of third wave of prosumers, or „aware” citizens.



A

Intoduction

Project Baltic Energy Areas – A Planning Perspective (BEA-APP) is implemented through Interreg Programme Baltic Sea Region 2014-2020, within priority 2 „Management of natural resources”. Project assumes actions for increasing renewable energy production in the region through improvement of the co-operation between public and private institutions during the planning process and through fulfilling needs of energy producers and consumers.

One of the main roles of the BEA-APP project is to conduct pilot studies addressing regional and local energy production with a primary focus on renewable energy. The topics of these pilot studies have been selected accordingly to reflect the wide range of renewable energy sources and their demands, including those connected with spatial management.

BEA-APP project partners from eight countries have conducted the following pilot studies:

- Geoenergy use in residential areas in Central Finland; Geoenergy is a prominent, new renewable energy source in the Central Finland region. Thus far it has only been used on a small scale. The main goal of this project is to identify locations which are planned for residential areas and to perform a detailed study of the utility of geoenergy.
- Energy mix in the town hall of Rõuge, Estonia. the Tartu Regional Energy Agency conducted a project, during which the town hall of Rõuge was renovated; this project included the increased functionality of this building through the use of RES installations.
- Green industrial areas in Mecklenburg – Vorpommern: an attempt was made to connect multiple industrial areas with different RES (RES used by local production companies). A dialogue forum for the companies involved has been created and research into the financing possibilities has been developed along with a marketing strategy.
- Sustainable energy in public spaces located in the town centers of the Central Functional Zone in the West Pomeranian Voivodeship based on the example of Połczyn-Zdrój: the primary focus of this project was to identify new methods for creating public spaces, where educational projects and urban investments would include RES (PP10).
- Increasing RES share in DH in Blekinge: the aim of this action was to find a way to use the surplus energy manufactured in Ronneby heating systems. During the course of this project, a report on profitability (both economical and social) was developed, as well as, a set of variants regarding the use of surplus heat in

planned residential areas.

- Increasing the RES share in DH systems in Kaunas: the aim of this project was to investigate the possibility of converting 100% of energy supply to the biomass (from wood processing) in DH systems in the city. The project investigated, among others, problems with communication and stakeholders' involvement in this kind of project.
- Increasing RES share in DH in Zeeland: similar to Blekinge, there is also a plan developed to utilize surplus heat energy from the local manufacturing plant. As a result there is a proposal of cooperation between the facility and the municipality.
- Urban planning for solar energy in Scania: The city of Lund (115.000 inhabitants) has been chosen as the project area. The city is planning a new district, Lund Sydvästra, where a new train station will be located. Assuring a big share of RE in the new district is an important matter during the planning process. that is why the local authorities are looking into new possibilities and solutions, like e. g. PV installations.
- Development of the off-shore wind farms in Blekinge: there are plans of building 500-700 wind turbines on the coast of Blekinge. During this pilot action, a preparatory study has been developed which investigates how these actions will influence future local and regional planning in various areas, such as, land use, transports, public services and the labor market.
- Development of the off-shore wind farms in Zeeland: a feasibility study for the location of wind turbines in Køge Bay has been developed. The project has been developed in cooperation with local investors in order to avoid any possible protests. The idea of this study was to find new methods of the proceedings during such actions. E. g. While searching for a proper location, the focus was set on local needs and interests.

The pilot projects contain a description of the uses and potential of RES in selected areas in addition to their recommendations – proposals for actions and studies which will show the use of this energy potential. The results can be used as basis for further actions, which will consist of: optimizing solutions, avoiding or conquering development barriers of RES, improving the quality of planning, as well as, improving the planning process. The results of the projects will be directed towards regional stakeholders, and additionally they will provide a summary of lessons learned, which will be of interest to other areas in and outside of BSR.

The following study is provided as a justification for the selection of West Pomerania as the project area. Additionally, a collection of conclusions and recommendations developed during the duration of the project: “sustainable energy approach in public spaces on example of Połczyn-Zdrój.”

The main aim of the project was to investigate the possibilities of using RES to optimize and improve energy efficiency while enhancing the quality of public spaces at Połczyn-Zdrój.

This study, due to its unique character, is also directed towards representatives of other local and regional units including: local clubs and societies, owners and managers of private and/or public buildings, entrepreneurs, energy companies, R&D departments in the field of energy efficiency.



B

Choosing the action area

The West Pomeranian Voivodeship is constantly monitoring the state of development of each of its counties, while implementing the appropriate tools for identifying any areas of deficit. After which they organize and prepare a plan for intervention. One of the actions included the delimitation and identification of an area with the most disadvantageous summary index of socio-economic development. This area is known as the Special Inclusion Zone (SIZ). By delimitation of SIZ, one of the criteria was the rule of accumulation of deficits in at least three problem areas from the catalogue, these include demography, technical infrastructure, access to public services, economical potential, so called post- PGR issues (PGR: State Agricultural Farm), poverty. SIZ is a basis for directing special support to the municipalities located in this area. Municipalities which are at a particular disadvantage are located in the central part of SIZ, where links to the surrounding area are very weak. In the Spatial Management Plan for the West Pomeranian Voivodeship, the Central Functional Zone (CFZ WV) has been identified as an area, which requires the integration of city potentials (Drawsko Pomorskie, Złocieniec, Czaplínek, Połczyn-Zdrój, Świdwin i Łobez). During the preparation of Self-governing contracts in the West Pomeranian Voivodeship, this Zone includes three counties: Drawsko, Łobez and Świdwiń.

The entire area is also a recipient of one of the main BEA-APP components: B. Optimizing spatial planning instruments for a sustainable growth of renewable energy, in which the Regional RES concept for CFZ is developed.

The CFZ has a large demographic potential – there are more than 140.000 inhabitants, and 80.000 of them live in the six main cities: Czaplínek, Drawsko Pomorskie, Łobez, Połczyn-Zdrój, Świdwin and Złocieniec. A small distance between these cities allows to take advantage of their combined potential. There is also a possibility of creating common, complementary labor and service markets, including investments, education and tourism, as well as a common potential for the production of energy from RES. Extended analysis and recommendations in this area have been presented in the aforementioned Regional RES concept for CFZ (a study developed for BEA-APP, WP 2.4, August 2018, ROFSP in Szczecin).

In November 2016, there was a three-day cycle of meetings held for the representatives of all municipalities in the CFZ. Over the course of those meetings, the representatives of the ROFSP presented objectives of the BEA-APP project and began a discussion about the state of RES in each municipality. As a result of those meetings and other on-site visits, a common problem was identified: an unsatisfactory quality of the public spaces in town centers in CFZ, which are the result of:

- low awareness by the inhabitants of energy efficiency of the local buildings,
- energy poverty,

- lack of dedicated support programs, which could assist the owners of buildings under the heritage protection act in the process of deep thermo modernization,
- laws restricting the transformation and renovation of buildings under the heritage and/or health resort protection act,
- lack of good examples developed within public spaces, which are both comprehensive and currently use RES,
- lack of DH networks, or technical limitations for creating these networks in the city area, particularly in areas under the heritage protection act,
- limitations and barriers in the functional development of the center- including those connecting the central area with its neighborhood.
- Extended analysis has been made for main centers of CFZ, regarding percentage of central heating installations and use of gas in households (see table below).

INDICATOR (in 2015)	Łobez	Drawsko Pomorskie	Złocieniec	Czaplinek	Połczyn- Zdrój	Świdwin
inhabitants	10 404	11 761	13 190	7 158	8 327	15 553
number of households	4064	4 559	5 152	2 796	3 253	6 075
gas consumers in cities (households)	2 613 (64,3%)	3 416 (74,9%)	3 717 (72,1%)	2 032 (72,7%)	714 (21,9%)	4 537 (74,7%)
apartments equipped with central heating instalation - in % of all apartments	89,6	86,6	82,2	85,9	76,6	85,9

The result of the analysis in Połczyn-Zdrój shows, that the smallest percentage of apartments equipped with central heating (71,6%) and the smallest rate of gas consumers compared to the number of inhabitants (21,9%) is there. Because of using the individual heat sources, which cause the low emission, it has been decided to undertake actions leading to increase of energy efficiency, implementation of RES, as well as conducting the wider analysis for chosen area of intervention linked to the area of spring park and health resort.

The main centers in the CFZ have been analyzed. Due to all of the above mentioned problems which exist in the city of Połczyn-Zdrój, it has been appointed as the pilot project area (a detailed description of the pilot project area can be found in chapter C.). Preliminary assumptions of the project have been presented at the meeting in Drawsko Pomorskie in December 2016, during a workshop about profits for local government units gained from the use of RES.

As a result of extended analysis, RPFSP (PP10) appointed a specific area and developed a pilot study in order to determine the optimal renewable energy mix in this specific area. It also developed a set of actions, which focus on the "prosumer" approach (particularly prosumers from the Third Wave, who will expect not only economical, but also social and ecological benefits), growth of citizen awareness and growth of social acceptance in the development of RES. The proposed actions will initiate the energy transition of this specific area, as well as, provide recommendations for other centers, which face similar problems in their public spaces.

A letter of intent for will of co-operation during the pilot project has been signed and agreed upon by the Director of the ROFSP and the Mayor of Połczyn-Zdrój.



Świdwin

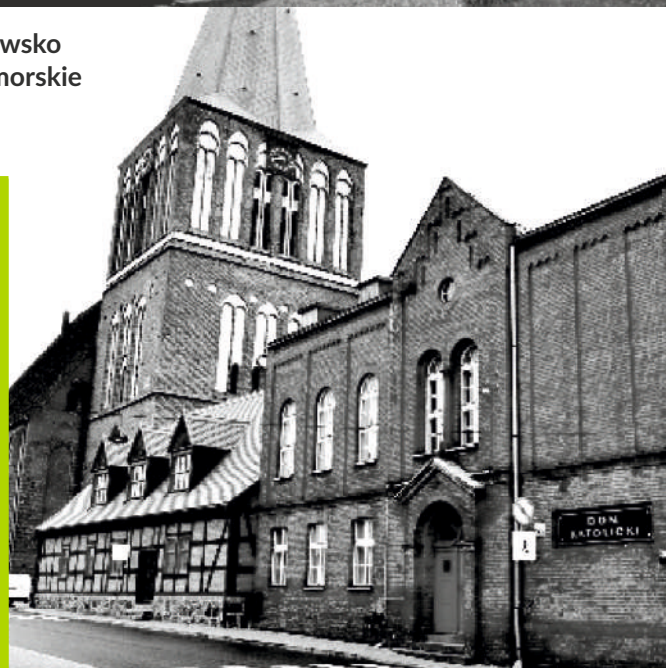


Złocieniec

Drawsko Pomorskie



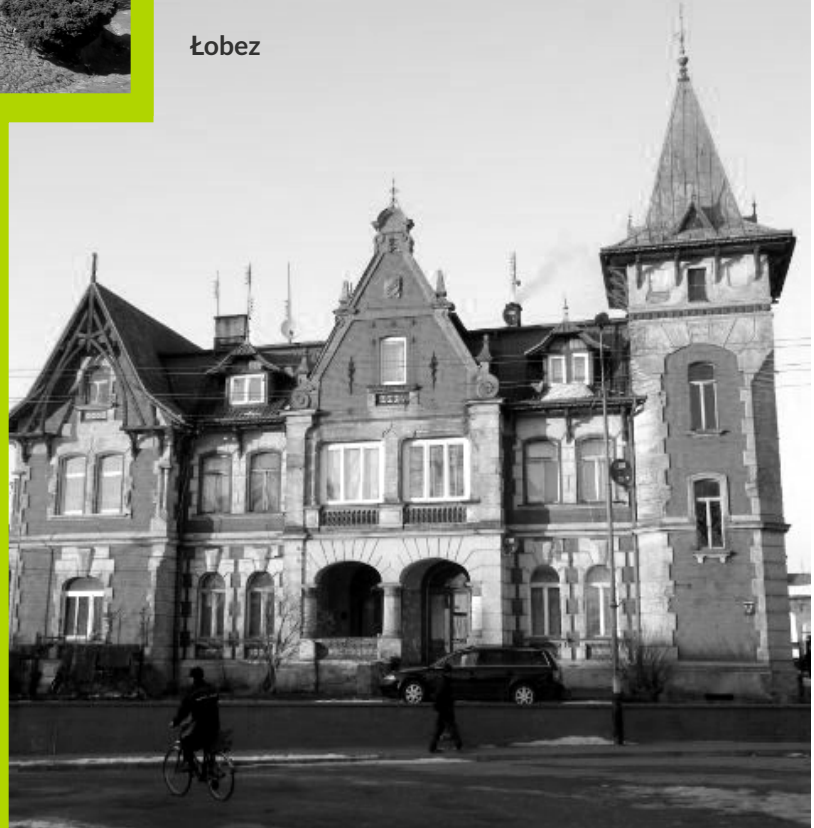
Połczyn-Zdrój



Łobez



Czaplinek





Photos 1 and 2, Workshop „Profits from RES for local government units”, 14.12.2016 r, Drawsko Pomorskie

On 27 March 2018, the Regional Office for Spatial Planning of Westpomeranian Voivodeship in Szczecin organized a study trip for students of the West Pomeranian University of Technology to the city of Połczyn-Zdrój. The activities focused on topics related to improving the quality of life of the city's residents and improving the quality of urban space using renewable energy sources. The theme of the students' work in the fields of Landscape Architecture and Spatial Management will be creating a concept for the development public spaces in Połczyn-Zdrój using renewable energy sources. The result of the meeting led to an analysis of the possibilities of increasing tourist attractiveness to the city centre, attracting more spa residents, and indicated guidelines for inventory of the area covered by the pilot project. The concepts developed by the students were submitted to the municipality in order to be displayed and presented for a wider audience in the municipality office building.

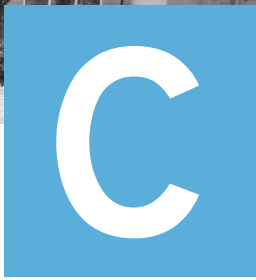
On 11th April 2018 in Połczyn-Zdrój (Regional dialogue meeting), a meeting dedicated to "Methods of thermo-modernization of buildings including RES located in the city of Połczyn-Zdrój" was discussed by conservation and spa protection officials. The meeting took into account the possibility of using devices to obtain energy from renewable sources. A study was carried out as part of a pilot project. The meeting was attended by 26 people, including representatives of the municipalities of the Central Functional Zone, Ewa Stanecka - Westpomeranian Conservator of Monuments, representatives of real estate management and design offices, and Ms Karolina Kurtz-Orecka - a representative of the Consortium of contractors of the study.

The following issues, related to the thermal modernization of construction objects covered by conservation and spa protection, were discussed:

- formal and legal basis for the process and energy intensity issues of small urban centres on the example of Połczyn-Zdrój,
- practical, technical and technological solutions for deep thermo-modernization,
- recommendations for thermo-modernization and the use of renewable energy sources.

One of the most important results of the meeting was working out a common statement which included comments from the conservator of monuments to the assumption of the pilot project.

During the project lifetime, the following stakeholders actively participated in meetings and project implementation: representatives of Regional Office for Spatial Planning of Westpomeranian Voivodeship, external contractors, mayors and administrative representatives of the CFZ municipalities, Westpomeranian Monuments Conservator and the representative of the regional conservator's delegation in Koszalin, the representatives of the spatial planning department and specialists responsible for infrastructure in the city, representatives of municipal real estate management offices, students and representatives of residents (municipality councilors).



Description of the pilot area

Połczyn-Zdrój is a city located in West Pomeranian Voivodeship, as well as a part of the CFZ, in the Świdwin county. It is the seat of the urban-rural municipality. According to data from 31.12.2017, there were 8 181 inhabitants in Połczyn-Zdrój, which places it in the 27th. position of West Pomerania.

The city is designated as a health resort, which limits the spatial planning possibilities. These limitations are connected to the development of manufacturing functions, obtrusive services and other forms of activities, which can have a negative influence on the health resort. Part of the Drawsko Landscape Park is situated within the borders of the municipality, as well as, protected Nature 2000 areas. These conditions determine the main direction of the municipality's development, which is focused on its attraction to tourists. The health resort status has a strong influence on the restrictions of spatial management.

Due to the uncontrollable spatial management of the city, as well as the energy consumption of the buildings within the downtown area, there is an indirect influence the deterioration of the environment. In particular the deterioration of air quality, which leads to a danger of losing the current attraction of this place, in addition to potentially losing its status as a health resort. Actions leading to the preservation of the quality of environment are a main priority, and should be realized not only by climate protection of the health resort, but primarily through the use of properly conducted revitalization of the buildings. This would lead to an increase in their energy efficiency. The revitalization should increase the share of low-emission energy sources in the energy management of the city.

The main task of developing development strategies in the smaller cities (like Połczyn-Zdrój and the rest of cities in CFZ, except for Świdwin, which is considered a middle size city) is to identify the crisis areas and to connect them with the main city-forming factors. Maintaining the city-forming function of the city can be performed by defining the main directions of the revitalization actions. In the case of Połczyn-Zdrój, a main tourist function is connected to the health resort function (in context of therapeutic tourism). However, since the health resort is self-sustainable, it doesn't attract any tourism to the city center. On the other hand, high levels of low emissions, caused by the high energy demand of the existing urban planning structure cause a threat to the function of health resort in addition to the fuel use for the living needs of inhabitants and high noise levels. The existing condition of the buildings and the space in the oldest part of the city (including energy demand, rising losses in the buildings, development of the free spaces) also influence and loosen the bonds between the city and the health resort, which puts a limit on the services provided by the city for the health resort (commerce, culture, accommodation services, other services for tourism) and in addition limits the flow of finances, which in turn intensifies the crisis of the space in the city centre. Interim

revitalization activities, without the system approach, are not able to stop the increasing degradation of the links between the institutions, which are becoming more and more independent, particularly in the situation of broadening of the offer by the health resort. It is necessary to maintain and increase the flow of patients between the city and the health resort by increasing and revitalizing their interest in urban spaces not only through providing services, but also by creating a safe and attractive space to spend their time.

In this context, a vital part of forming public spaces is their illumination. This influences the feeling of spatial order, safety and comfort to anyone who spends time in these spaces, whether they are using public communication routes or inhabitants of the adjacent buildings. Lighting also plays a role in providing information, promotion or warnings. Improper planning of lighting systems can lead to a phenomenon known as “light pollution” (see chapter D.2) which can have an influence on the low energy and economic efficiency of the solutions.

From this perspective, the actions of the municipality should focus on:

- improving the aesthetic of the downtown/old town area,
- improvement of energy efficiency in downtown/old town space in all aspects, including illumination of public spaces,
- introducing energy from RES and emission free energy into the energy balance of the buildings,
- actions leading to limiting the voids in the buildings and developing projects for existing undeveloped plots,
- conducting continuous monitoring of the air quality and an assessment of increasing the energy efficiency in the revitalization process – both on an urban and architectural scale.



Photo 3. Plac Wolności.
Źródło: ROFSP WZ in Szczecin.



Photo 4. Grunwaldzka street.
Source: ROFSP WZ in Szczecin.

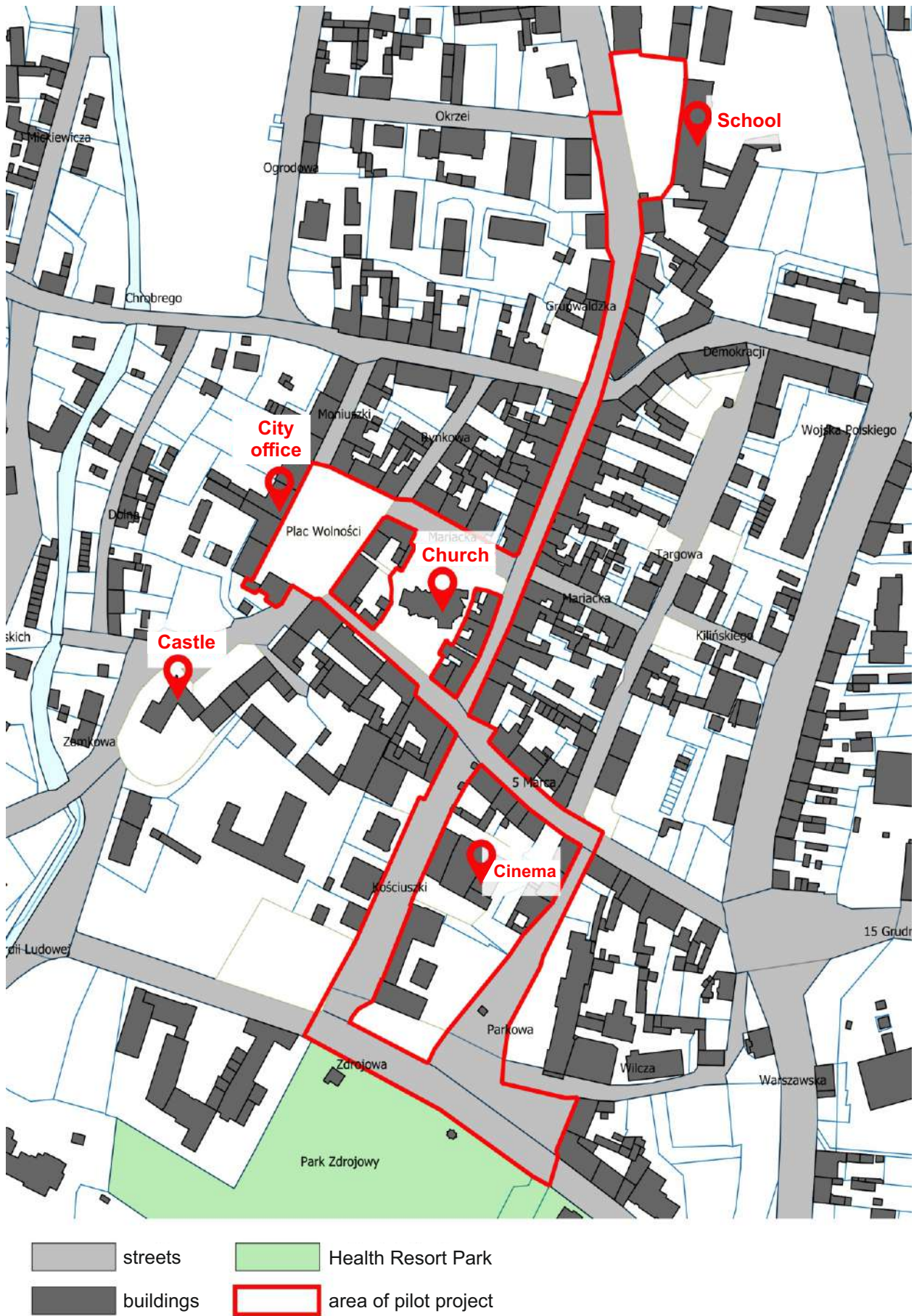


Fig. 1 Pilot project area
 Source: ROFSP WZ in Szczecin.

In the end, area of 3,8 ha has been chosen for pilot project. The area is situated between the following streets: Parkowa, Zdrojowa, Grunwaldzka, Kościuszki, 5 Marca, Mariacka and Plac Wolności. Streets Parkowa and Kościuszki connect Spring Park, located in the southern part of the city, with the downtown. Part of the Grunwaldzka Str. is excluded from the traffic and is pedestrian only area. At the end of this street a ground school is located. Plac Wolności is the heart of the old town, there is i.a. Municipality Office, and directly next to it, there is a medieval duke castle and Mary Immaculate church.

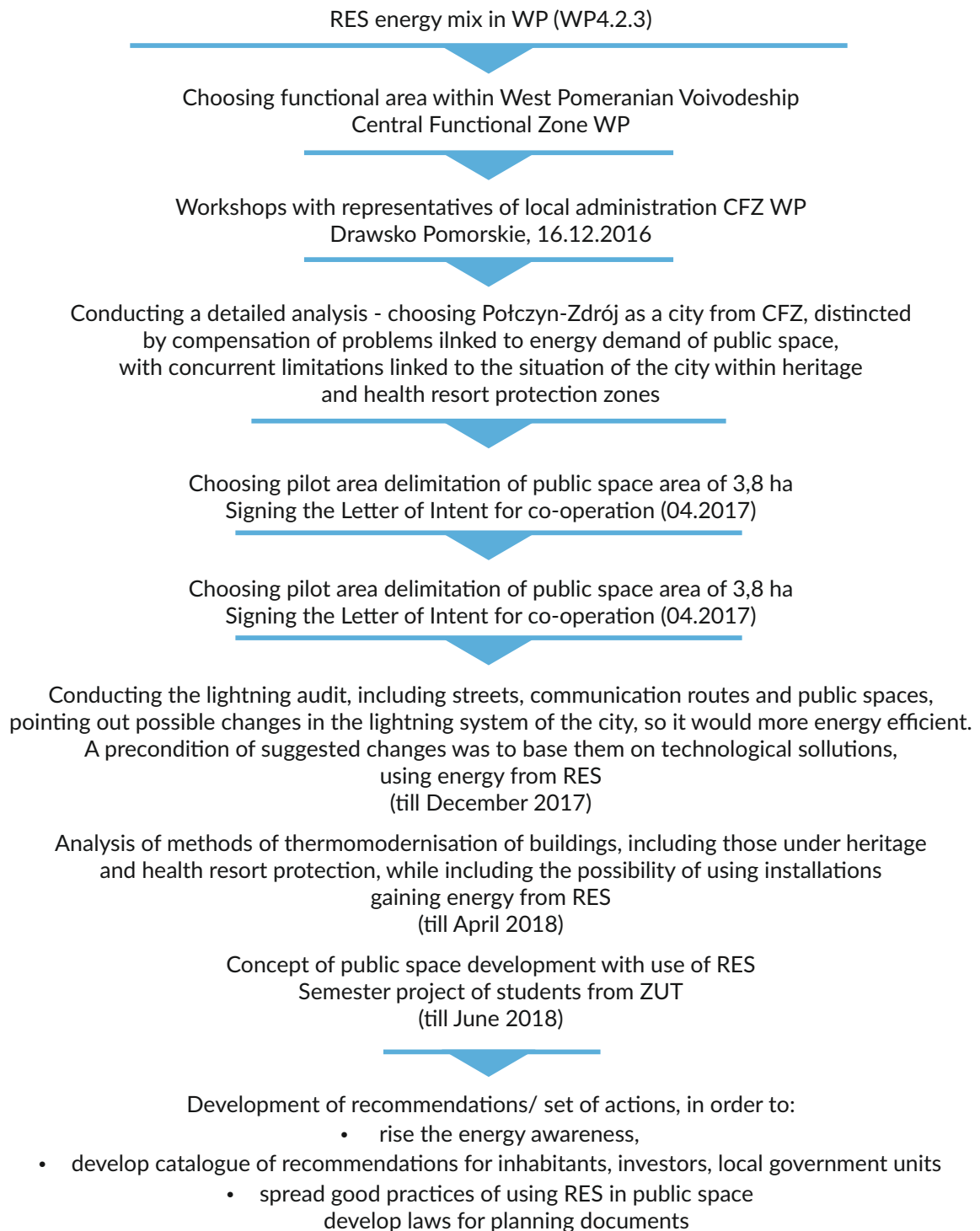


Fig.2 Pilot structure.
Source: ROFSP WZ in Szczecin.



In-depth analysis of public space area in Połczyn-Zdrój to scope the possibility of using RES

The pilot project consists of three parts, which propose to answer the challenges and problems connected to the energy consumption of small cities, space management and life quality of the inhabitants in relation to the use of RES and the process of transition into a low-emission economy:

1. The first section provides an answer to a problem which exists in many cities in Poland, i.e. thermo-modernization and an increase in the energy efficiency of the buildings under heritage protection law and in the protected areas of health resorts. This part of the project not only proposes specific technical and technological solutions, but also increases the awareness of the authorities, stakeholders and citizens which are affected by the project.

There is an undeniable necessity for sustainable planning of these spaces, due to the worsening condition of the environment, observed climate changes and to ensure the safe conditions for life and development for future generations. These are the main reasons behind the formal upheaval, which is currently being integrated into the architecture¹, in addition to historical protection. This upheaval is connected to **space and energy management**. Modern technological facilities, which give us the possibility to maintain an almost perfect comfort level in microclimate of buildings alongside the diminishing technical quality of the buildings creates a significant environmental impact. It is estimated, that the construction industry is responsible for using about 40% of energy generated by the EU and for the emission of 37%^{2,3}, of pollution. This is therefore one of the most promising areas, where steps for a significant reduction in energy use and emission can be implemented. In this context, lowering energy needs is one of the most important challenges of the 21st. century, both in terms of economy and politics.

The technical solutions currently used in historical buildings result in high energy demand, mostly due to heating. This leads to high maintenance costs (Fig. 2). Financial and aesthetics are the main reasons for low competitiveness supporting the modernization buildings, where many technological and infrastructural facilities are available. Improving the living conditions of these buildings is restricted in many ways, since many of them are located in one of the

¹Rahm Ph., Forma i funkcja wynikają z klimatu (2005) [www.http://teoriaarchitektury.blogspot.com/2017/12/philippe-rahm-forma-i-funkcja-wynikaja.html](http://teoriaarchitektury.blogspot.com/2017/12/philippe-rahm-forma-i-funkcja-wynikaja.html).

²Energy Balance of OECD Countries 1999-2000; OECD-IEA; Energy Outlook 2002; OECD-IEA.

³Dyrektywa Parlamentu Europejskiego i Rady 2010/31/WE z dn. 19.05.2010 r. w sprawie charakterystyki energetycznej budynków, Dz.U. UE L (2010) 153/13.

following protected zones – heritage or health resort protection.

Standard renovation of old buildings to meet the modern expectations is a common problem for their owners. The technologies and materials, which were commonly used during their construction, as opposed to the current methods seem old and inefficient.

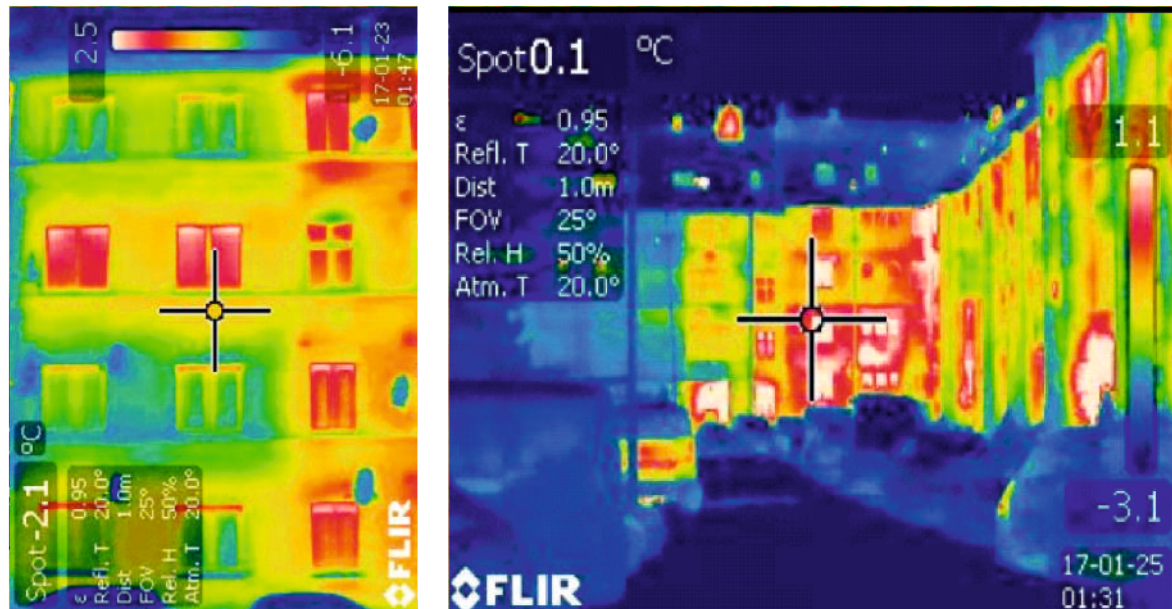


Fig.3 Thermal quality of surface of houses from turn of 19th. and 20th. century (photo by K. Kurtz-Orecka)

According to the low-emission economy survey conducted by the Mayor of Połczyn-Zdrój, all buildings located in the old town are being supplied with heat from individual heat sources:

- 41% of properties have embedded local boiler rooms (most likely situated in the basements, directly underneath the premises),
- 35% of heat sources are located directly in rooms – tiled stoves, etc.,
- 20% – various types of gas boilers,
- 4% of sources are electrical storage heating installations.

Energy awareness of the users

Results from a survey about low-emission economy as well as the author's own research have allowed to arrive to the conclusion, that there is a drastically low awareness of the energy usage in the building and energy efficiency by the the building users and building managers. This has been observed by:

- lack of energy conservation, shown in the daily behavior of the users. Additionally, a complete disregard for small solutions by buildings' managers (e.g. lack of habit of closing the doors in the common spaces),
- numerous examples of damaged glass and insulation in the basements and attics, as well as common staircases and passages,
- long-term lack of repairs, which are supposed to seal and insulate areas, which are not heated.

This part of the project is supposed to help the administrators, managers and citizens to understand the advantages of the prosumer approach better, and to demonstrate real technical RES solutions, in order for them to gain economical and ecological benefits.

2. The second part of the project concerns the lightning of public spaces.

An energy audit has been developed in this part of the project. It is supposed to point out weak points in the lightning of the streets and public spaces, as well as to suggest optimal solutions for using RES to fix the existing problems.



Fig.4 Light pollution in Połczyn-Zdrój. (photo by Dr Eng. Tomasz Walski)

This action was supposed to broaden the catalogue of solutions in using RES mix and to raise the awareness of RES regarding lightning in public spaces. This action is directed mainly towards decision makers, but in long term perspective it should also be directed towards citizens, in order to change their understanding and acceptance of RES in public places.

The following problems have been identified in the area and solutions regarding the lightning of public spaces have been suggested:

- energy efficiency – there are technologies on the market, which can successfully replace existing light sources; as an effect of these changes in accordance with the modernization of lightning, the electric energy use and the power of lightning points can be lowered by a level of 64%;
- economic efficiency: - Using new technologies will enable the financial returns within 12 years and further use of lightning infrastructure with lower maintenance costs.; changing tariff group doesn't require any expenditures, and it would bring 10% savings a year in energy distribution costs;
- ecological efficiency – choosing LED technology with a programmable power control of light source, to permit lower lightning conditions during so called „late night”. This will cause a reduction of gas and dust emissions by about 64%. By introducing the investments related to signaling and information based on RES, despite a necessary increase in energy demand, will not cause increased air pollution in the city.
- lightning control – the implementation of new settings using digital astronomical programs will provide an option to schedule on and off times for the lightning; These times will be directly correlated with sunrises and sunsets and the so called sense of “darkness”;
- safety in public space – LED technologies enable a color rendering index of 80 and higher, which means that space and color perception is similar to daylight; it also improves the picture from CCTV. From a tourist's point of view, the attractiveness of such spaces are much better;
- light pollution – the level of light pollution caused by street lamps and other light sources is dependant on the construction of the light fixtures, and more precisely in the way, the light stream is directed by them; the best fixtures are ones that do not direct the light in unnecessary directions, particularly upwards; however each

artificial light source placed outside of the building increases the light pollution; with the current lifestyle of modern societies it is impossible to eliminate night lightning completely, but a rational use of this lightning can reduce light pollution, and also provide safe energy; Existing fixtures currently used for sodium-vapor lamps can be replaced with LED light sources to help to direct the light in the appropriate direction without the use of reflectors.

3. The third part of the project plans to increase energy awareness regarding RES among the youth and students. For this part of the project, students from the West Pomeranian University of Technology in Szczecin were invited. This action focused on creating the prosumers approach (third wave) among the students, who developed projects regarding RES and public spaces in Połczyn-Zdrój for their semester projects. Their works were presented as an exhibition in the Municipal Office in Połczyn-Zdrój.



Photo 5,6. Students' study visit in Połczyn-Zdrój

Among the solutions suggested in the projects, the following are worth mentioning:

- solar benches with chargers for small electronic devices,
- luminescent paving stones – during the day they look like regular concrete stones, but in the dark they illuminate (these could also be used for bicycle paths) – they could mark important routes in the city,
- solar lamps placed in the ground, illuminating small architecture and plants,
- solar panels in city lightning installations,
- multimedia screens with tourist information, trivia about the city etc.,
- „green walls” – climbing plants growing on the „blind” walls, which can be seen from far away,
- bicycle stations powered by solar panels,
- compost trash can – collects biowaste, like fruits, paper or food that people throw away. Bioreactive substances, based on photocatalysis, can be placed in the trashcan to help turn the waste into compost; these substances also eliminate odor and speed up the composting process.

Examples visualization of urban spaces in Połczyn-Zdrój which use RES:



Visualization of Plac Wolności, project developed by Olga Augustyniak, Ilona Jabłońska, Karolina Jakubaszek, Marta Nadolna, Magdalena Kujawa



Visualization of part of Grunwaldzka street and school area in Połczyn-Zdrój.
Authors of the project: Daria Pelczyk, Alicja Wiśniewska, Michalina Kaczmarek, Kacper Maksymczuk, Jakub Przespolewski, Przemysław Kawecki

Best practice examples in using RES in public spaces:



Example 1. Frameless photovoltaic on the roof of the church of Saint. Peter and Paul in Ettingen
<http://www.rkk-ettingen.ch/ueber-uns/kirche-st-peter-und-paul.html> ,



Example 2. photovoltaic on the roof of the church in Greiswald (Dorfkirche- Wieck)
https://commons.wikimedia.org/wiki/File:Greifswald_-_Wiecker_Kirche.jpg



Example 4. Solar Roadways Panels. Solar Roadways is a modular system of solar panels that transforms street surfaces into smart, energy-generating infrastructure
<https://collection.cooperhewitt.org/objects/2318795878>



Example 3. An illuminated bike path made out of swirling solar-powered LEDs and light-collecting paint, Eindhoven, Holland
<https://inhabitat.com/roosegaarde-studios-bike-path-is-a-twinkling-road-inspired-by-van-gogh/>



Example 5. the Solar Trees in Mexico City
The solar-powered lamppost shaped like towering palms is illuminating a pedestrian street downtown
<https://www.zdnet.com/article/solar-trees-shine-on-mexico-city/>



Example 6. Solar panel windows
<https://www.verdict.co.uk/solar-panel-windows-polysolar-power-generation-city-centre/>



Set of actions for self-government administration, institutions, local societies and investors regarding the implementation of actions connected to the use of RES and influencing the energy transition of public spaces

The initial analysis for the possibilities for implementation of RENEWABLE ENERGY SOURCES in public spaces located in the centres of the Central Functional Zone of West Pomeranian Voivodeship has already shown that the ability to use various forms of RENEWABLE ENERGY SOURCES must be preceded by pro-efficiency actions. An overriding need for comprehensive energy efficiency improvements was identified and in the end would allow for the application of various RENEWABLE ENERGY SOURCES solutions. At present, the barrier for such activities are expensive and there is often a lack of information about possible solutions.

A superior recommendation, received over the course of the work, was the necessity to focus significant financial assistance funds for action in energy efficiency combined with the use of various forms of RENEWABLE ENERGY SOURCES.

In May 2018 similar proposals were presented in a report "Fighting Smog: Energy Efficiency and Anti-Smog in Single Family Buildings in Poland", developed by the World Bank, on behalf of the European Commission. They were concerned with reduction of air pollution originating in the low emission sources that are generated by the single-family sector in Poland. Development has been carried out on the basis of experience gained in the Lesser Poland Voivodeship and the Silesian Voivodeship, but it has a universal application for the whole of Poland, particularly in areas such as the Central Functional Zone. It's worth paying special attention to the consistency in our observations that "it is essential to coordinate the use of public funds from the government and EU at both the national and regional levels, and it is recommended that a National Fund for Anti-Smog and Energy Efficiency be established to pool various funding resources" as well as the fact that "technical assistance, capacity building, and public education and awareness campaigns are critical to the success of the anti-smog and energy efficiency program".

The main premise for the development of the use of RENEWABLE ENERGY SOURCES in public spaces was implemented during the project recommendations decided upon out within the project.

In particular, chapter E (Set of actions for self-government administration, institutions, local societies and investors regarding the implementation of actions connected to the use of RES and influencing the energy transition of public spaces) is based on results from discussions with decision makers and stakeholders on smart, local renewable energy mixes in central areas.

During the project lifetime, issues were raised related to the preparation of a common energy strategy, utilization of RES in the energy consumption of buildings and space, management of public space in the context of its lighting, as well as, raising energy awareness of the local community.

Key findings are also included in the document "Statement on creating and supporting conditions for the development of local renewable energy" approved by all representatives of communes, counties and the Marshal of the Westpomeranian Voivodeship.



E.1.

Municipality as leader in promotion of energy efficiency

In the current energy revolution taking place in construction sector, it is necessary to know basic rules of energy needs of the buildings, what interactions occur inside those buildings and what are the possible improvements to their energy efficiency by implementing multidisciplinary approach on different levels. The overall aim is to reduce energy use, improve energy efficiency and limit the emission of harmful substances into the atmosphere.

The preparation of local governments and the role of their leaders in shaping the social attitudes of energy saving is not sufficient. In most cases, there are no separate structures in the administration, dedicated to energy management. Issues linked to the *energy demands of the buildings, energy gain on both the macro scale and for single apartments* – are still marginalized and are not regarded as strategic for the municipality, when compared to other statutory obligations of the municipality. There is a lack of full understanding of the processes, which occur in the public space, including buildings (particularly historical or those located in protected areas). This can lead to non-viable, even harmful, solutions both in the development process of the strategy, and for each step of the investment process.

In order to prepare local administrations with their mission to improve energy efficiency, the following actions are recommended:

- ✓ analysis of the structure of local government unit – specifying departments responsible for energy management in the unit, methods of information collection and flow, implementation of procedures, competencies and qualifications of personnel (including a multidisciplinary approach to energy issues), frequent actions to improve qualifications and update the current knowledge;
- ✓ regarding the size of the aforementioned cells – support for teams in the area of complementing the knowledge in associated fields, particularly of the personnel responsible for drafting and giving opinions for and those that issue the conditions for implementing actions in the buildings;
- ✓ progressive increase in the qualifications and awareness of the personnel responsible for the preparation of development conditions for buildings and areas.
- ✓ drafting opinions for concepts and project documentation for other resolutions (long-term impact) in the fields of energy management and pollution emission, according to the maxim⁴: *hundred years after us, when we are forgotten, those, who never heard of us will have to live with consequences of our actions*;
- ✓ establishing cooperation with experienced external units who have a thorough understanding of energy efficiency and RES (universities, research institutions, other advisory units) in order to share their knowledge and innovations.



The main role of the local government in the creation of high energy efficiency also requires the implementation of sustainable development in their own structures and realization of actions leading to a maximum reduction of the environmental impact of buildings used by them (reduction of emission and energy intensity). This stems directly from the EPBD2010 Directive .

In order to implement these revitalization actions, both in bigger area, as well as, in single buildings, requires a close cooperation of all administrative units and participants of the investment process. The revitalization process should include third parties, ideally those with no connection to the investments or actions. They should be informed about the progress of the action and/or engaged in small activities pertaining to the project. This will allow us to strengthen the results of raising awareness about the process and its influence on the surrounding areas.

The view and landscape of the area where this action will take place will change for the better, which will lead to better identification with the place, not only in case of the inhabitants, but in case of visitors as well – in my neighborhood.../ in the city I've visited in my region.. This approach requires positive strategies and methods of communication between the local administration and the citizens it serves, as well as tourists, patients and other users of the space.

⁴Holmes'a: A hundred years after we are gone and forgotten those who have never heard of us will have to live with consequences of our actions (...) - Hegger M., Fuchs M., Stark T., Energy manual: Sustainable Architecture, Birkhäuser, Basel – Boston – Berlin, 2006.

E.2.

Detailed recommendations regarding an improvement of energy efficiency of the public spaces

In order to improve the energy efficiency of the buildings and to reduce the emission of pollution, it is recommended to implement complex thermo modernization actions, which include energy efficiency of housing, technical systems and the introduction of RES in order to fulfill some parts of own needs. Complex solutions, which include the entire modernization of the building with heating and cooling systems, a local energy management system and introduction of RES – will allow us to achieve the energy, economic and environmental aims of the thermo modernization investment⁵.

In regards to buildings located in the heritage protection area, it is suggested:

1. in terms of the project:

- ✓ to conduct an energy audit, which will define the direction and range of thermo modernization, as well as, provide parameters of the adopted improvement and expected costs of their realization;
- ✓ to conduct an analysis (using simulations) of the amount of energy yield from RES installations;
- ✓ in the case of planning the ground source heat pumps, it is necessary to conduct initial geological research, to assess the local conditions of the area and their heat exchanges and the estimated overall energy efficiency;

2. in terms of implementation:

- ✓ a prohibition of modification (regarding the basic planning documentation), particularly in the case of insulation materials and so called constructing chemistry as well as, prohibiting the use of solutions other than those planned in the terms of installation technique and energy sources;
- ✓ in thermo modernization actions regarding the replacement of windows, glass partitions and/or replacement of glass units with new ones, it is required to describe in full detail all of the characteristics of the glass (including solar radiation transmittance index g_n), and the internal insulation method regarding overheating during summer;
- ✓ conducting research regarding airtightness using a fan method during the final steps of the thermo modernization;

3. in terms of planning, including shaping of the space:

- ✓ a necessity of keeping the continuity of buildings, regardless of their protection status (whether they are included or in the monuments database or not);
- ✓ prohibition of raising the height and/or ridge of buildings, with a permissible exception to the height, when it is a result roof insulation;
- ✓ maintaining the parameters and details of the facades, interiors and other items of cultural value;
- ✓ including modern utilitarian infrastructure where applicable;
- ✓ permitting the possibility of realizing thermal insulation through the use of new layers of cladding on the outside of historical buildings, even those located in the heritage protection area. Albeit, these must be stripped of details, or have details with low value;
- ✓ in the case of full thermo modernization – it must be considered that a change to the

⁵Lewis J.O., Hógáin S.H., Borghi A., Building Energy Efficiency in European Cities. Cities of Tomorrow – ction Today. URBACT II Capitalisation, May 2013.

original building line will occur in width as a result of the thickness of thermal insulation layer and new plaster on the outside of the building;

- ✓ permitting the modification and renovation of non-habitable attics for habitable purposes, by providing lightning through roof windows, while at the same time prohibiting the construction of new dormers or other significant changes (only expiation being permitted in the adaptation of the partitions according to the law, particularly in terms of moisture and heat requirements),
- ✓ covering the facades of modern buildings, which interrupt the cultural context of the old town, with an external structural facade (double facade solution), in order to mitigate the dissonance in line of buildings and to improve the thermal insulation conditions;
- ✓ allowing for the construction of roof installations to existing building, in order to gain energy from RES, while making the adapted solutions (typical installations/special solutions) conditional on the visibility of roofs from the level of communication routes.

Regarding the improvement of lightning in public space:

- ✓ conducting regular analysis of the quality of street and public space lightning and indicating the directions of actions in order to re-adapt to the new norms;
- ✓ developing a complete, consistent and unitary concept of lightning of all streets and other public areas based on lightning requirements. Function analysis in the spaces of the city, including specification of the main transit and local routes;
- ✓ minimizing the light pollution of the space with artificial light from dusk till dawn. This is an important step during the realization of illumination of buildings and local areas;
- ✓ replacement of lighting sources using solutions which reduce the scattering of light onto the facades of houses;
- ✓ using energy saving technologies which also reduce the CO₂ emission, and are based on RES;
- ✓ using modern light steering systems;
- ✓ implementing an urban information system which operates with the use of RES.

In terms of institutional actions, including the raising of awareness and social acceptance, it is recommended:

- ✓ to strengthen existing or creating new (in the case of there being none) cells or separate positions, which would deal with energy planning and management in the area of the local government unit; actions in the area of energy planning and management should only be delegated to people who have the proper qualifications;
- ✓ improving qualifications of employees and officials linked to the spatial management, property management and environment protection by offering trainings in the field of conducting the investments of thermo modernization (with RES);
- ✓ creating information exchange platforms informing of the best practices in the field of thermo modernization (this can also be performed in the revitalization process) and the use of RES;
- ✓ increasing the openness and flexibility of different forms of cooperation amongst private operators by creating public - private partnerships for the purpose of creating investments leading to an increase of energy efficiency;
- ✓ introducing actions linked to raising awareness among the citizens and other users of public space in order to increase the acceptance for thermo modernization actions and RES – promotional and informational actions;
- ✓ raising the awareness of building owners regarding the increase of their real estate market value after deep thermo modernization and renewal/revival of the space in its

surroundings. For example an investment can be made in leisure activities (in case of cities with developed tourist infrastructure), area attractiveness and finally by promoting a positive change to the image of the entire city;

- ✓ **undertaking actions for creating positive growth-oriented attitudes in everyday use of the space, as well as, in the thermo modernization process itself, since the success of the undertaking is dependent on the habits and behaviors of the users;**
- ✓ conducting campaigns, which focus and inform of the energy loss – mainly in public and apartment buildings, in the form of reporting any failures, noticed anomalies. This will shorten the time of identifying the causes of energy loss and, at the same time, help to save energy due to faster repairs;
- ✓ creation and preservation of partnerships with stakeholders: the aim is to include local societies to promote a wider social participation in the revitalization and thermo modernization actions. In order to strengthen and maintain the effectiveness of revitalization, it is necessary to have strong and lasting partnership between different subjects involved in this process, particularly in the implementation and assessment of the energy effects in the revitalization process;
- ✓ enabling wide access to knowledge, trainings, and possibilities of improving competencies, as well as, cooperation of the society in the field of thermo modernization and increased energy efficiency;
- ✓ supporting the educational and informational systems in the field of implementation and financing new thermo modernization techniques and technologies;
- ✓ developing, promoting and implementing local recommendations for minimal requirements of RES energy use in renovated buildings and buildings during the thermo modernization process;
- ✓ undertaking integrated plans of a wide and complex approach to thermo modernization – the realization of single investments does not bring the desired result on the urban scale; actions which include a wider spatial range also allow for lower investment costs since they avoid the repetitive procedures involved both on the side of orderer and the contractor (e.g. preparation and initiation of the tendering procedure).

Moreover, in terms extending thermo modernization, which is linked to supporting and developing RES it is recommended:

- ✓ to work out system conveniences for investors pursuing to build or modernize buildings with the use of locally produced materials, which can give a measurable savings on the energy embedded into constructions in the context of the full life cycle as well as in the transport of said materials. This will also have the benefit of stimulating and developing the local labor market;
- ✓ to encourage entrepreneurs to continue in the development and production of technology using energy from RES in order to diversify the structure of RES mix as much as possible;
- ✓ to implement conveniences in terms of energy production from RES for local and regional small to medium enterprises along with new possibilities for development and employment – Shaping local policy to promote small to medium enterprises which produce and use energy from RES for their own needs and/or those which sell the surplus of energy;
- ✓ to develop monitoring and assessment instruments which will increase energy efficiency, and enable the assessment of the quality of conducted investments.

E.3.

Recommendations in terms of including issues linked to energy efficiency, including thermo modernization, and using RES in programming, strategic and planning documents

Improvement of energy efficiency, including the realization of so called deep thermo modernization of urban tissue, improvement of energy efficiency of city's technical systems and buildings, a process of replacing the solutions based on conventional energy sources with RES (in this context, promotion of RES) should be reflected in programming, strategic and planning documents, as well as in the revitalization plans.

indicating any crisis/problematic areas regarding energy management which should particularly include an analysis of the technical and energy condition of buildings in those areas, in the form of a city (unit) audit or expert opinion, e.g. thermographic. At the same time, research about the concentration of air pollution should be carried out.

The revitalization program or local revitalization plan along with the deep thermo modernization program should be one of the most important tools for introducing changes in urban areas of territory units. Such an approach requires the organization of efficient coordination – anchored in the development of a management unit in the city and its structure, e.g. by integrating a department for energy management within its structure or by giving those tasks to another institution.

Regarding the above mentioned improvements to programming, planning and project actions, it is recommended to:

- ✓ conduct analysis (also in files) of the local potential and inventory of restrictions and threats in terms of energy gain from RES, e.g.:
 - ✓ energy – cost analysis of wind energy micro installations (up to 40 kW of installed power), presuming a possible realization in urban areas with low density of buildings,
 - ✓ initial geological research in the area, including the expected amount of energy to be gained from ground heat pumps,
 - ✓ profitability analysis of energy supply for the unit using geothermal installations and using HDR (Hot Dry Rocks)⁶ technology,
 - ✓ analysis of improvement of efficiency in using the available net heating and the use of public district heating by final consumers⁷.
- ✓ elaborate and implement a municipal plan of deep thermo modernization with RES use for the improvement of energy efficiency of urban tissue;
- ✓ clarify structures and methods for implementation management of the municipal thermo modernization program associated with revitalization;
- ✓ organize a system of regular monitoring and assessment of the municipal program in the improvement of energy efficiency and RES use, as well as, defining the interval between each assessment;
- ✓ in areas characterized by high building density and high concentration of other infrastructure it is recommended to implement energy gains from zero emission (in context of low emission) sources;
- ✓ the program and strategic documents should be assessed by external units, who specialize in energy management on the urban and architectural scale;

⁶The West Pomeranian Voivodeship has specific geological conditions for the implementation of these kind of actions.

The idea of using the temperature of dry rock mass for energy arose in 1970 in Los Alamos Laboratory. the Fenton Hill Project (1974-1984) uses production and absorption holes with a depth of 4,39km and a rock mass temperature of 327 °C: it is necessary to assess the potential, heat balance and promising geological structures for closed geothermal systems (HDR) in Poland. Ministerstwo Środowiska, Warszawa/ Kraków 2013

⁷Derived directly from Energy Efficiency Act .

- ✓ establishing a regional expert for energy efficiency, as a part of providing support for different territorial units which which undertake actions.
- ✓ creation of consistent regional policy.

In terms of planning documents it is also recommended to:

- ✓ identify public space areas, where the local spatial management plan should be developed, along with local revitalization which includes an improvement of the energy efficiency of buildings and location using RES;
- ✓ determining parameters for buildings and public spaces, which will introduce modern solutions into historical urban tissue, including RES installations on facades and roofs of protected buildings and within communication routes, while respecting the value of their cultural heritage;
- ✓ pointing out areas to be excluded from biofuels or bioliquids production, stemming from a detailed environmental analysis;
- ✓ providing adequate protection of surface and underground waters along with other elements in the natural environment, as well as, the needs and interests of the local society during the process of production and during the use of biofuels;
- ✓ extending the obligatory formal procedure regarding the development of planning documents by requesting additional expert consultations, which would focus on influencing an increase of energy efficiency in the transformed space.

The results of research, analysis, and expert consultations should be included in the planning documents as a part of regarding the protection and creation of spatial order, rules for the protection of cultural heritage and monuments, rules for the creation of buildings and area management parameters, requirements for public spaces and sectors regarding modernization, construction and expansion of the communication systems and technical infrastructure. Graphically, where RES installations and facilities should be located and, if it is justified, areas excluded from those actions.

Moreover, regional documents, like the spatial management plan of Westpomeranian Voivodeship, should include all the records – guidelines and recommendations – pointing out the necessity of inclusion in the development policy of energy efficiency issues, using local RES and identifying potential urban areas in small to medium cities, which require pilot studies in the field of energy efficiency.



Those recommendations point out the suggested approach to improving the energy efficiency – in particular, to historically and culturally valuable areas, with specific focus on the old towns and rural areas, under protection of monument conservation or health resorts. It is necessary to adapt the solutions to the local conditions, which is connected to the use of expensive, specialized solutions, dedicated to building tissue, and requiring preservation and protection of historical elements such as, common cultural heritage. Corresponding problems regarding the modernization of technical infrastructure located in the areas of particular cultural value. Standard solutions in these cases are insufficient.

Therefore, it is validated to support small cities in actions, which improve their wide understanding of energy efficiency, through the transfer of support from the regional level, e.g. through including financing of those actions in Regional Operational Program of the West Pomeranian Voivodeship.



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